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SNAPSHOT OF RENEWABLE ENERGY DEVELOPMENT IN THE EU-28 Volume 2

*Current status and expected progress in comparison with
national renewable energy action plans*

Manjola Banja, Fabio Monforti-Ferrario, Nicolae Scarlat,
Jean-François Dallemand, Heinz Ossenbrink, Vincenzo Motola

2015



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Abstract

This report presents a snapshot of the current state of renewable energy development in the European Union and the progress expected by 2020, as forecasted in the Member States' national renewable energy action plans. The report compares the progress achieved between 2005 and 2012 as that reported by EU Member States in their bi-annual progress reports with the expected results, as set out in their action plans. It goes on to describe in details each Member State's overall contribution to the development of renewable energy since 2005. The findings draw on the Member States' bi-annual progress reports, the progress each country has made in the use of each renewable energy source and the contribution of renewable energy in each Member State to the heating/cooling, electricity and transport sectors are summarized in standardized tables and graphs allowing quick comparison among different countries and for EU as a whole.

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Preface

The Renewable Energy Directive (RED) [1] requires EU Member States to increase their use of renewable energy so that by 2020 it accounts for at least 20% of gross final energy consumption in the European Union and 10% of renewable energy in the transport sector in the EU and in each Member State. In addition, the Fuel Quality Directive [6] set a target of a 6% greenhouse gas reduction for fuels used in the transport sector by 2020. Both the RED and the Fuel Quality Directive include criteria for sustainable biofuels production so that they can also count towards RED targets. The two Directives also lay down procedures for verifying that the criteria are met.

Under Article 4 of the RED, Member States had to prepare national renewable energy action plans (NREAPs) [3] showing how they were going to reach the renewable energy targets in the electricity, heating/cooling and transport sectors. In their NREAPs, they also had to state the measures they had in place or were planning in order to achieve their national overall renewable energy targets. These followed a harmonised template [4] and comprehensive planning, which would make it possible to compare the data from the different Member States. The Member States submitted their NREAPs in the course of 2010. Their content was summarised and presented in two previous Joint Research Centre reports [5], [6].

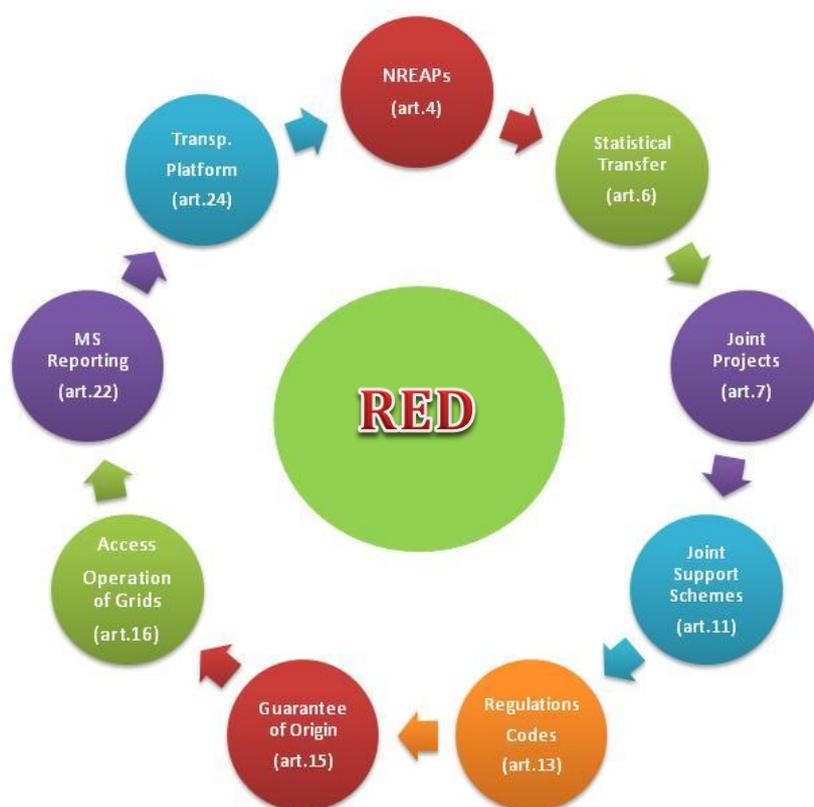


Figure I. RED mechanism supporting renewable energy deployment in the EU

Under Article 22 of the RED, each Member State has to submit to the European Commission every two years a progress report on the developments in renewable energy sources in that country compared with the interim targets in its NREAP. These progress reports cover the years 2010-20. European Commission drew up a template [7] to ensure that the Member

State progress reports were complete, covered all the requirements of Article 22 of the Directive and were comparable with each other and with the NREAPs.

The progress reports have to include the following:

- the contribution expected from energy efficiency and energy saving measures; the total contribution expected from each renewable energy technology towards meeting the binding 2020 targets; and
- an indicative interim trajectory for achieving the respective shares of energy from renewable resources in electricity, heating/cooling and transport.

In addition, the Member States have to report on their policies and the measures they have taken to promote the use of energy from renewable resources in the three sectors mentioned above. They also have to include a section on the sustainability scheme for biofuels and bioliquids consumed in the EU and the economic, social, and environmental consequences of that consumption.

Executive summary

The first wave of EU MS bi-annual progress reports, which provided data for 2009-10, was analysed by JRC in a previous set of publications [6], [8], [9], [10]. This report¹ based on the data contained in the Member States' NREAPs and bi-annual progress reports updates the information in the previous report [9] with data from the second wave of progress reports, for 2011 and 2012.

Indicators assessed in this report

- *Overall renewable energy share in the EU-28 and the shares of renewables in electricity, in heating/cooling and in transport (RES-T-10² and RES-T-20³);*
- *Total renewable energy use in the EU-28 and renewable energy's contribution to each sector i.e. heating/cooling, electricity and transport (double and multiple counting);*
- *The deployment of renewable energy sources in each Member State. In order to avoid duplication of analysis of renewable sources development, the relevant section presents the development of renewable energy sources used in electricity and heating/cooling (i.e. biomass, geothermal energy and solar energy) and of biofuels used in transport;*
- *Other renewable energy sources are analysed in the dedicated sections on electricity, heating/cooling and transport;*
- *The contribution of renewable energy sources (hydropower, geothermal, solar, marine, wind and biomass) to the electricity sector (installed capacity and electricity production);*
- *Renewable energy sources (geothermal, solar, biomass and heat pumps) in heating and cooling;*
- *Renewable energy use in transport (bioethanol/bio-ethyl tert-butyl ether (ETBE), biodiesel, other biofuels, biofuels as provided for in Article 21(2) of the RED, imported biofuels and renewable electricity).*

¹ Disclaimer: This report is not a policy document and as such it does not represent the views of the European Commission

² As laid down in Article 4 of the RED multiple counting of final renewable energy consumption in transport sector is used to calculate the EU-28 10% share of renewable energy (**hereafter RES-T-10**) in this sector in 2020. The methodology is presented in table 4b of the NREAPs template [4] and includes the 2.5 times contribution of renewable electricity used in road transport and 2 times the contribution of biofuels Art.21.2 (in bioethanol/bio-ETBE, biodiesel and other biofuels). In this report the analysis of renewable energy share in transport sector in MS is referring only to RES-T-10 share.

³ As laid down in Article 5 (c) of the RED double counting of final renewable energy consumption in transport sector is used to calculate the EU-28 20% target of renewable energy (**hereafter RES-T-20**) in gross final energy consumption in 2020. Double counting of final renewable energy consumption in transport sector includes the contribution of all renewable sources (bioethanol, biodiesel, hydrogen, renewable electricity and other biofuels) used in this sector. In this report the analysis of final consumption of renewable energy in this sector in MS is referring only to RES-T-20 final consumption.

First part of the report presents a **snapshot of the use of renewable energy in the European Union, the current situation, the deviations from the aggregated NREAPs plans in each sector, for each source/technology and the progress towards 2020 targets.**

The *Second part* summarized the **Member States' overall contribution to renewable energy since in 2005, situation in 2011 and 2012, deviations from, their plans in the NREAPs, and progress towards their 2020 targets.**

A description of 2013 progress reports data-check procedure used in order to fix possible miscalculations and misreporting is presented in *Annex I* of the report. In the Annex the calculated and reported total values of renewable energy consumption in electricity, heating/cooling and transport sectors are compared as well as the total values of renewable energy consumption for the EU.

A summary of renewable energy development in each Member State, progress towards, and the deviation from their targets in NREAPs for period 2011-12 is presented in *Annex II* and *Annex III* of this report. In the *Annex II* the **2013 renewable energy shares (overall and in each sector)** in the EU Member States are also presented based on data from the Eurostat SHARES Tool [11].

A set of maps showing the current share of renewable energy sources in each EU-28 Member State renewable energy mix and the expected developments of these shares up to 2020 is presented in the *Annex IV* of this report.

Main findings

18 Member States met or surpassed the expected overall RES share in 2011. 10 Member States (IE, ES, FR, CY, LV, MT, NL, AT, PT and UK) missed their respective overall RES share in 2011.

23 Member States met or surpassed the expected overall RES shares in 2012. 5 Member States (IE, ES, FR, NL and PT) missed the planned overall RES share in 2012.

23 Member States met or surpassed the expected renewable energy share in heating/cooling sector in 2011. 4 Member States (IE, FR, LV, MT and NL) missed their respective renewable energy share in heating/cooling sector in 2011.

24 Member States met or surpassed the expected renewable energy share in heating/cooling sector in 2012. 4 Member States (IE, FR, LV and NL) missed their respective renewable energy share in heating/cooling sector in 2012.

14 Member States met or surpassed the expected renewable energy share in electricity sector in 2011. 14 Member States (CZ, DK, IE, EL, CY, LV, LT, LU, HU, MT, PL, PT, SK and UK) missed their respective renewable energy share in heating/cooling sector in 2011.

14 Member States met or surpassed the expected renewable energy share in electricity sector in 2012. 14 Member States (IE, EL, FR, LV, LT, LU, HU, MT, NL, AT, PT, RO, SK and UK) missed their respective renewable energy share in electricity sector in 2012.

15 Member States met or surpassed the expected renewable energy share in transport sector (RES-T-10) in 2011. 13 Member States (BG, DE, EE, EL, ES, CY, LV, HR, MT, AT, PT, RO and UK) missed their renewable energy share in transport sector (RES-T-10) in 2011.

15 Member States met or surpassed the expected renewable energy share in transport sector (RES-T-10) in 2012. 13 Member States (BE, BG, DK, EE, EL, ES, CY, LV, HR, HU, PL, PT and RO) missed their renewable energy share in transport sector (RES-T-10) in 2012.

The overall share of RES in gross final energy consumption in the EU-28 increased from 8.2 % in 2005 to 14.17 % in 2012, compared with the expected overall RES share of 12.9 % for 2012, as laid down in the NREAPs.

The share of renewable energy in heating/cooling increased from 9.3 % in 2005 to 15.8 % in 2012, compared with the planned RES-H/C share of 13.7 % for 2012 in the NREAPs.

The share of renewable energy in electricity increased from 14.8 % in 2005 to 23.4 % in 2012, compared with the planned RES-E share of 22.2 % for 2012 in the NREAPs.

The share of renewable energy in transport sector (RES-T-20) increased from 2% in 2005 to 5.2% in 2012, compared with the planned RES-T share of 6.1% for 2012 in the NREAPs

The share of renewable energy in transport (RES-T-10) increased from 1.3 % in 2005 to 6.0 % in 2012, compared with the planned RES-T share of 6.1 % for 2012 in the NREAPs.

Total renewable energy consumed in the EU-28 increased from 101 Mtoe (4 223 PJ) in 2005 to 159.5 Mtoe (6 677 PJ) in 2012. This figure is expected to reach 248.2 Mtoe (10 392 PJ) in 2020.

Total renewable energy consumed in the EU- 28 slightly missed the expected level for 2011 laid down in the NREAPs by 0.7 % (-1113.5 ktoe) and exceeded it in 2012 by 1.4 % (+2 170 ktoe).

Renewable electricity consumption in the EU-28 increased from 488.5 TWh (1 758.5 PJ) in 2005 to 746.7 TWh (2 688 PJ) in 2012. This figure is expected to reach 1 210.4 TWh (4 357.6 PJ) in 2020.

Renewable electricity consumption missed the expected level laid down in the NREAPs in both years: 4.2 % (-29.7 TWh) under in 2011 and 0.4 % (-3.3 TWh) under in 2012.

Final consumption of renewable energy in heating/cooling sector increased from 54.8 Mtoe (2 293 PJ) in 2005 to 82 Mtoe (3 433 PJ) in 2012. This figure is expected to reach 111.8 Mtoe (4 680.8 PJ) in 2020.

Renewable energy in heating/cooling sector exceeded the expected level laid down in the NREAPs in both years: 8.1 % (+5 775 ktoe) over in 2011 and 10 % (7 466 ktoe) over in 2012.

Final consumption of renewable energy in transport increased from 4.1 Mtoe (171.2 PJ) in 2005 to 13.2 Mtoe (555.5 PJ) in 2012. The figure is expected to reach 32.3 Mtoe (1 352 PJ) in 2020.

Final consumption of renewable energy in transport sector missed the expected level laid down in the NREAPs in both years: 25.3% (-4 336 ktoe) under in 2011 and 27.4% (-5 013 ktoe) under in 2012.

Final consumption in transport sector with multiple counting increased from 4.14 Mtoe (173.5 PJ) in 2005 to 15.5 Mtoe (648.3 PJ) in 2012. The figure is expected to reach 36 Mtoe (1 506 PJ) in 2020.

Multiple counting final consumption of renewable energy in transport sector missed the expected levels laid down in the NREAPs in both years: 19.9% (-3 498 ktoe) under in 2011 and 18.2% (-3 443 ktoe) under in 2012.

Sweden leads the EU-28 with an overall RES share of 51% already reaching in 2012 the expected 2020 overall RES share target of 50.2%. Sweden has also exceeded the expected 2020 renewable energy shares in heating/cooling and transport (RES-T-10), recording figures of 65.60% compared with 62.0% and 15.7% compared with 13.5% respectively.

Bulgaria has also already exceeded in 2012 the overall RES share target for 2020, reaching 16.4% compared with 16.0%.

Italy has exceeded in 2012 the expected 2020 renewable electricity share, reaching 27.4% compared with 26.4%.

Estonia has exceeded in 2012 the expected 2020 renewable energy share in heating/cooling, reaching 41.4% compared with 34.8%.

Malta has exceeded in 2012 the expected 2020 renewable energy share in heating/cooling, reaching 12.5% compared with 6.2%.

Austria has exceeded in 2012 the expected 2020 renewable energy share in heating/cooling, reaching 45% compared with 32.6%.

Romania has exceeded in 2012 the expected 2020 renewable energy share in heating/cooling, reaching 25.7% compared with 22.1%.

CZ, DK, EE, EL, IT, LV, LT, HR, AT, PL, RO, SK and FI's overall RES shares for 2012 were less than 5 percentage points from reaching their 2020 targets.

DE, IE, FR, CY, LU, HU, MT, PT and SI's overall RES shares for 2012 were more than 5 percentage points but less than 10 percentage points from reaching their 2020 targets.

UK and NL's overall RES shares for 2012 were more than 10 percentage points from reaching their 2020 targets.

How to read this report

This report presents the analysis of a large amount of data on renewable energy in the EU-28 following two main approaches:

- absolute increase/decrease of a certain indicator or source during a multiannual or annual period, comparison with expected figures for a certain year and progress towards 2020; and
- relative increase/decrease of a certain indicator or source during a multiannual or annual period, comparison with expected figures for a certain year and progress towards 2020.

Absolute increase/decrease analysis presents always the whole development of a certain indicator or source in the EU-28 during a multiannual period (ex. 2005-11, 2005-12 or/and 2012-20).

Relative increase/decrease analysis presents the whole development in this terms as well as the average annual development of renewable energy in the EU-28 during a multi-annual period. The type of relative growth rate (annual or average) used is always putted in evidence in the text.

PART I

Renewable energy development in European Union *Status in 2012 and progress in comparison with national renewable energy action plans*

1. Development of renewable energy in EU-28

Renewable energy consumed in EU-28 increased from 101 Mtoe (4222.7 PJ) in 2005 to 148 Mtoe (6192 PJ) in 2011 and 159.5 Mtoe⁴ (6677 PJ) in 2012. The renewable energy consumption in EU-28 is expected to further increase to 248.2 Mtoe (10392 PJ) until 2020 (Figure 1).

Renewable energy consumed in EU-28 was 0.7% (-1113.5 ktoe) under expectations in 2011 but an increase by 7.8% (+11.6 Mtoe) between 2011 and 2012 made possible exceeding the NREAP planned value for 2012 by 1.4% (+2170.3 ktoe).

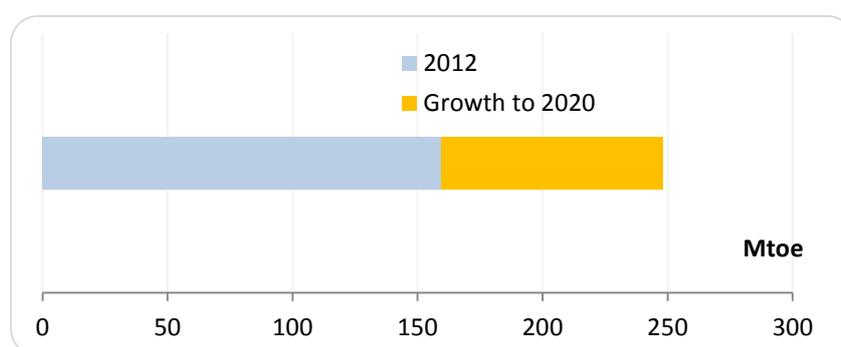


Figure 1. RES total in EU-28 in 2012 and the expected growth to 2020 target

EU-28 had in heating/cooling sector a renewable energy development faster than planned in aggregated NREAPs in both years: 8.1% (+5792 ktoe) over planned in 2011 and 10% (+7464 ktoe) over planned in 2012. In total, 2011 the consumption of heat originated from renewable sources reached 77.3 Mtoe (3235 PJ) increasing further by 6.1% (+4739 ktoe) in 2012.

The increase of renewable electricity was slightly under the aggregated NREAPs planned value in both years: 4.2% (-29.7 TWh or -107 PJ) less than expected in 2011 and 0.4% (-3.3 TWh or -11.8 PJ) less than expected in 2012. In 2011 EU-28 has consumed 672.7 TWh (57.9 Mtoe or 2422 PJ) of renewable electricity increasing more in 2012 by 11% (+74 TWh or 266.3 PJ).

Renewable energy consumed in transport sector experienced a very fast increase up to 2011 with +35.4% per annum in average (+8684.8 ktoe) but this pace slowed down in 2012 with additional renewable energy in 2012 amounting only to +495.2 ktoe (+3.9%). Nevertheless, the use of renewable energy in this sector missed the NREAP plans in both years: 25.3% (-4336 ktoe) less than planned in 2011 and 27.4% (-5013 ktoe) less than planned in 2012.

Multiple counting of renewable energy in transport sector reveals a contribution that reached 15.48 (648.3 PJ) Mtoe in 2012 from 4.14 Mtoe (173.4 PJ) in the baseline year. Nevertheless this type of contribution was found under the aggregated NREAPs expected levels in both years: 19.9% (-3498.4 ktoe) under in 2011 and 18.2% (-3443.4 ktoe) under in 2012.

⁴ All EU28 data reported in this chapter are computed summing data provided by MS for single sources or technologies, without adjusting for sectorial or intermediate totals, if different. See Data Check introduction for further details.

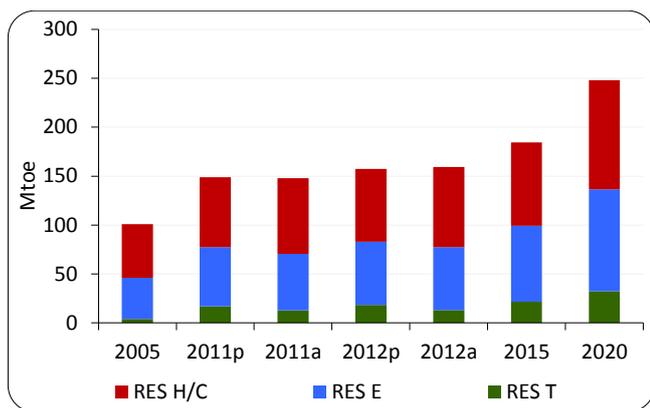


Figure 2 . RES deployment in EU-28: projected growth and actual progress until 2020.

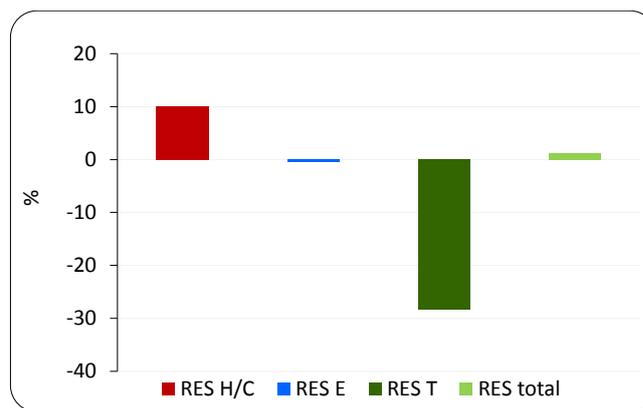


Figure 3. Deviation from NREAP in the RES consumption in EU-28 in 2012.

2. Sources of renewable energy⁵

Biomass was the main renewable energy source in EU-28 with a contribution of 53.7% in renewable energy mix in 2012, followed by hydropower⁶ with 17.9%, wind³ with 10.8%, biofuels with 7.5%, solar with 5.1%, heat pumps⁷ with 4.3% and geothermal with 0.7%.

Solar (electricity and thermal) had a fast development in 2005-12 with an average annual growth rate of 126.3⁸% (+7220.4 ktoe) from 816.4 ktoe (34.2 PJ) in the baseline year. This source exceeded in 2011 the expected NREAP level by 32.3% (+1428.4 ktoe) and in 2012 by 50.2% (+2687 ktoe).

Biomass energy in electricity and heating/cooling sectors was the renewable energy source showing the largest consumption increase in 2005-2012 in absolute terms: +25.9 Mtoe (+43.8%), from 59.1 Mtoe (2473 PJ) in baseline year. Biomass showed also the highest absolute positive deviation from the NREAPs expected level in both years with +4579.6 ktoe (+6.1%) and +6930 ktoe (+8.9%) respectively.

Geothermal electricity and heating/cooling sectors during period 2005-2012 increased by only 2.8% per annum in average (+179 ktoe in the whole period) reaching 1091.5 ktoe (45.7 PJ) in 2012. This development was not fast enough to meet the expected NREAPs plans for year 2011 and 2012: 18.2% (-239.9 ktoe) under expectations in 2011 and 24.9% (-361 ktoe) under expectations in 2012.

Biofuels consumed in transport sector have grown at the annual rate of 42.7% (+8942 ktoe in the whole period) between 2005 and 2012 from 2994 ktoe (125.4 PJ) in the baseline year. Despite such an increase the biofuels consumption was under the NREAPs planned values,

⁵ In this section (**for EU-28 and each MS**) the share of renewable energy sources/technologies refers to the renewable energy mix in the EU-28 which differs from the share of renewable energy sources/technologies in final consumption of renewable energy (calculated as a sum of final consumption of renewable energy in three sectors). The share of renewable energy sources/technologies in final consumption of renewable energy in 2012 was: **biomass 53.3%, hydropower 17.7%, wind 10.7%, biofuels 7.5%, solar 5.1%, heat pumps 4.2%, geothermal 0.7% and renewable electricity in transport 0.8%.**

⁶ A detailed analysis of these sources is presented in renewable electricity section of EU-28 and each Member States'

⁷ A detailed analysis of these sources is presented in heating/cooling section of EU-28 and each Member States'

⁸ The ratio between the relative increases of solar photovoltaics and solar thermal in 2012 was 3.7:1

missing the expected levels in both 2011 and 2012: 26.8% (-4197.9 ktoe) less in 2011 and 28.6% (-5012.5 ktoe) less in 2012

In 2020, the share of biomass in renewable energy mix is expected to decrease down to 45.1% while the contribution of wind is expected to reach 17.2%. Hydropower will follow with 12.9% together with biofuels (11.9%), solar (6.2%), heat pumps (5%), geothermal (1.5%) and marine (0.2%).

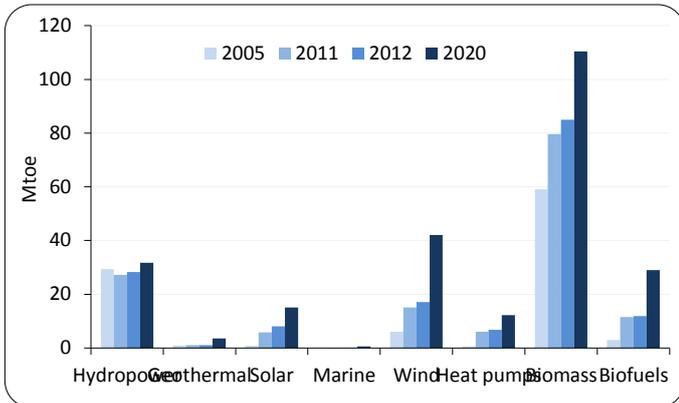


Figure 4. Contribution of renewable energy sources in EU-28: actual and projected in 2020

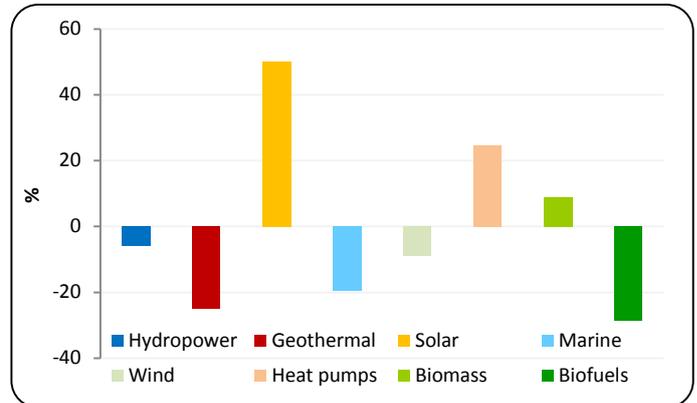


Figure 5. Deviation from NREAP in the contribution of renewable sources in EU-28 in 2012

3. Renewable energy share

The overall renewable energy contribution in Gross Final Energy Consumption in the EU-28 reached 13.1% in 2011 and 14.15% in 2012. The overall share of renewable energy in the EU-28 was over expected NREAPs plans by 0.8% points in year 2011 and by 1.2% points in 2012. The 2020 target that EU28 MS have planned to reach for the overall RES share is 20.6%, slightly over the legally binding target of 20%.

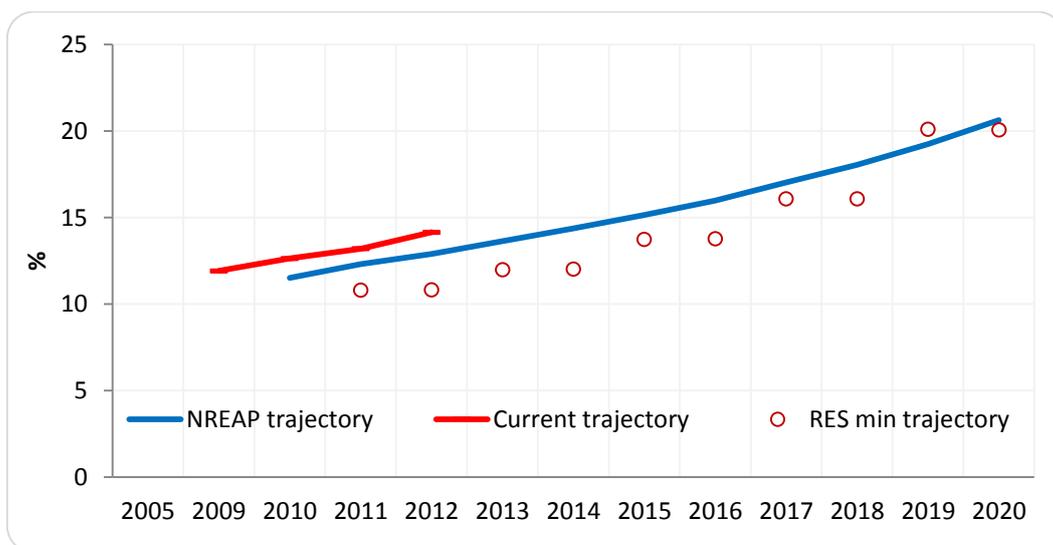


Figure 6. Overall RES share in EU-28, 2011-12

The overall RES share trajectory in EU-28 during period 2011-2012 was well higher than both the expected NREAP trajectory and the indicative minimum trajectories for 2011/2012. RES share in both 2011 and 2012 also already exceeded the minimum trajectory for 2013/2014. As the RES share trajectory, is clearly over the minimum indicative trajectory share defined in RED Directive, based on the progress made, the EU-28 seems to be well on track for achieving the 2020 RES share target.

The share of renewable energy in the electricity sector reached 21.5% in 2011 and 23.5% in 2012. In comparison with 2005 values, the renewable electricity share increased in 2011 by +6.76% points and by +2% points more in 2012. Comparing with NREAP planned shares in this sector EU-28 was over in both years: +0.56% points in 2011 and +1.3% points in 2012.

In 2011 renewable energy share in heating/cooling sector amounted to 15.28% increasing by further +0.64% points in 2012. The increase of renewable energy share in heating/cooling sector between 2011 and 2012 was faster than what was planned in the aggregated NREAPs being over the target by +2.2% points in both years.

The share of renewable energy in transport sector (RES-T-20) reached 4.5% in 2011 and 5.2% in 2012 missing the planned shares laid down in aggregated NREAPs: 1.0% points under in 2011 and 0.9% points under in 2012.

The share of renewable energy in transport sector (RES-T-10) increased by 3.7% points in 2011 over 2005 share, and by a further 1.04% between 2011 and 2012. Nevertheless the development of renewable energy share in transport sector was slower than expected in the aggregated NREAPs in both years: 0.57% points under expectation in 2011 but just 0.01% points under expectations in 2012.

In terms of renewable consumption shares, a major increase is expected to be achieved between 2012 and 2020 in the electricity sector (+10.5% points), followed by heating/cooling sector (+5.4% points) and transport (+5.4% points).

4. Renewable electricity

4.1 Installed capacity

Renewable electricity installed capacity in EU28 increased from 169.8 GW in 2005 to 278.6 GW in 2011 and to 312.3 GW in 2012. In 2020 the EU-28 is expected to have put in place 476.2 GW of renewable electricity.

Renewable installed capacity in EU-28 exceeded by 3.4% (+9.22 GW) and 7.5% (+21.86 GW) the respective NREAP planned capacities for years 2011 and 2012

In 2012 wind and hydropower technologies shared almost the same contribution to the overall renewable energy installed capacity, 34% and 33.7% respectively, followed by solar technology with 22.7%, biomass with 9.3%, geothermal with 0.2% and marine with 0.1%.

Solar technology (photovoltaic and CSP) had the fastest development between 2005 and 2012 with +441% per annum in average (+68.6 GW in the whole period) from 2221 MW in the baseline year. This source also showed the highest (both absolute and relative) positive deviations from the NREAP planned levels for year 2011 and 2012: 55.6% (+18.8 GW) over expectations in 2011 and 77.8% (+31 GW) over expectations in 2012.

In 2012, PV capacity already reached more than 80% of 2020 planned value of 83.7 GW

Wind power was the second faster developing technology in 2005-2012 with 23.3% per annum in average (+65.9 GW in the whole period) from 40.5 GW in 2005. Nevertheless, this source missed both 2011 and 2012 NREAPs plans respectively by 2.3% (-2186 MW) and 1.5% (-1606 MW).

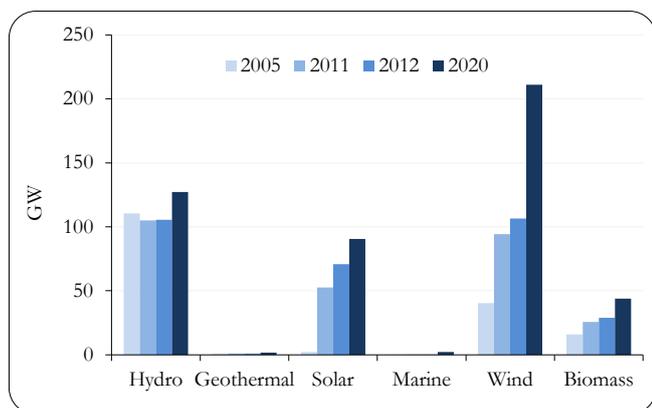


Figure 7. RES capacity deployment and progress until 2020 in EU-28.

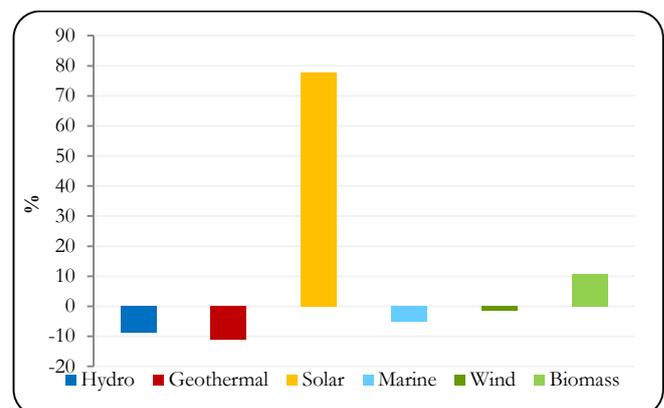


Figure 8. Deviation from NREAP in the RES installed capacity in EU-28 in 2012.

During period 2005-2012 biomass for electricity production installed capacity in EU-28 increased by a factor of 1.8 (+13 GW) from the baseline level of 15.74 GW. This development brought biomass capacity over the NREAPs projections in both 2011 and 2012: 6.4% (+1532 MW) more in 2011 and 10.6% (+2745 MW) more in 2012.

Solar, wind and biomass accounted respectively for 54%, 35.8% and 9.16% of the additional renewable electricity capacity installed between 2011 and 2012

Hydropower was the only renewable source for which installed capacity has decreased between 2005 and 2012, with a decrease of 4.6% (-5038 MW) compared with baseline capacity of 110.4 GW. Comparing with expected 2011 and 2012 NREAPs capacities this source was under expectations in both years: 7.8% (-8865 MW) under in 2011 and 8.8% (-10148 MW) under in 2012.

Although an increase by 5.5% (+41 MW) from 741 MW baseline year level took place in geothermal capacity during period 2005-12 this source remained under the expected

NREAPs capacities in both 2011 and 2012: by 7.8% (-66 MW) in 2011 and by 11.2% (-99 MW) in 2012.

Marine installed capacity has increased very slightly between 2005 and 2012 by 3.1% (+7 MW) from 240 MW in the baseline year. This development was found slower than the NREAP projected one missing the planned capacities in both years: 0.8% (-2 MW) less in 2011 and 5.2% (-14 MW) less in 2012.

In 2020 wind power is expected to account for the largest share of renewable installed capacities with 44.3%, followed by hydropower with 26.7%, solar with 19%, biomass with 9.2%, marine with 0.5% and geothermal with 0.3%.

4.2 Consumption

Renewable electricity consumption in the EU-28 amounted to 672.6 TWh (2421.7 PJ) in 2011 and 746.6 TWh (2688 PJ) in 2012 from 488.5 TWh (1758.5 PJ) in 2005. In 2020 the renewable electricity consumption in EU-28 is expected to amount to 1210.4 TWh (4357.6 PJ).

The overall deployment of renewable electricity in EU-28 missed the aggregated NREAPs absolute values in both 2011 (-4.2%; -29.7 TWh) and 2012 (-0.4%; -3.3 TWh)

43.9% of renewable electricity consumed in EU-28 in 2012 was produced by hydropower while the contributions of wind and biomass accounted for respectively 26.6% and 19.1%. Solar photovoltaic followed with 9.5% and the rest was 0.8% geothermal and 0.1% each marine and CSP.

Contribution of PV in renewable electricity consumption increased by 1.5 times between 2011 and 2012

Renewable electricity originated from solar photovoltaic increased very fast during period 2005-12 by 643% per annum in average (+66.2 TWh) from the baseline year of 1470 GWh (5.3 PJ) and exceeded significantly the expected NREAPs values in both 2011 and 2012: 57.1% (+16.8 TWh) over expectation in 2011 and 93.2% (+32.6 TWh) over expectations in 2012.

CSP had the highest relative increase during 2011-12 period with 92.7% (+1816 GWh). Nevertheless the development of CSP was slower than expected missing in both years the NREAPs levels: 28.4% (-776 GWh) less in 2011 compared with the planned level of 2735 GWh and 22.5% (-1095 GWh) less than the plan of 4870 GWh in 2012.

Wind technology almost tripled its contribution to renewable electricity between 2005 and 2012 reaching 198.5 TWh (714.7 PJ) in 2012 over 70.4 TWh (253.3 PJ) in 2005. Nevertheless this development was somewhat slower than what was projected in the NREAP and expected targets were missed in both 2011 and 2012: 8.3% (-15.8 TWh) under in 2011 and 8.9% (-19.4 TWh) under in 2012.

Biomass use for electricity has developed by 13.7% per annum in average during period 2005-11 (+56.8 TWh in the whole period) from the 69.1 TWh (248.6 PJ) value in the baseline

year. This development was fast enough to surpass the expected NREAPs value by 0.4% (+0.5 TWh) in 2011. An increase by 12.9% (+16.2 TWh) took place between 2011 and 2012 leading to an exceedance by 4.1% the 2012 planned level of 136.5 TWh (491.3 PJ).

Hydropower renewable electricity decreased by 3.9% (-13.2 TWh) in 2012 from 341.6 TWh (1229.6 PJ) in 2005. Comparing with expected NREAPs value this source missed both the 2011 and 2012 targets: by 8.6% (-30 TWh) and by 5.8% (-20.3 TWh) in 2012.

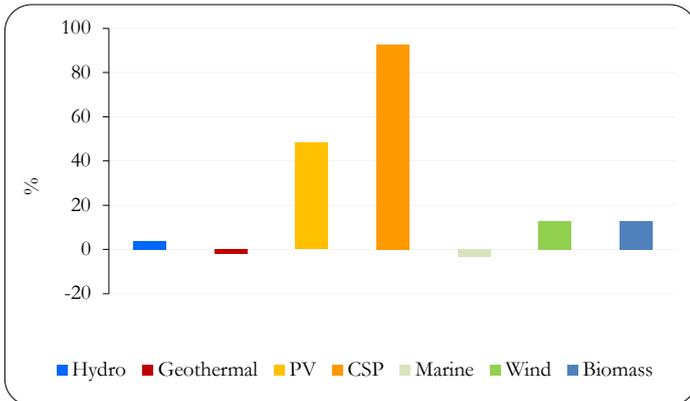


Figure 9. Relative increase/decrease of RES electricity sources in EU-28, 2011-12

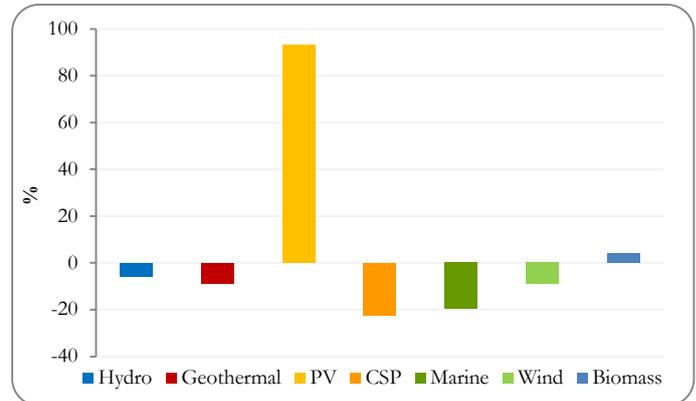


Figure 10. Deviation from NREAP in RES electricity in EU-28 in 2012.

Renewable electricity from geothermal increased by 6.2% (+338 GWh) during period 2005-2012 over 5477 GWh (19.7 PJ) level in 2005. Despite of this increase geothermal electricity remained under the expected NREAP values in both 2011 and 2012: 3.4% (-207 GWh) under in 2011 and 8.6% (-549 GWh) under in 2012.

Marine renewable electricity decreased by 13.6% (-73 GWh) between 2005 and 2012 from 535 GWh (1.9 PJ) in the baseline year and it was found under the expected NREAPs value in both 2011 and 2012: 4.8% (-24 GWh) under in 2011 and 19.7% (-113 GWh) under in 2012.

The expected developments until 2020 will change picture of renewable electricity technologies contribution to the overall renewable electricity consumption in EU28. Wind power is expected to be the main contributor with more than 40% followed by hydropower with 30.5%, biomass with 19.3%, solar with 8.4%, geothermal with 0.9% and marine with 0.5%.

5. Renewable energy in heating & cooling

The consumption of renewable energy in heating and cooling in the EU-28 reached 77.3 Mtoe (3234.7 PJ) in 2011 increasing by +22.4 Mtoe (+40.8%) during 2005-11. The additional

Renewable heat/cool in EU-28 was over NREAPs targets in both 2011 (+ 8.1%; +5773 ktoe) and in 2012 (+ 10%; +7451 ktoe).

heat consumed between 2011 and 2012 amounted to +4740 ktoe (+6.1%) leading the overall renewable consumption in the heat/cool sector to 82 Mtoe (3433 PJ). The heat/cool consumption

originated from renewable energy sources is expected to reach 111.8 Mtoe (4680.8 PJ) in 2020.

In 2012 biomass has been the main renewable source in heating/cooling sector providing 88.7% of the production while the rest consisted in heat pumps (8.3%), solar (2.3%) and geothermal (0.7%).

In absolute terms, biomass provided the highest additional renewable heat/cool that was consumed between 2005 and 2011 with +15.7 Mtoe reaching 68.8 Mtoe (2882 PJ). This consumption increased further by 5.7% (+3.9 Mtoe) in 2012. The development of biomass source for heat was faster enough to exceed the aggregated NREAPs planned values in both years: by 7.1% (+4536 ktoe) in 2011 and by 9.7% (+6449 ktoe) in 2012.

Heat pumps were the second source of renewable heat/cool in EU-28 with 6762 ktoe (283 PJ) in 2012. This technology had the fastest relative development among renewable energy sources between 2011 and 2012 with +10.7% (+656.4 ktoe) and remained over the expected NREAPs values: by 29.5% (+1391 ktoe) in 2011 and by 24.7% (+1341 ktoe) in 2012.

The development of solar thermal was also faster than planned in 2005-11, increasing by +25.8% per annum in average (+1069 ktoe) exceeding the expected NREAP planned values by 4.1% (+70.1 ktoe). Nevertheless, the increase of heat consumption originated from this technology between 2011 and 2012 was not enough to meet the expected NREAPs level for 2012 that was missed by 1.3% (-25.9 ktoe).

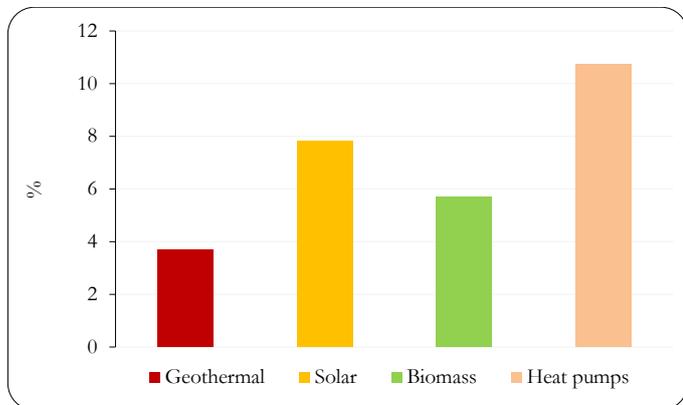


Figure 11. Relative increase/decrease of RES heating/cooling sources in EU-28, 2011-12.

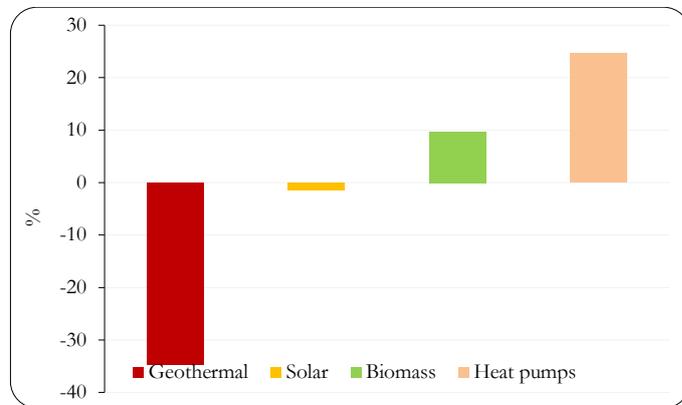


Figure 12. Deviation from NREAP in the RES heat consumption in EU-28 in 2012.

Geothermal use in this sector increased by 4.8% per annum in average in 2005-12 (+150 ktoe) beyond the level of 441.3 ktoe (18.5 PJ) in the baseline year. Nevertheless, this source remained under the NREAP expectations by 28% (-222 ktoe) in 2011 and by 34.7% (-314 ktoe) in 2012.

In 2020 the relative contribution of biomass will decrease down to 81% while the solar thermal is expected to double its share to 5.8%. The contribution of heat pumps is expected to increase to 11% and geothermal will reach 2.4%.

6. Renewable energy in transport

The consumption of renewable energy in EU28 in transport reached 12.8 Mtoe (534.8 PJ) in 2011 increasing further by 3.9% (+495.2 ktoe/+20.7 PJ) in 2012.

The consumption of renewable energy in transport sector in 2020 is expected to reach 32.3 Mtoe (1352.4 PJ).

In 2012 biodiesel accounted for the highest share of total renewable energy consumed in transport sector in EU (68.4%) while the rest was divided between bioethanol/bio-ETBE (19.7%), renewable electricity (10.2%) and other biofuels (1.7%).

The consumption of renewable energy in transport sector in EU-28 missed the NREAPs levels in both years: by 25.3% (-4336 ktoe) in 2011 and by 27.4% (-5013 ktoe) in 2012.

Biodiesel made the main progress in transport sector during 2005-2011 with +6441 ktoe, increasing further by 2.7% in 2012 and then reaching 8938 ktoe (374.4 PJ). Nevertheless the biodiesel consumption did not reach the planned levels: 25.3% (-2945.3 ktoe) less in 2011 and 27.9% (-3460 ktoe) less in 2012.

Bioethanol/bio-ETBE increased by +28.8 ktoe between 2011 and 2012 reaching 2575 ktoe (106.6 PJ). Nevertheless, its use was 33.1% (-1258.4 ktoe) less than planned in 2011 and 36.7% (-1495 ktoe) less in 2012.

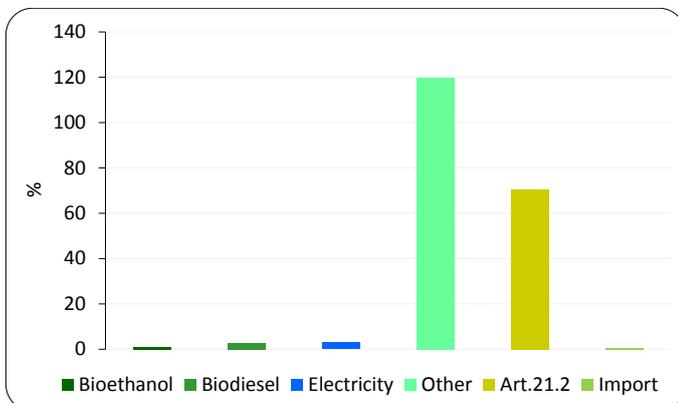


Figure 13. Relative increase/decrease of RES transport uses in EU-28, 2011-12.

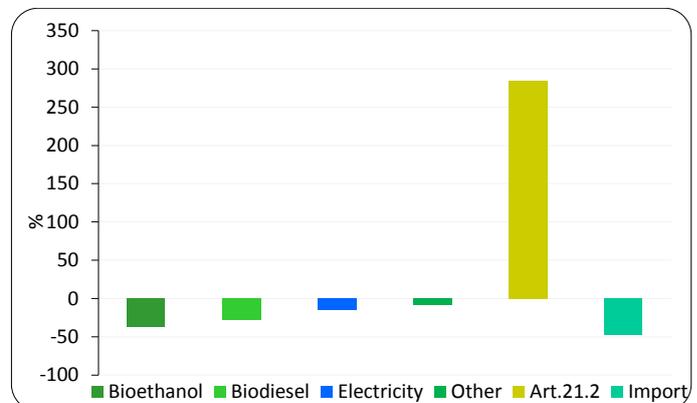


Figure 14. Deviation from NREAP in the RES use in transport in EU-28 in 2012.

The consumption of biofuels from wastes, residues, ligno-cellulosic and other biofuels (biogas and vegetable oils) material reached 220.4 ktoe (9.2 PJ) in 2012 increasing significantly between 2011 and 2012: +120% (+120.2 ktoe). Nevertheless this development was not enough to meet the planned levels in both years and this source remained 55.4% (-124.7 ktoe) under expectations in 2011 and 8.2% (-19.6 ktoe) under expectations in 2012.

Imported biofuels increased by +2714 ktoe between 2005 and 2011 reaching 2884.3 ktoe (120.8 PJ). EU28 imported less biofuels than what planned in the aggregated NREAPs in both years: 44.9% (-2347.8 ktoe) less in 2011 and 47.3% (-2604 ktoe) less in 2012.

In 2011 Article 21.2 biofuels reached 1282.5 ktoe (53.7 PJ) increasing further in 2012 by 70.4% (+903.5 ktoe). Article 21.2 biofuels experienced a significant increase during period 2005-2012 exceeding the NREAP planned levels in both years: 200% (+855 ktoe) more in 2011 and 283.8% (+1616 ktoe) more in 2012.

The consumption of renewable electricity in transport also increased by +200 ktoe in the 2005-11 period while only 37.7 ktoe (+2.9%) were added in the 2011-12 time span. Comparing with NREAPs the consumption of renewable electricity in transport was under the expectations in both years: by 9.8% (-141.2 ktoe) in 2011 and by 15.4% (-242.2 ktoe) in 2012.

In 2020 biodiesel is expected to cover 64.9% of total renewable energy in transport sector, followed by bioethanol/bio-ETBE with 22.7%, renewable electricity with 10% and other biofuels with 2.3%.

PART II

Renewable energy development in EU-28 Member States

*Status in 2012 and progress in comparison with
national renewable energy action plans*

1. Renewable energy in Belgium

1.1 Deployment of renewable energy

Renewable energy consumed in Belgium increased from 719 ktoe (30.1 PJ) in 2005 to 1883.2 ktoe (78.8 PJ) in 2011 and 2467.9 ktoe (103.3 PJ) in 2012. Renewable energy consumption in Belgium is expected to further increase to 5463 ktoe (228.7 PJ) until 2020 (Figure 1-1).

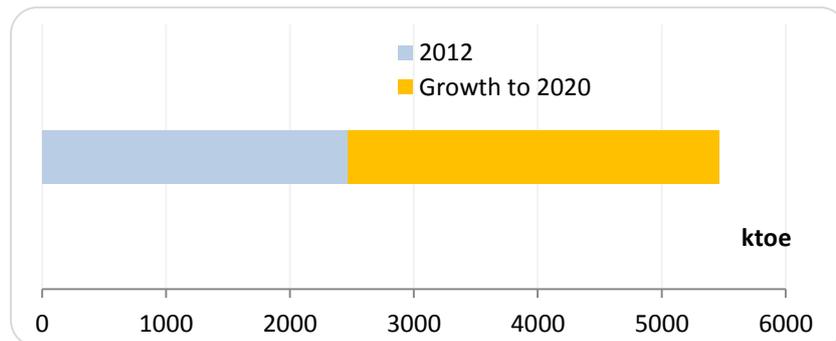


Figure 1-1. RES total in Belgium in 2012 and the expected growth to 2020 target

Renewable energy consumed in transport sector made the most significant progress in relative terms from year 2005. It experienced a very fast increase up to 2011 with +353.8% per annum in average (+348.1 ktoe) but the additional renewable energy in 2012 was only +8.3 ktoe (+2.3%). Comparing with NREAP the achieved uses were found over in 2011 with 2.4% (+8.4 ktoe) but under in 2012 with 15.6% (-69.1 ktoe).

The development of renewable energy in heating/cooling sector in relative terms was faster in period 2011-2012 with 42.6% (+383.8 ktoe) compared with the development during 2005-2011 period with 14% per annum in average (+411 ktoe). Due to this renewable energy in this sector missed the expected NREAP in 2011 with 0.9% (-8.5 ktoe) but exceeded it in 2012 with 26.6% (+270.4 ktoe).

The deployment of renewable energy in Belgium exceeded the NREAP expectations in both 2011 and 2012 respectively by +5.0% (90.2 ktoe) and +16.2% (343.5 ktoe)

Renewable energy in electricity sector developed with almost the same yearly rate during periods 2005-2011 (31.9%) and 2011-2012 (31.2%) reaching 809.6 ktoe (33.9 PJ) in 2012 over 212 ktoe (8.9 PJ) in 2005. Comparing with expected NREAP levels renewable energy in this sector was found over in both 2011 and 2012: 17.1% (+90.3 ktoe) over in 2011 and 21.3% (+142.3 ktoe) over in 2012.

The fastest progress until 2020 is expected in electricity sector (+18.2% per annum in average) followed by transport sector (+17.2% per annum in average) and heating/cooling sector (+12.7% per annum in average).

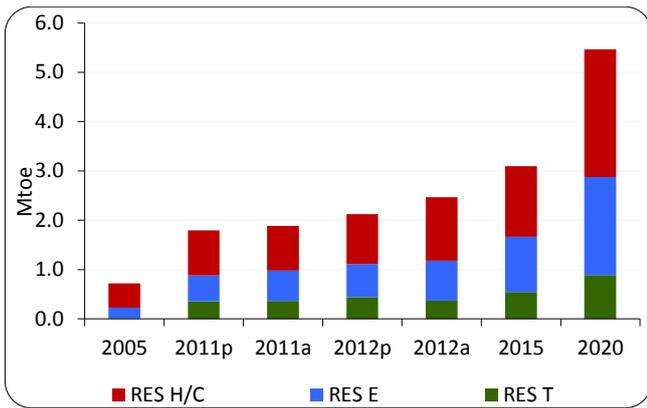


Figure 1-2. RES deployment in Belgium: projected growth and actual progress until 2020.

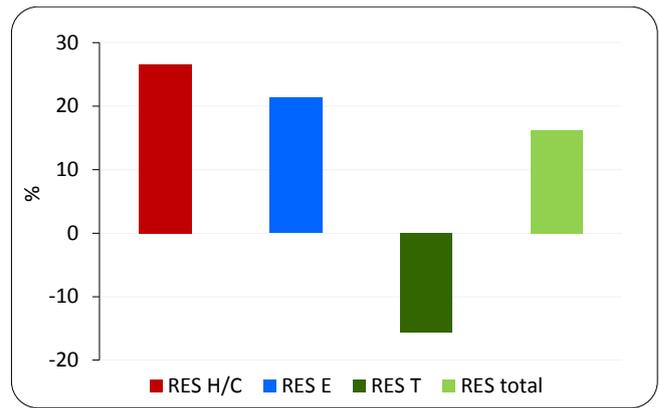


Figure 1-3. Deviation from NREAP in the RES consumption in Belgium in 2012.

1.2 Sources of renewable energy

Biomass was the main renewable energy source in Belgium with a 66.9% contribution in renewable energy mix in 2012, followed by biofuels with 14.3%, wind with 9.3%, solar with 8.3%, hydropower with 1.1% and geothermal with 0.1%.

Solar source experienced the fastest development between 2005 and 2012 with 821% per annum in average (+196.6 ktoe) from the marginal level of 3.4 ktoe (0.14 PJ) in baseline year. This development was fast enough to exceed the expected NREAP plans in both 2011 and 2012: 54.9% (+40.8 ktoe) more in 2011 and 127% (+112 ktoe) more in 2012.

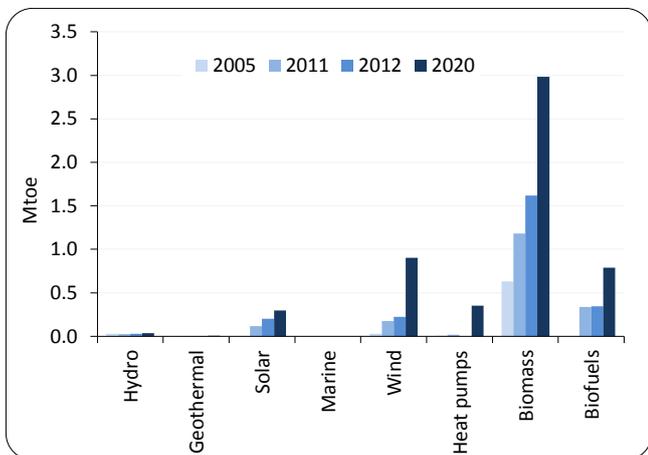


Figure 1-4. Contribution of renewable energy sources in Belgium: actual and projected in 2020

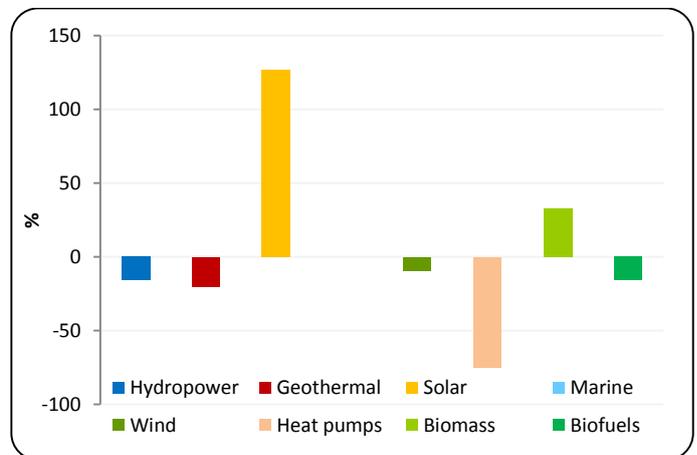


Figure 1-5. Deviation from NREAP in the contribution of renewable sources in Belgium in 2012

Biomass use in electricity and heating/cooling sectors had the highest additional energy production during period 2005-2012 with +986.5 ktoe (+156.2%) from 631.4 ktoe (26.4 PJ) in 2005. Energy consumption from this source was found to be over the expected NREAP plans in both 2011 and 2012: 7.1% (+78.2 ktoe) over in 2011 and 32.7% (+398.5 ktoe) over in 2012.

Biofuels consumed in transport sector reached 338 ktoe (14.2 PJ) in 2011 increasing further in 2012 with 2.3% (+7.9 ktoe). Comparing with expected NREAP plans these consumptions

were found to be over in 2011 with 2.6% (+8.7 ktoe) and under in 2012 with 16% (-66.1 ktoe).

Geothermal⁹ source use in electricity and heat sectors reached in 2012 the level of 2.8 ktoe (0.12 PJ) as in the baseline year after the decrease with 7.1% (-0.2 ktoe) that took place between 2005 and 2011. This source missed the expected NREAP plans in both 2011 and 2012: 23.5% (-0.8 ktoe) under in 2011 and 20% (-0.7 ktoe) under in 2012.

In 2020, the share of biomass in renewable energy mix is expected to decrease up to 56% while the contribution of wind is expected to double reaching 17%. Biofuels will follow with 15% together with heat pumps with 6% and solar with 5%.

1.3 Renewable energy share

The overall renewable energy contribution in Gross Final Energy Consumption in Belgium reached 5.17% in 2011 and 6.81% in 2012. Comparing with the expected shares for 2011 and 2012 the overall share of RES was over by 0.8% points in year 2011 and 1.6% points in 2012. The 2020 target that Belgium has to reach for the overall RES share is 13%.

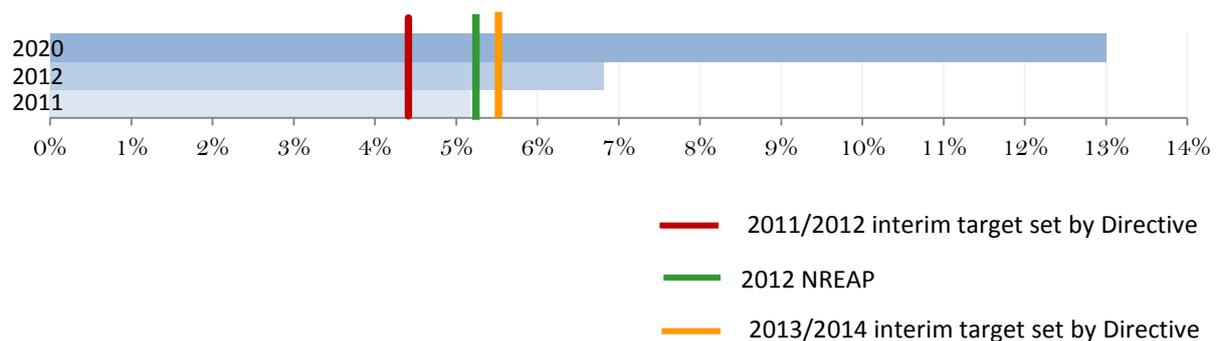


Figure 1-6. Overall RES share in Belgium, 2011-12

In 2012 Belgium the overall RES share exceeded the NREAP target value and the indicative minimum trajectories for both 2011/2012 and 2013/2014. Also considering that NREAP targets are higher than the minimum indicative trajectory defined in RED Directive, based on reported overall RES shares in 2011 and 2012 Belgium seems to be in good position for the achievement of 2020 RES share target.

In electricity sector the share of renewable energy increased with +6.1% points in 2011 compared with 2005 but only with +2.3% points more in 2012. Renewable energy share in this sector was found to be over the NREAP planned share in 2011, by +2.6% points and in 2012 by + 3.32% points.

⁹ In Belgium this source contributed only in heating/cooling sector

The share of renewable energy in transport sector increased by +3.8% points in 2011 compared with 2005 but only with +0.46% points in 2012. The share of RES in this sector was found to be over the expected share in 2011 with +0.17% points but under in 2012 with 0.29% points.

The increase of RES share in heating/cooling sector from 2005 was with +2.38% points in 2011 and it increased further with +1.96% points in 2012. The share of renewable energy in this sector was over the planned shares in both years, respectively by +0.5% points and +1.94% points.

Major increase from year 2012 is expected to be achieved until 2020, according to the NREAP, in heating/cooling (from 17.2% to 33%), followed by electricity sector (from 16.7% to 27%) and transport (from 7.4% to 10.2%).

1.4 Renewable electricity

1.4.1 Installed capacity

The renewable energy installed capacity in Belgium increased from 640 MW in 2005 to 3490 MW in 2011 and 4936 MW in 2012. In 2020 renewable energy capacity is expected to 8255 MW.

In 2012 solar presented 52.3% of renewable energy installed capacity in Belgium followed by wind with 27.6%, biomass with 17.7% and hydropower with 2.4%.

Renewable electricity installed capacity was found to be over the expectations in both 2011 and 2012: +50.5% (+1171 MW) 2011 and +83.6% (+2248 MW) in 2012.

The main progress was made in solar photovoltaic which increased with 17972% per annum in average (+2579 MW) in 2012 over the very marginal level of 2 MW in the baseline year. This development was so fast that this source almost two-folded in 2012 the 2020 plan capacity of 1340 MW. The expected NREAP capacities are exceeded in both 2011 and 2012 respectively with 225% (+963 MW) and 432% (+2096 MW).

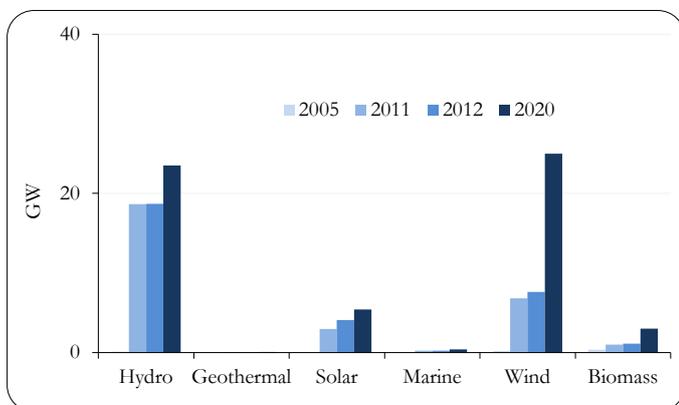


Figure 1-7. RES capacity deployment and progress until 2020 in Belgium.

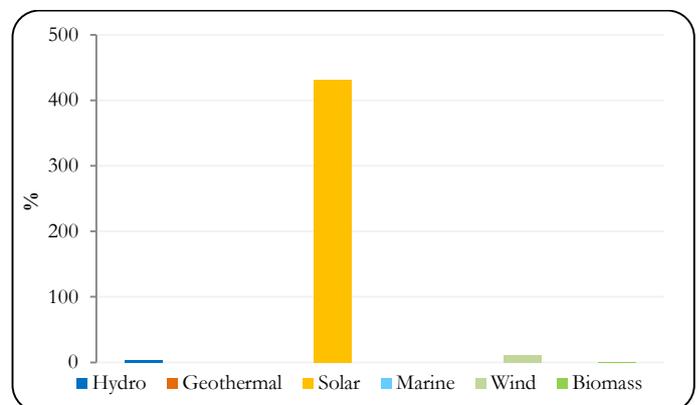


Figure 1-8. Deviation from NREAP in the RES installed capacity in Belgium in 2012.

Wind power capacity increased with 88.2% per annum in average (+1174 MW) between 2005 and 2012 from 190 MW in the baseline year. This development was enough to surpass the NREAP capacities in both 2011 and 2012: 5.2% (+53 MW) over in 2011 and 11.6% (+141 MW) over in 2012.

Biomass installed capacity increase from baseline year with 22.4% per annum in average (+534 MW) reaching 874 MW in 2012. This increase was enough to surpass the NREAP expected capacities in both 2011 and 2012: 19.5% (+149 MW) more in 2011 and 0.7% (+6 MW) more in 2012.

PV installed capacity in Belgium in 2012 was almost 2 times higher than the 2020 planned value of 1340 MW

Hydropower capacity increased with 8.2% (+9 MW) between 2005 and 2012 over the 108 MW installed in the baseline year. This increase was enough to allow this source surpassing the expected NREAP capacities in both 2011 and 2012: 6% (+7 MW) over

in 2011 and 4.2% (+5 MW) over in 2012.

In 2020 the contribution of wind is expected to substitute the 2012 contribution of solar photovoltaic reaching 52.3% and the rest will be biomass 29.7%, solar photovoltaic 16.2% and hydropower 2%.

1.4.2 Consumption

Renewable electricity consumption in Belgium amounted to 7174.3 GWh (25.8 PJ) in 2011 and 9414 GWh (33.9 PJ) in 2012 from 2462 GWh (8.9 PJ) in 2005. In 2020 the renewable electricity consumption in Belgium is expected to amount to 23121 GWh (83.2 PJ).

Renewable electricity consumption in Belgium exceeded the NREAP planned values by +17.1% (+1050 GWh) in 2011 and 21.3% (+1654 GWh) in 2012.

In 2012 biomass provided 46.2% of renewable electricity consumed in Belgium followed by wind with 27.6%, solar photovoltaic with 22.8% and hydropower with 3.3%.

Renewable electricity originated by solar photovoltaic developed very fast in 2012 with a yearly average growth rate of 29495% (+2147 GWh) from the very marginal level of 1.04 GWh in the baseline year. This renewable electricity was found to exceed the 2020 planned level with 88.6% (+1009 GWh). The 2011 and 2012 expected NREAP consumptions are also exceeded respectively with 216.2% (+799.7 GWh) and 414% (+1730 GWh).

Wind power also increased fast the renewable electricity that was consumed between 2005 and 2012 with 102% per annum in average (+2283 GWh) from 319.6 GWh (1.2 PJ). This development was enough to exceed the 2011 plan with 17.7% (+309.8 GWh) but not the 2012 plan being under with 9.2% (-263 GWh).

Biomass used for electricity increased from 1791 GWh (6.4 PJ) in 2005 with 20.4% (+2557 GWh) between 2005 and 2012. These consumptions were found to be over the expected NREAP ones in both 2011 and 2012: 0.3% (+12.3 GWh) over in 2011 and 6% (+245 GWh) over in 2012.

Hydropower was the only technology producing less renewable electricity in Belgium in 2012 (315 GWh or 1.1 PJ) from 2005 level (350.4 GWh or 1.3 PJ). Due to this downward trend this source didn't reach the NREAP plans in both 2011 and 2012: 19.5% (-71.7 GWh) less in 2011 and 15.6% (-58 GWh) less in 2012.

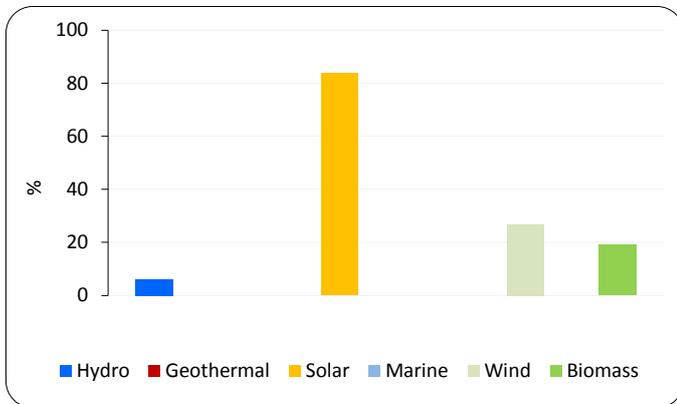


Figure 1-9. Relative increase/decrease of RES electricity sources in Belgium, 2011-12

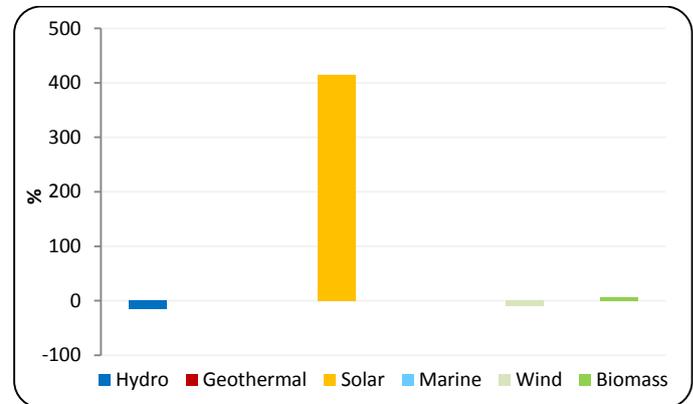


Figure 1-10. Deviation from NREAP in the RES electricity consumption in Belgium in 2012.

In 2020 almost 93% of renewable electricity expected to be produced will be provided by biomass (47.7%) and wind (45.3%). The rest is expected to be divided between solar (4.9%), hydropower (1.9%) and geothermal (0.1%).

1.5 Renewable energy in heating & cooling

The use of renewable energy in heating and cooling in Belgium increased by +411 ktoe (+88.3%) during 2005-2011 and the additional heat in period 2011-12 was +383.6 ktoe (+42.5%). The heat consumption originated from renewable energy sources is expected to reach 2588.4 ktoe (108.4 PJ) in 2020.

In 2012 almost 99% of heat production was coming from biomass and the rest was solar (1.2%) and geothermal¹⁰ (0.2%).

In relative terms the main progress from 2005 took place in solar thermal source which increased with 51.3% per annum in average (+12 ktoe) in 2012 over the marginal level of 3.3 ktoe (0.14 PJ) in the baseline year. Nevertheless this development was slower than the projected NREAP one missing the expected levels in both 2011 and 2012: 66% (-28 ktoe) less in 2011 and 70.7% (-37 ktoe) less in 2012.

Biomass used for heat increased with 23% per annum in average during period 2005-2012 over the level of 477.4 ktoe (20 PJ) in the baseline year. Comparing with NREAP plans this source was found to be over in both 2011 and 2012: 9.8% (+77.1 ktoe) over in 2011 and 43.5% (+377 ktoe) over in 2012.

Renewable energy in heating/cooling sector in Belgium was found under the NREAP value by 0.9% (-8 ktoe) in 2011 while in 2012 planned values were exceeded by 26.6% (+270 ktoe).

In 2012 penetration of biomass for heating purposes in renewable energy mix in Belgium was more than 50%.

¹⁰ See section 2.2 for the analysis of this source

The development of heat pumps in Belgium was well behind the expected according to its NREAPs reaching in 2012 only 23.4 ktoe (0.98 PJ) which was 4.4 ktoe (23.2%) above the 2011 level. Comparing with NREAP levels in 2011 the heat production from heat pumps was found to be 74.9% (-56.7 ktoe) below the plan and in 2012 74.8% (-69 ktoe) below the plan.

In 2020 biomass contribution in renewable heat is expected to decrease to 78.6% and the rest will be covered by heat pumps with 13.5%, solar thermal with 7.7% and geothermal thermal with 0.2%.

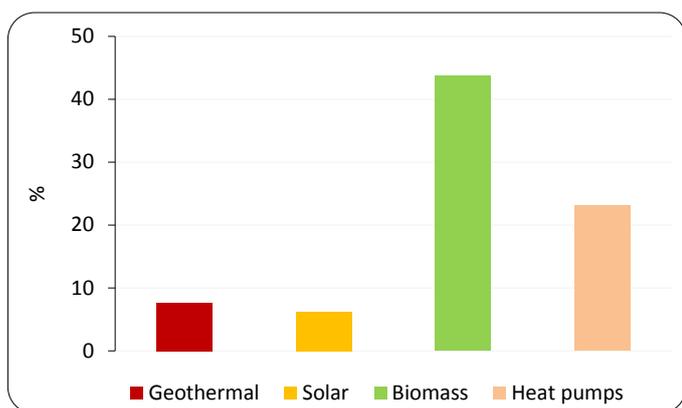


Figure 1-11. Relative increase/decrease of RES heating/cooling sources in Belgium, 2011-12.

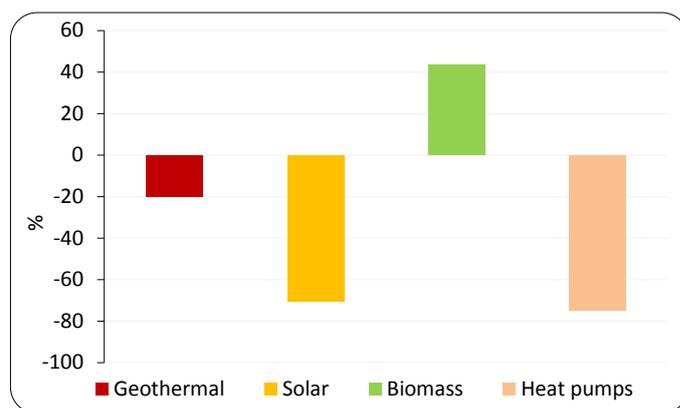


Figure 1-12. Deviation from NREAP in the RES heat consumption in Belgium in 2012.

1.6 Renewable energy in transport

Final consumption of renewable energy in transport reached 364.5 ktoe (15.3 PJ) in 2011 and 372.8 ktoe (15.6 PJ) in 2012. The use of renewable energy in transport sector in 2020 is expected to be 886.3 ktoe (37.1 PJ).

In 2012 biodiesel covered almost 80% of renewable energy consumed and the rest was bioethanol/bio-ETBE (12.9%) and renewable electricity (7.2%).

Biodiesel made the main progress in transport sector during 2005-11 increasing with +290 ktoe in 2011 but only +0.8 ktoe in 2011-12 time span. Despite of this increase in comparison with NREAP planned values the use of biodiesel in Belgium was lower in both years: 1.2% (-3.4 ktoe) less in 2011 and 19.2% (-71 ktoe) less in 2012.

Renewable energy use in transport sector in Belgium was 2.4% (+8.4 ktoe) above plans in 2011 and 15.6% (-69.1 ktoe) below planned in 2012, in comparison with NREAP values.

Bioethanol/bio-ETBE increased with +48 ktoe in period 2005-2011 but there was no increase during 2011-12 being so 23.5% and 20% under the NREAP planned values for 2011 and 2012.

No use of Article 21.2 biofuels from wastes, residues, ligno-cellulosic and other biofuels (biogas and vegetable oils) material happened in Belgium during 2011-12 time span.

While no import of biofuels was planned for period 2011-12, Belgium imported 51.9 ktoe in 2011 and 52.7 ktoe in 2012.

The use of renewable electricity in transport also increased with only 9.6 ktoe in period 2005-2011 adding only 1 ktoe in 2011-12 time span. Comparing with NREAP the use of renewable electricity in transport was under in both years: 1.3% in 2011 and 10.2% in 2012.

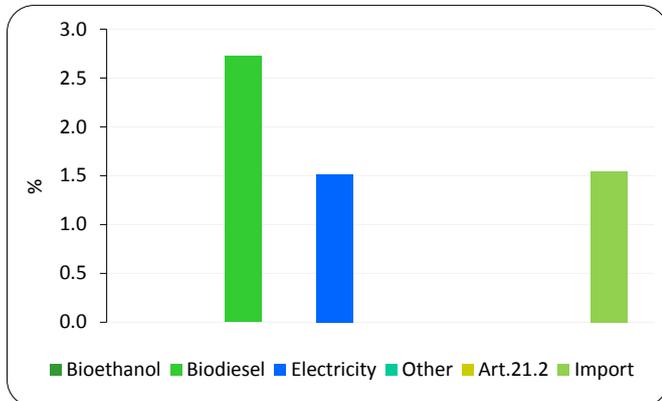


Figure 1-13. Relative increase/decrease of RES transport uses in Belgium, 2011-12.

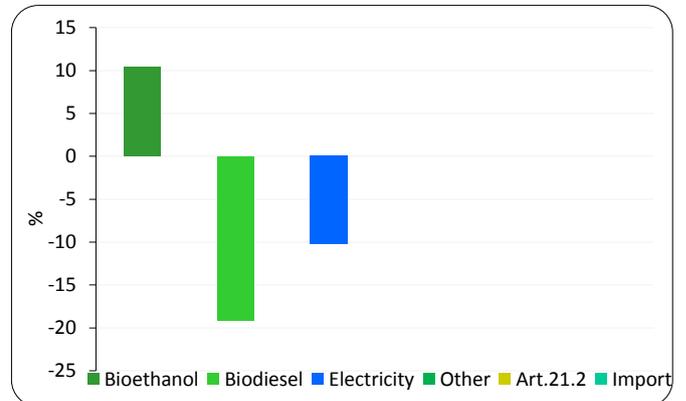


Figure 1-14. Deviation from NREAP in the RES use in transport in Belgium in 2012.

In 2020 the share of biodiesel is expected to reach 78.7% while the shares of bioethanol/bio-ETBE and renewable electricity will be 10.3% and 11%.

2. Renewable energy in Bulgaria

2.1 Deployment of renewable energy

The renewable energy consumed in Bulgaria increased from 991 ktoe (41.5 PJ) in 2005 to 1466 ktoe (61.4 PJ) in 2011 and 1636 ktoe (68.5 PJ) in 2012. The renewable energy consumed in Bulgaria is expected to further increase to 2059 ktoe (86.2 PJ) until 2020 (Figure 2-1).

Renewable energy consumption in Bulgaria exceeded the expected developments in both 2011 and 2012 respectively by 22.4% (+268.5 ktoe) and 26.3% (+340.3 ktoe).

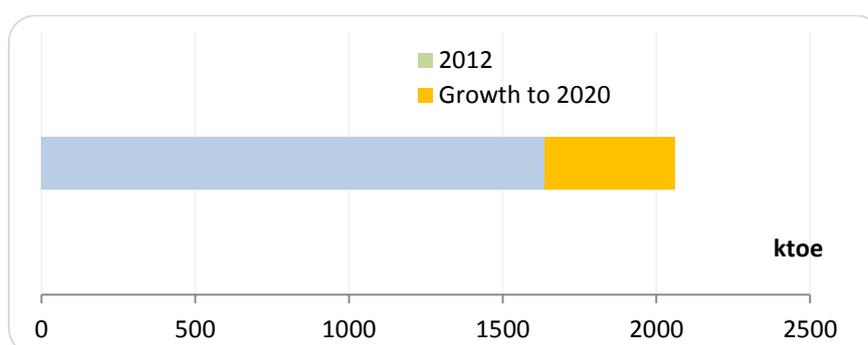


Figure 2-1. RES total in Bulgaria in 2012 and the expected growth to 2020 target

In relative terms renewable energy consumed in transport sector¹¹ made the most significant progress from year 2005. It experienced a fast increase up to 2011 with +27.8% per annum in average (+5 ktoe) but it decreased during 2011-12 by 23.8% (-1.9 ktoe). This development was slower than planned missing the NREAP planned levels in both 2011 and 2012: 43 ktoe (-84.3%) less in 2011 and 64.9 ktoe (-91.4%) less in 2012.

The development of renewable energy in heating/cooling sector had the higher absolute increase from year 2005 with +309 ktoe (+7.1%) but it increased only by +67 ktoe (+6.5%) during 2011-12 period. It reached in 2012 almost the planned value for year 2020. In this sector the development was faster than planned in both 2011 and 2012: 35% (+268 ktoe) higher in 2011 and 37.7%

A faster development in electricity sector happened during period 2011-12 with an additional of +104.8 ktoe (+24.7%) but less than the increase from 2005, +265.5 ktoe (+14.4% per annum in average). Electricity sector in Bulgaria was found to be 11.4% (+43.5 ktoe) higher in 2011 and 24.5% (+104.2 ktoe) higher in 2012.

Up to 2020 the fastest development is expected to take place in transport sector with an average growth rate of 606% (+296 ktoe). Electricity sector is expected to have a use of renewable energy with +23.4% (+124.2 ktoe) more compared with 2012 level while the

¹¹ Only renewable electricity use in transport sector was reported in second progress report of Bulgaria

development in heating/cooling sector is expected to be very slowly due to the fast development it reached up to 2012.

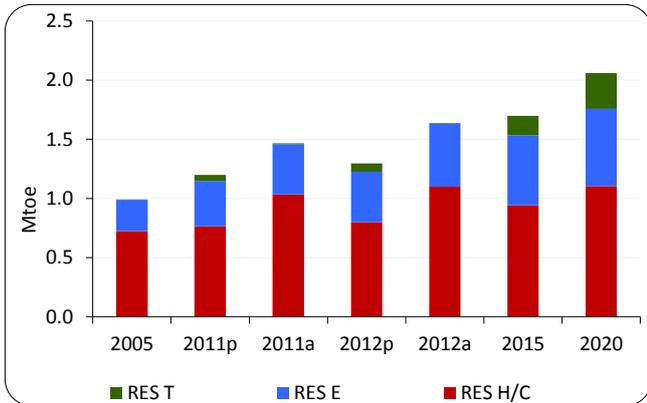


Figure 2-2. RES deployment in Bulgaria: projected growth and actual progress until 2020.

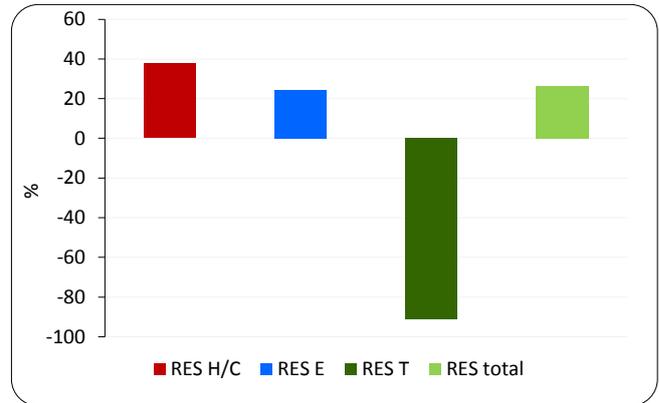


Figure 2-3. Deviation from NREAP in the RES consumption in Bulgaria in 2012.

2.2 Sources of renewable energy

Biomass was the main renewable energy source in Bulgaria with a 62% contribution in renewable energy mix in 2012, followed by hydropower with 22.4%, wind with 5.5%, solar with 5.2%, heat pumps with 3% and geothermal with 1.4%.

Biomass use for energy purposes in Bulgaria had the highest additional contribution in renewable energy consumption during period 2005 and 2012 with +286.7 ktoe (+39.6%) reaching in 2012 the amount of 1011 ktoe (42.3 PJ). This increase was enough to surpass the NREAP planned consumptions in both 2011 and 2012: 24.7% (+188 ktoe) more in 2011 and 26.3% (+210.4 ktoe) more in 2012.

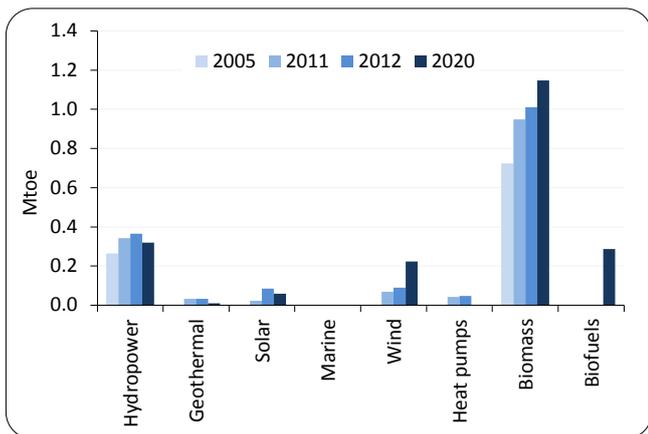


Figure 2-4. Contribution of renewable energy sources in Bulgaria: actual and projected in 2020

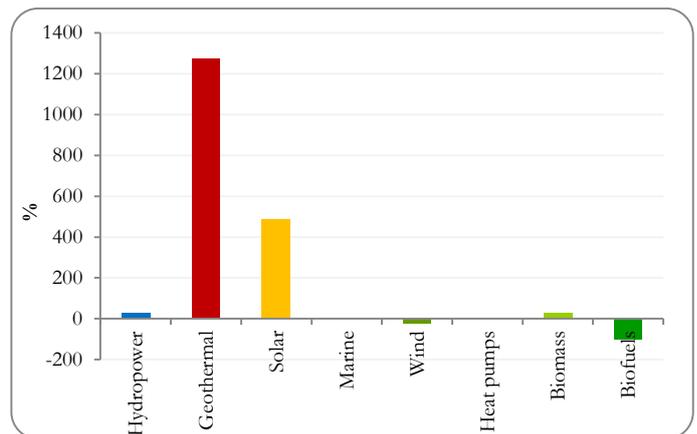


Figure 2-5. Deviation from NREAP in the contribution of renewable sources in Bulgaria in 2012

Solar source developed fast between 2011 and 2012 with 274.7% (+62.3 ktoe) reaching 85 ktoe (3.6 PJ) in 2012. Comparing with expected NREAP plans for this source the achieved levels were found to be significantly over in both 2011 and 2012: 112% (+ 12 ktoe) over in 2011 and 485.0% (+70.5 ktoe) over in 2012.

Geothermal¹² source had the highest exceedance from the expected NREAP levels in both 2011 and 2012: 1550% (+31 ktoe) in 2011 over 2 ktoe (0.08 PJ) planned level and 1275% (+30.6 ktoe) in 2012 over 2.4 ktoe (0.1 PJ) planned level.

In 2020, the share of biomass in RES mix is expected to decrease to 56% followed by hydropower with 16%, biofuels with 14%, wind with 11% and solar with 3%.

2.3 Renewable energy share

The overall renewable energy contribution in Gross Final Energy Consumption in Bulgaria reached 14.6% in 2011 and 16.4% in 2012. The 2020 target of overall RES share for Bulgaria is set to 16%.

Comparing with the expected shares for 2011 and 2012 the overall share of RES was over by 3.9% points in year 2011 and 5.7% points in 2012.

In 2012 the overall RES share in Bulgaria already exceeded as the overall 2020 target of 16% and then the indicative trajectories for both 2011/2012 and 2013/2014, and the NREAP plans for 2012 as well.

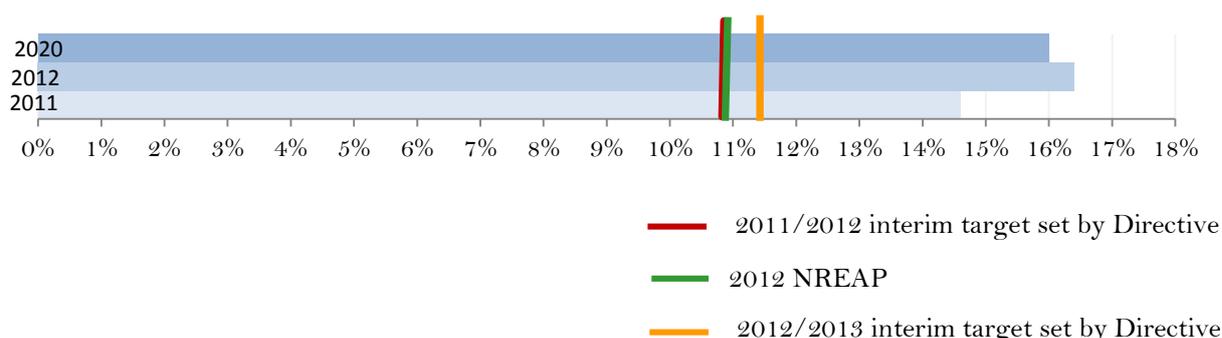


Figure 2-6. Overall RES share in Bulgaria, 2011-12

The heating/cooling sector experienced a very fast development from 2005 with +9% points in 2011 increasing further with +2.6% points in 2012. The share of RES in this sector exceeded since in year 2011 the 2020 planned share by +1.1% points influencing the exceedance of 2020 planned overall RES share in Bulgaria.

In electricity sector the share of renewable energy increased with +5.2% points in 2011 compared with 2005 and further more by +2.3% points in 2012. Renewable energy share in this sector was found to be over the NREAP planned share in 2011, by +1.5% points and in 2012 by + 3.3% points.

The share of renewable energy in transport sector increased by only +0.6% points in 2011 compared with 2005 but it decreased by 0.3% points in 2012. The share of RES in this sector was found to be under the expected share: -1.1% points in 2011 and -2.0% points in 2012.

Major increase from year 2012 is expected to be achieved until 2020, according to the NREAP, transport sector which is well behind the 2020 NREAP planned share, 10.4% points less.

¹² In Bulgaria this source contributed only in heating/cooling sector

2.4 Renewable electricity

2.4.1 Installed capacity

The renewable energy installed capacity in Bulgaria increased from 2059 MW in 2005 to 2801 MW in 2011 and 3820 MW in 2012. In 2020 Bulgaria has planned to have installed 4325 MW of renewable energy.

In 2012 the main contributor in renewable electricity installed capacity was hydropower with 55.4% followed by solar photovoltaic with 26.5%, wind with 17.7% and biomass with 0.4%.

Renewable energy installed capacity was found to exceed the expected values in both 2011 and 2012: 0.1% (+2 MW) over in 2011 and 24.4% (+750 MW) over in 2012.

Solar photovoltaic reached in 2012 a capacity of 1013 MW which is almost 3 times higher the 2020 planned capacity for this technology. The fastest development took place between 2011 and 2012 when this technology increased the capacity with 557.8% (+859 MW) over 2011 level. The exceedance from the expected 2011 and 2012 NREAP capacities were respectively 305.3% (+116 MW) and 1251% (+938 MW).

Wind capacity developed very fast during period 2005-2012 with 1194.6% per annum in average (+669 MW) over the low level of 8 MW in the baseline year. Despite of this increase this source missed the expected NREAP capacities in both 2011 and 2012: 3.4% (-19 MW) less in 2011 and 12.3% (-95 MW) less in 2012.

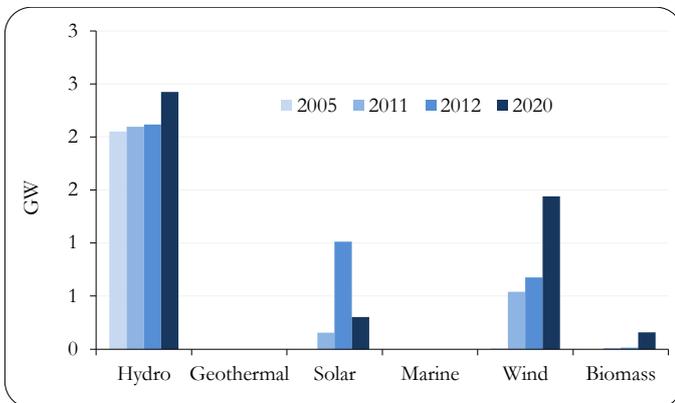


Figure 2-7. RES capacity deployment and progress until 2020 in Bulgaria.

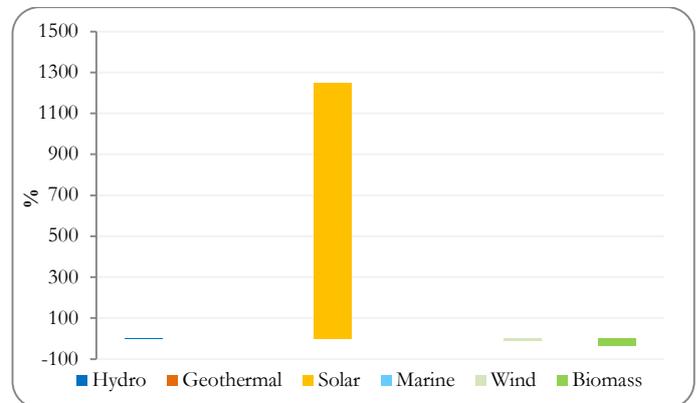


Figure 2-8. Deviation from NREAP in the RES installed capacity in Bulgaria in 2012.

Hydropower capacity increased slightly with 3.2% (+65 MW) between 2005 and 2012 reaching 2116 MW. This development was slower than the NREAP projected one missing both expected capacities in 2011 and 2012: 4.4% (-96 MW) less in 2011 and 3.9% (-85 MW) less in 2012.

Biomass capacity in Bulgaria reached only 11 MW in year 2011 increasing then with only +3 MW (+27.3%) in 2012. Nevertheless this development was not as planned in the NREAP exceeding only the 2011 planned capacity, 10% (+1 MW) over, but missing it in 2012 with 36.4% (-8 MW).

In 2020 hydropower will still remain the main source of renewable energy mix in Bulgaria. Wind power is expected to almost double its share reaching 33%, while solar capacity share will be decreased by nearly 4 times reaching 7%. The share of biomass is expected to reach 4% in Bulgarian renewable energy mix in 2020.

2.4.2 Consumption

Renewable electricity consumption in Bulgaria amounted to 4941 GWh (17.8 PJ) in 2011 and 6160 GWh (22.2 PJ) in 2012 from 3073 GWh (11.1 PJ) in 2005. In 2020 renewable electricity consumption in Bulgaria is expected to amount to 7604 GWh (27.4 PJ).

Consumption renewable electricity in Bulgaria exceeded the NREAP planned values by 11.4% (506 GWh) in 2011 and by 24.5% (+1212 GWh) in 2012.

In 2012 almost 69% of renewable electricity was coming from hydropower and the rest from wind (16.9%), photovoltaic (13.2%) and biomass (1.1%).

Wind power had the fastest development during period 2005-2012 with 2954% per annum in average (1034 GWh) from the very low level of 5 GWh (0.02 PJ) in 2005. Despite of this development this source didn't reach the expected NREAP levels being under in both 2011 and 2012: 20.4% (-206 GWh) under in 2011 and 25.3% (-351 GWh) under in 2012.

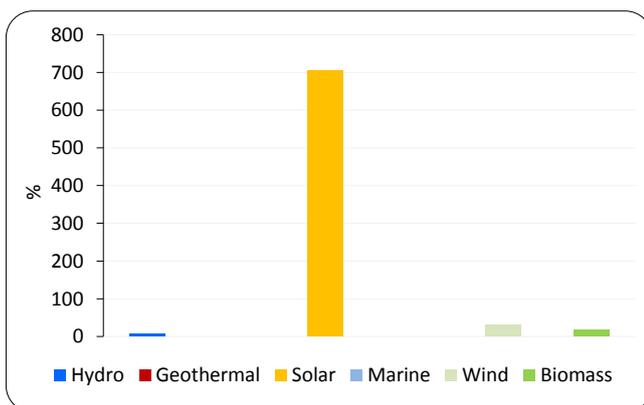


Figure 2-9. Relative increase/decrease of RES electricity sources in Bulgaria, 2011-12

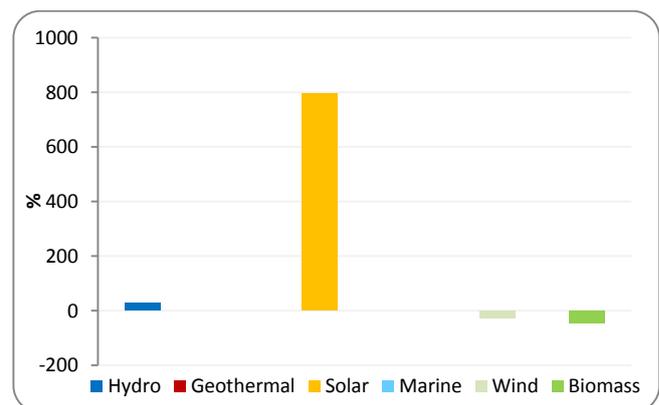


Figure 2-10. Deviation from NREAP in the RES electricity consumption in Bulgaria in 2012.

Solar photovoltaic experienced the fastest development during period 2011-12 increasing with 706% (+713 GWh) from the level of 91 GWh (0.4 PJ) in 2011. This development was fast enough exceeding not only the expected NREAP levels for 2011 and 2012 respectively with 102% (+51 GWh) and 795.4% (+723 GWh) but even the 2020 planned consumption with 87% (+379 GWh).

In 2012 renewable electricity from PV was found being 2 times higher than the 2020 planned value of 435 GWh.

The development of hydropower renewable electricity between 2005 and 2012 took place with 5.5% per annum in average (+1173 GWh) from 3068 GWh (11 PJ) in the baseline year. This source developed faster than the NREAP projections in both 2011 and 2012: 19.9% (+660 GWh) more in 2011 and 26.7% (+894 GWh) more in 2012.

Biomass use for electricity increased with 17.9% (+10 GWh) between 2011 and 2012 reaching 66 GWh (0.2 PJ) in 2012. These consumptions were found over the expected NREAP level in 2011 with 1.8% (+1.0 GWh) but under in 2012 with 45% (-54 GWh).

In 2020 wind power is expected to almost double its share presenting 34.1% of total renewable electricity expected to be produced in this year while the share of hydropower is expected to decrease up to 48.8%. Shares of biomass and solar photovoltaic are expected to be respectively 11.4% and 5.7%.

2.5 Renewable energy in heating & cooling

The use of renewable energy in heating/cooling sector in Bulgaria reached 1033 ktoe (43.2 PJ) in 2011 and 1100 ktoe (46.1 PJ) in 2012 from 724 ktoe (30.3 PJ).

In 2012 biomass share in total renewable heat reached 91.4% and the rest was heat pumps (4.3%), geothermal (3.0%) and solar (1.4%).

Renewable energy consumed in heating/cooling exceeded the NREAP plans by 35% (+269 ktoe) in 2011 and by 37.7% (+301 ktoe) in 2012.

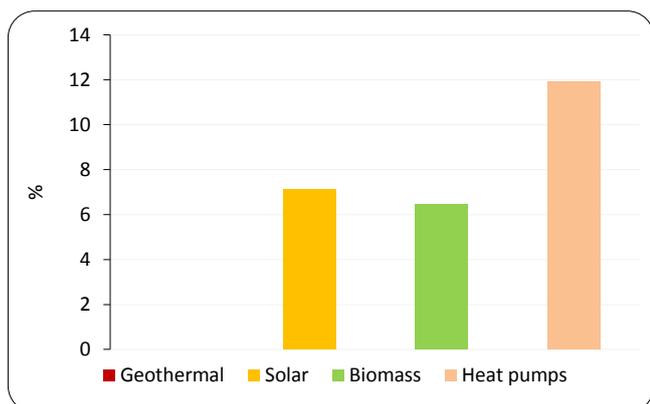


Figure 2-11. Relative increase/decrease of RES heating/cooling sources in Bulgaria, 2011-12.

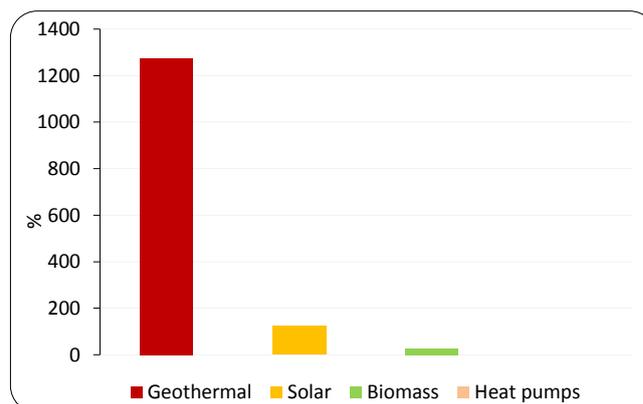


Figure 2-12. Deviation from NREAP in the RES heat consumption in Bulgaria in 2012.

Biomass heat was developed with 5.5% per annum in average (+281 ktoe) between 2005 and 2012 from 724 ktoe (30.3 PJ) in the baseline year. The exceedances from expected NREAP levels for 2011 and 2012 were respectively 24.9% (+188 ktoe) and 27.2% (+215 ktoe).

Solar heat reached 14 ktoe (0.59 PJ) in 2011 increasing then with 7.1% (+1 ktoe) in 2012. This development was faster than what was planned in the NREAP exceeding the respective levels in both 2011 and 2012: 118.8% (+7.6 ktoe) more in 2011 and 124% (+8 ktoe) more in 2012.

While no contribution from heat pumps was planned for years 2011 and 2012, Bulgaria reported a consumption of heat originated from this technology equal to 42 ktoe in 2011 further increasing by 11.9% (+ 5 ktoe) in 2012.

Geothermal had the highest relative in 2011 and 2012 with respectively 1550% (+31 ktoe) and 1275% (+31 ktoe) from 2 ktoe level planned for each year.

In 2020 the share of biomass in total heat production is expected to increase to 97.3%. Solar and geothermal are expected to have a contribution of 1.9% and 0.8%.

2.6 Renewable energy in transport

Renewable energy consumed in transport sector in Bulgaria¹³ reached only 8 ktoe (0.33 PJ) in 2011 decreasing then to 6.1 ktoe (0.26 PJ) in 2012. The use of renewable energy in transport sector is expected to reach 302 ktoe (12.6 PJ) in 2020.

Reported renewable energy use in the transport sector missed both the 2011 and 2012 expected NREAP values: by 84.3% (-43 ktoe) in 2011 and by 91.4% (-65 ktoe) in 2012.

The use of renewable electricity reached only 8 ktoe in 2011 and 6.1 ktoe in 2012 being over the planned levels in both years: 100% (+4 ktoe) more in 2011 and 52.5% (+2 ktoe) more in 2012.

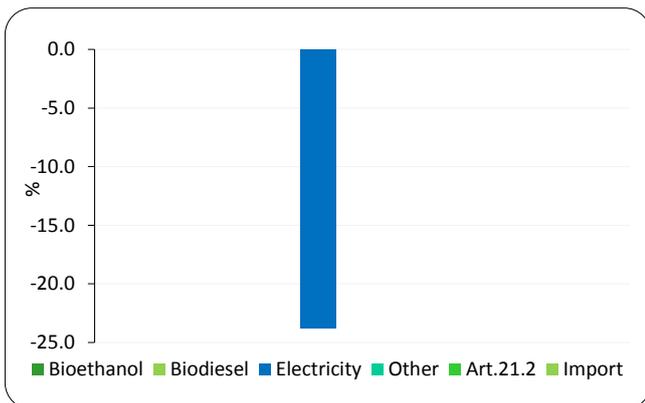


Figure 2-13. Relative increase/decrease of RES transport uses in Bulgaria, 2011-12.

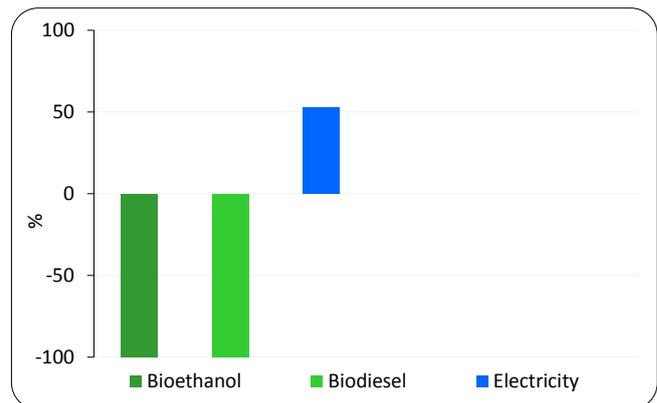


Figure 2-14. Deviation from NREAP in the RES use in transport in Bulgaria in 2012.

In 2020 Bulgaria expect a contribution of 72.8% from biodiesel and the rest will be bioethanol/bio-ETBE (19.9%), renewable electricity (5%) and other biofuels (2.3%).

¹³ Biofuels used in transport sector in Bulgaria didn't fulfil the sustainability criteria according to Article 17 of the Directive. No data on biofuels use in this sector for period 2011-2012 was reported in the Bulgarian second progress report

3. Renewable energy in Czech Republic

3.1 Deployment of renewable energy

Renewable energy consumed in Czech Republic increased from 1674 ktoe (70.1 PJ) in 2005 to 2731 ktoe (114.4 PJ) in 2011 and 2887 ktoe (121 PJ) in 2012. Renewable energy consumed in Czech Republic is expected to further increase to 4173 ktoe (174.7 PJ) until 2020 (Figure 3-1).

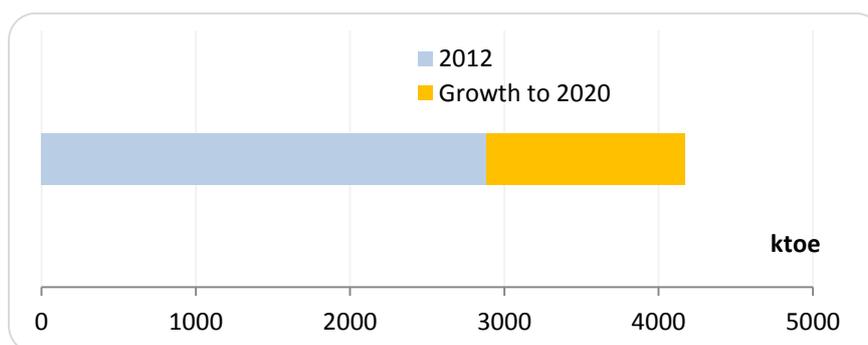


Figure 3-1 RES total in Czech Republic in 2012 and the expected growth to 2020 target

Renewable energy consumed in transport sector made the most significant progress from year 2005 in relative terms. It experienced a very fast increase up to 2011 with +554% per annum in average (+299 ktoe) but it decreased in 2012 by 6.2% (-19 ktoe). Due to this trend renewable energy consumed in this sector surpassed the 2011 plan with 8.1% (+23 ktoe) but missed the 2012 plan with 11.6% (+38 ktoe).

Development of renewable energy in Czech Republic did not reach the expected values neither in 2011 nor 2012 respectively by -5.5% (-158.7 ktoe) and by -7.2% (-224 ktoe).

The development of renewable energy in heating/cooling sector was faster in period 2011-12 (+5.8%) compared with the development during 2005-2011 period (+3.9% per annum in average). This development was slower than the expected NREAP one with 8.9% (-176 ktoe) less in 2011 and 9.2% (-193 ktoe) less in 2012.

Electricity sector increased by +34.6% per annum in average in period 2005-11 having an additional of +420.7 ktoe increasing further with only 70.4 ktoe (+11.3%). Nevertheless renewable electricity consumptions in 2011 and 2012 were found under the expected NREAP levels respectively with 0.9% (-5.7 ktoe) in 2011 but 1% (+6.9 ktoe) over in 2012.

Up to 2020 the highest additional contribution is expected to be seen in heating/cooling sector with +661 ktoe (+27.7 PJ) while the additional contributions in electricity and transport sector are expected to reach +220.2 ktoe (+9.2 PJ) and +405 ktoe (+17 PJ) respectively. The fastest development will take place in transport sector with an average growth rate of 17.5%.

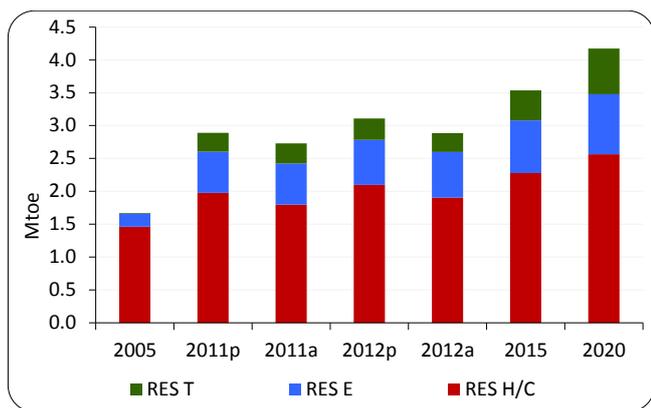


Figure 3-2. RES deployment in CZ: projected growth and actual progress until 2020.

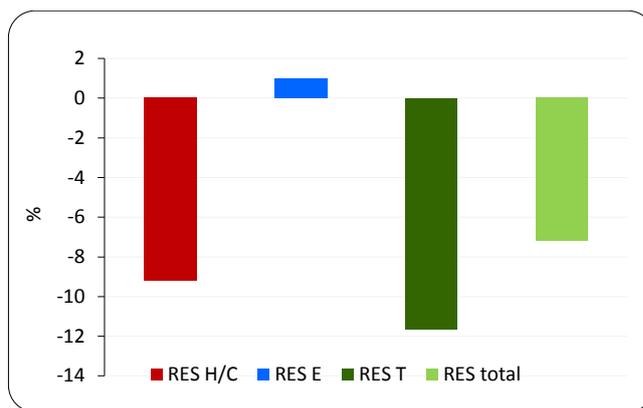


Figure 3-3. Deviation from NREAP in the RES consumption in CZ in 2012.

3.2 Sources of renewable energy

Biomass was the main renewable energy source in Czech Republic with a contribution in renewable energy mix in 2012 equal to 73.6%, followed by biofuels with 9.7%, solar with 6.9%, hydropower with 6.4%, heat pumps with 2.2% and wind 1.2%.

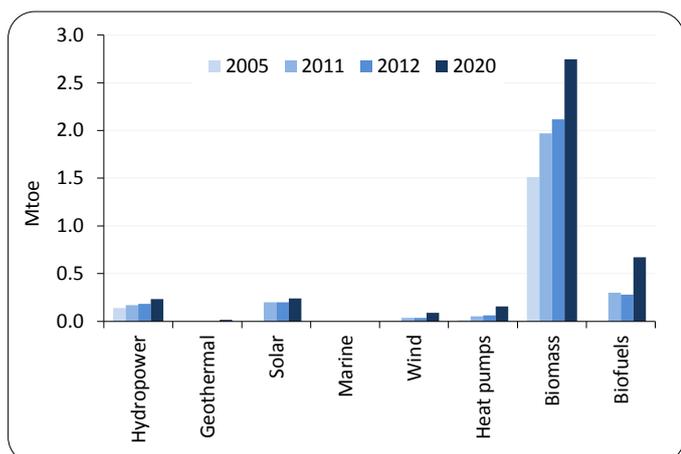


Figure 3-4. Contribution of renewable energy sources in CZ: actual and projected in 2020

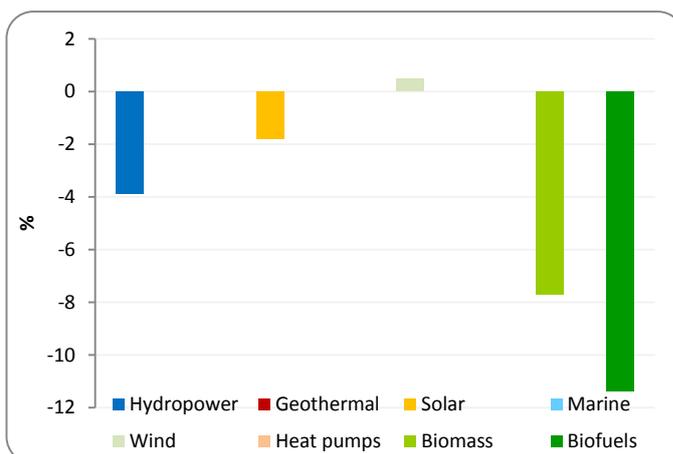


Figure 3-5. Deviation from NREAP in the contribution of renewable sources in CZ in 2012

Solar source had the fastest development between 2005 and 2012 with a yearly average growth rate of 1398.4% (+195.8 ktoe) over the very marginal level of 2 ktoe in the baseline year. This source met in 2011 the planned NREAP value but missed it in 2012 with 1.8% (-3.6 ktoe).

Biofuels consumed in transport sector had the second relative increase during period 2005-2012 with 1319% per annum in average (+277 ktoe) from the very low level of 3 ktoe in 2005. Nevertheless this development was found over the respective NREAP plans in 2011 with 9.1% (+25 ktoe) but under in 2012 with 11.4% (-36 ktoe).

The use of biomass in electricity and heating/cooling sectors developed with only 5.8% per annum in average (+609 ktoe) during period 2005-2012 over the level of 1510 ktoe (63.2 PJ) in 2005. Nevertheless this development was slower than the one projected from NREAP missing both 2011 and 2012 expected uses: 7.9% (-168.6 ktoe) less in 2011 and 7.7% (-177.3 ktoe) less in 2012.

In 2020, the share of biomass in renewable energy mix is expected to decrease up to 66% while biofuels contribution will increase to 16%. Solar and hydropower contribution will remain almost unchanged, 6% and 7%, while heat pumps and wind will increase slightly to 4% and 2% respectively.

3.3 Renewable energy share

The overall renewable energy contribution in Gross Final Energy Consumption in Czech Republic reached 10.5% in 2011 and 11.2% in 2012. Comparing with the expected shares for 2011 and 2012 the overall share of RES in Czech Republic was over by 0.7% points in each year. The 2020 target of overall RES share for Czech Republic is 14%.

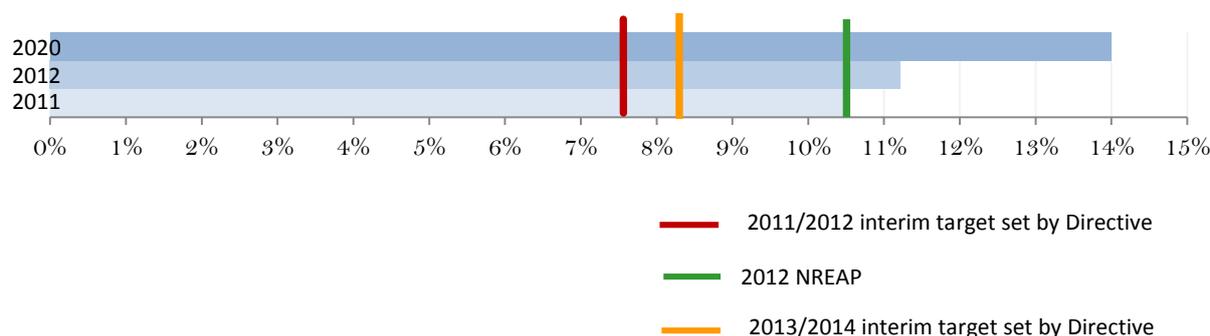


Figure 3-6. Overall RES share in Czech Republic, 2011-12

The 2011-2012 overall RES share in Czech Republic remained over the NREAP planned value. As the Czech NREAP set the overall RES share trajectory well over the indicative overall RES share trajectory fixed by the Directive, the overall RES share in Czech Republic exceeded both the 2011/2012 and 2013/2014 interim target since in year 2011. Based on reported overall RES shares in 2011 and 2012 Czech Republic seems to be in good position for the achievement of 2020 RES share target.

Electricity sector share had the fastest increase during 2005-2011 with +10.5% points exceeding the 2020 plan share for this sector. The share of renewable energy in electricity sector increased further with 3.1% points in 2012. Renewable energy share in this sector was found to be over the NREAP planned shares in 2011 and 2012, by +1.3% points and +1.4% points respectively.

The increase of renewable energy share in heating/cooling sector from 2005 was with +4.4% points in 2011 and it increased further with +0.9% points in 2012. The share of renewable energy in this sector was over the planned shares in both years, respectively by 1.3% points and 1.4% points.

Renewable energy share in transport sector increased by +5.8% points in 2011 compared with 2005 but in 2012 this share decreased by 0.3% points. Nevertheless the share of RES in

this sector was found to be over the expected shares in both years: +1.3% points in 2011 and +0.3% points in 2012.

Major increase from year 2012 is expected to be achieved until 2020, according to the NREAP, in transport sector (from 5.6% to 15.5%) followed by heating/cooling sector (from 13.6% to 15.5%).

3.4 Renewable electricity 3.4.1 Installed capacity

Renewable energy installed capacity in Czech Republic increased from 1079 MW in 2005 to 3353 MW in 2011 and 3645 MW in 2012. The expected 2020 renewable capacity in Czech Republic is 4156 MW.

In 2012 solar technology presented 56% of renewable energy installed capacity in Czech Republic followed by hydropower with 29%, biomass with 8% and wind with 7%. Except biomass capacity all other renewable electricity sources met the 2011 NREAP planned capacities.

Renewable electricity installed capacity in Czech Republic missed the planned value by 0.1% (-5 MW) in 2011 while exceeded it by 5.3% (+184 MW) in 2012.

Solar photovoltaic had the fastest development between 2005 and 2012 with 28871.4% (+2022 MW) over the very low level of 1 MW in the baseline year. In 2012 the achieved capacity was 4.5% (+87 MW) over the expected capacity.

Wind power capacity developed with 153.2% per annum in average (+236 MW) in 2012 over 22 MW in 2005. In 2012 this source exceeded with 2% (+5 MW) the NREAP plan for this year.

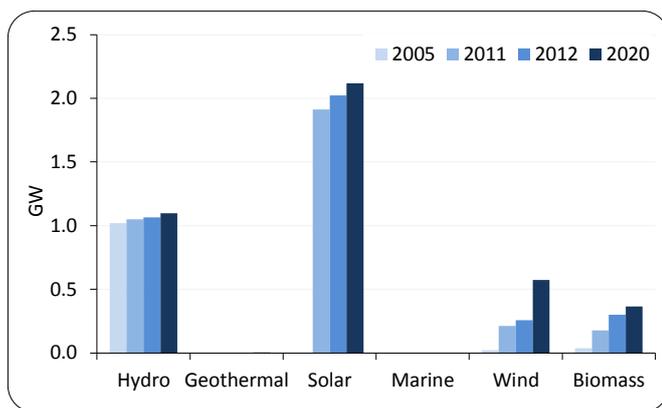


Figure 3-7. RES capacity deployment and progress until 2020 in CZ.

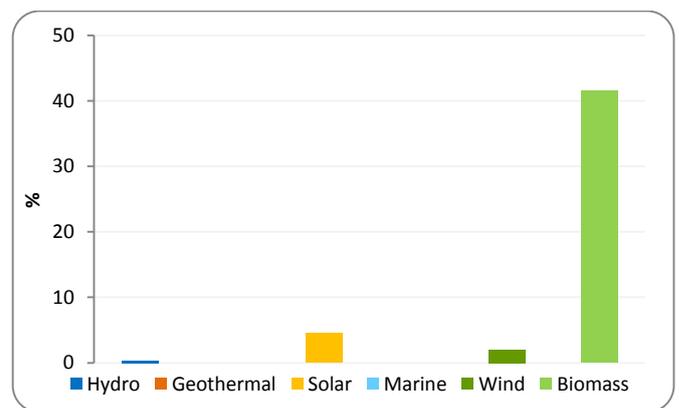


Figure 3-8. Deviation from NREAP in the RES installed capacity in CZ in 2012.

Biomass capacity developed with 104.8% (+264 MW) between 2005 and 2012 over the level of 36 MW in the baseline year. Nevertheless this source missed in 2011 the expected NREAP capacity with 2.7% (-5 MW) exceeding then it in 2012 with 41.5% (+88 MW).

Hydropower capacity developed with an average growth rate of 0.6% (+45 MW) between 2005 and 2012 reaching 1065 MW. In 2012 the current capacity was found to be 0.4% (+4 MW) over the NREAP planned one.

In 2020 solar will remain the main contributor in renewable installed capacities with 51% followed by hydropower with 26%, wind with 14% and biomass with 9%.

3.4.2 Consumption

Renewable electricity consumption in Czech Republic amounted to 7247 GWh (26.1 PJ) in 2011 and 8066 GWh (29 PJ) in 2012 from 2355 GWh (8.5 PJ) in 2005. In 2020 the renewable electricity consumption in Czech Republic is expected to amount to 10626 GWh (38.3 PJ).

In 2012 biomass share in total renewable electricity consumption was 41.8% followed by solar with 26.6%, hydropower with 26.4% and wind with 5.2%.

Renewable electricity originated from wind power had the fastest development between 2005 and 2012 with 357% per annum in average (+400 GWh) over the low level of 16 GWh (0.1 PJ) in 2005. Comparing with expected NREAP levels this source surpassed them in both 2011 and 2012: 7% (+26 GWh) more in 2011 and 0.5% (+2 GWh) more in 2012.

Renewable electricity consumption in Czech Republic did not reach the 2011 NREAP planned values by 0.9% (-66 GWh) while in 2012 it exceeded the target by 1.0% (+80 GWh).

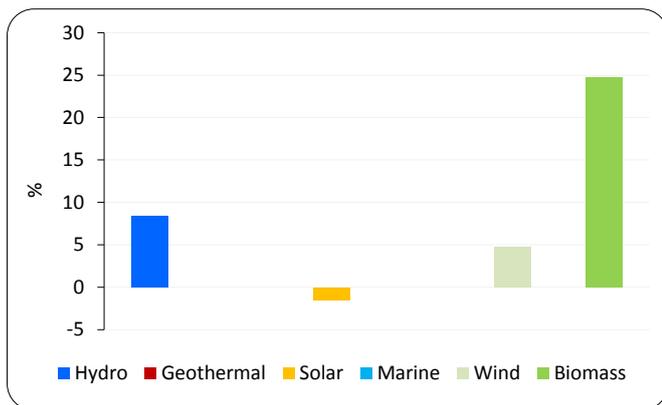


Figure 3-9. Relative increase/decrease of RES electricity sources in CZ, 2011-12

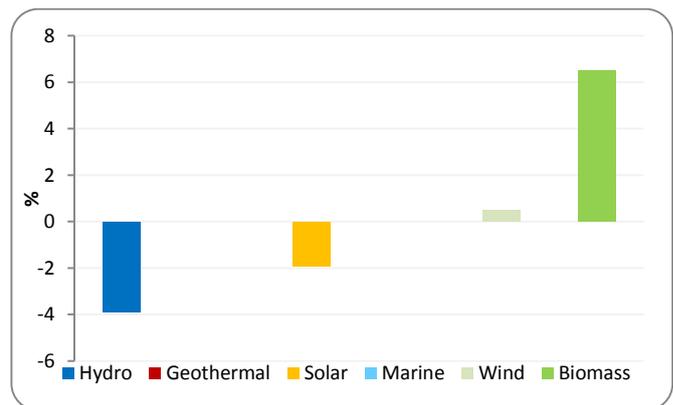


Figure 3-10. Deviation from NREAP in the RES electricity consumption in CZ in 2012.

Biomass used in this sector had an average growth rate of 52.5% (+2651 GWh) during period 2005-2012 over the level of 721 GWh (2.6 PJ) in 2005. The current levels were found to be over the expected NREAP consumptions in both 2011 and 2012: 3.3% (+86 GWh) more in 2011 and 6.5% (+206 GWh) more in 2012.

Renewable electricity originated from solar photovoltaic reached 2182 GWh (7.9 PJ) meeting the NREAP plan for this year: Even that a decrease with 1.5% (-33 GWh) took place in 2012 the achieved consumption was over the expected NREAP one with 0.5% (+2 GWh).

Hydropower source had an average growth rate of 4.5% (+511 GWh) between 2005 and 2012 over 1618 GWh (5.8 PJ) in the baseline year. Nevertheless this development was not fast enough to exceed the expected NREAP consumptions in both 2011 and 2012: 8.3% (-178 GWh) under in 2011 and 3.9% (-86 GWh) under in 2012.

In 2020 biomass will remain the main contributor with 42.2% followed by hydropower with 25.5%, solar photovoltaic with 22.6%, wind with 9.5% and geothermal with 0.2%.

3.5 Renewable energy in heating & cooling

The use of renewable energy in heating and cooling in Czech Republic increased by only 338 ktoe (+8.2%) in 2011 over 1462 ktoe (61.2 PJ) of 2005 and the additional heat in period 2011-12 was 104 ktoe (+5.8%). The heat originated from renewable energy sources is expected to reach 2565 ktoe (107.4 PJ) in 2020.

Renewable energy consumed in heating/cooling sector in Czech Republic missed the NREAP planned value by 8.9% (-176 ktoe) in 2011 and by 9.2% (-193 ktoe) in 2012.

In 2012 the contribution of biomass reached 96.1% of total renewable heat consumption and the rest was 3.3% heat pumps and 0.7% solar thermal.

The main progress from 2005 happened in biomass which increased by +289 ktoe (+20%) in 2011 and further more with +92 ktoe (+5.3%) in 2012. Despite this increase heat produced by biomass was under the expected levels in both years: 176 ktoe (-9.2%) less in 2011 and 195 ktoe (-9.6%) less in 2012.

Biomass use in heating/cooling sector in Czech Republic covered 63.6% of total renewable energy mix consumed the sector in 2012.

Heat pumps produced 40 ktoe more in 2011 over the 2005 level, increasing more with +10 ktoe (+19.2%) in 2012. It was found to be only 2 ktoe (+3.3%) over the expected NREAP level in year 2012. Heat pumps had the highest relative increase during period 2011-12 with +19.2% (+10 ktoe).

Solar thermal increased from 2005 with +9 ktoe (+450%) in 2011 and only with +2.0 ktoe (+18.2%) during 2011-12. Heat from solar thermal in Czech Republic met the NREAP planned levels in both years. The increase of solar thermal in 2012 happened with +18.2% (+2 ktoe) over 2011 level.

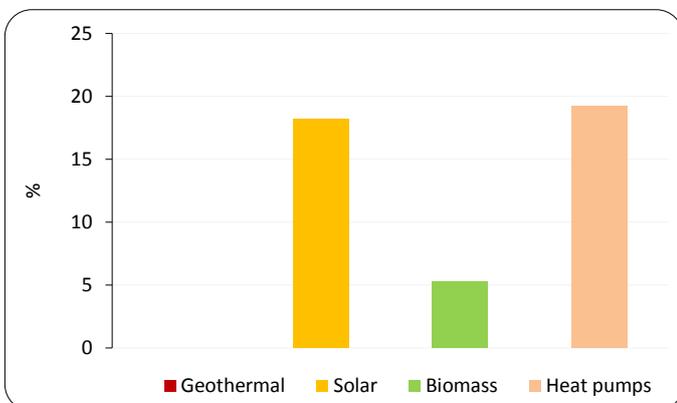


Figure 3-11. Relative increase/decrease of RES heating/cooling sources in CZ, 2011-12.

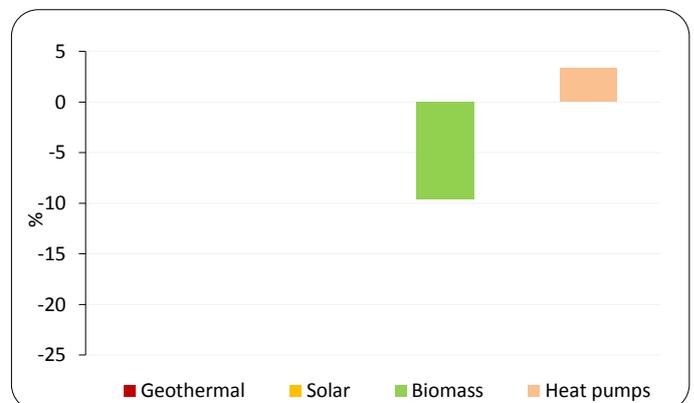


Figure 3-12. Deviation from NREAP in the RES heat consumption in CZ in 2012.

In 2020 the share of biomass in total renewable heat expected to be produced will reach 92% and the rest will be 6.1% heta pumps, 1.2% solar thermal and 0.6% geothermal thermal.

3.6 Renewable energy in transport

The use of renewable energy in transport reached 308 ktoe (12.9 PJ) in 2011 decreasing then to 289 ktoe (12.1 PJ) in 2012. The use of renewable energy in transport sector in 2020 is expected to be 694 ktoe (29.1 PJ).

In 2012 biodiesel share in total renewable energy consumed in this sector was 76.5% while the rest was 20.4% bioethanol/bio-ETBE and 3.1% renewable electricity.

The expected renewable energy consumption in transport sector set by the Czech NREAP was exceeded by 8.1% (+23 ktoe) in 2011 while missed by 11.6% (-38 ktoe) in 2012.

Biodiesel made the main progress in transport sector during 2005-2011 increasing with 238 ktoe but decreasing by 8.3% (-20 ktoe) in 2011-12 time span. In comparison with NREAP planned values the use of biodiesel in Czech Republic was higher by 9% in 2011 but lower of 12% in 2012.

Bioethanol/bio-ETBE increased in 2011 by 59 ktoe over the 2005 level. Even that an increase was planned in the NREAP during period 2011-12 in the use of bioethanol/bio-ETBE no change took place in this period. In 2011 bioethanol/bio-ETBE exceeded by only 5 ktoe (+9.3%) the planned value but missed it in 2012 by 9.2% (-6.0 ktoe).

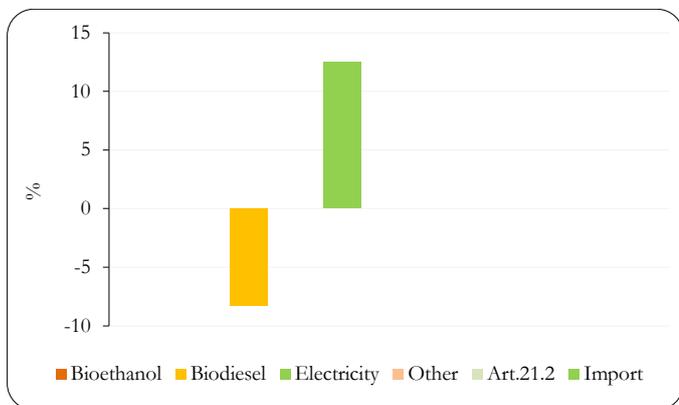


Figure 3-13. Relative increase/decrease of RES transport uses in CZ, 2011-12.

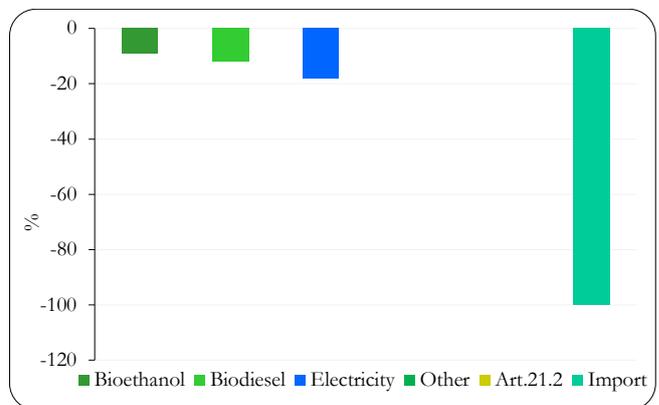


Figure 3-14. Deviation from NREAP in the RES use in transport in CZ in 2012.

Even that planned no imported biofuels is used in Czech Republic during 2011-12 time span. The use of renewable electricity in transport increased but not enough to meet the NREAP planned values in both years: 20% (-2 ktoe) under in 2011 and 18.2% (-2 ktoe) under in 2012.

In 2020 the share of biodiesel is expected to reach 71.3% and the rest 18.4% bioethanol/bio-ETBE, 7.1% other biofuels and 3.2% renewable electricity.

4. Renewable energy in Denmark

4.1 Deployment of renewable energy

The renewable energy consumed in Denmark increased from 2728 ktoe (114.2 PJ) in 2005 to 3332.4 (139.5 PJ) ktoe in 2011 and 3592.4 (150.4 PJ) ktoe in 2012. The renewable energy consumed in Denmark is expected to further increase to 5090 ktoe (213 PJ) until 2020 (Figure 4-1).

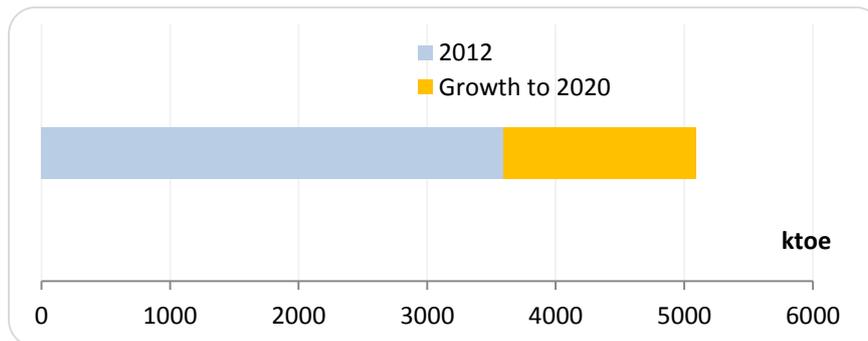


Figure 4-1 RES total in Denmark in 2012 and the expected growth to 2020 target

The development of renewable energy in heating/cooling sector had the higher absolute

In compared with expectations set in the NREAP renewable energy consumed in Denmark was 13.4% (-514.6 ktoe) lower in 2011 and 10.6% (-424.3 ktoe) lower in 2012.

increase during 2005-11 (+270 ktoe or +2.4% per annum in average) increasing further in 2012 by 112 ktoe (+5.2%). Nevertheless the development in this sector was slower than what was planned in the NREAP: -15.6% (-395.6 ktoe) in 2011 and -12.1% (-309.4 ktoe) in 2012.

In relative terms renewable energy consumed in transport sector made in 2011 the most significant progress from year 2005 with +256% per annum in average (+138 ktoe) increasing further in 2012 by 51% (+74.8 ktoe). Nevertheless the development was not fast enough to meet the NREAP planned values: 2.6% (-4 ktoe) under in 2011 and 13.7% (-35.2 ktoe) under in 2012.

The development in electricity sector in relative terms between 2011 and 2012 (+7%) was almost double the development during period 2005-11 (+3.8% per annum in average) reaching in 2012 the amount of 119 ktoe (46.8 PJ). Compared with planned development renewable electricity development was slower in both years: 9.9% (-115 ktoe) slower in 2011 and 6.6% (-79.7 ktoe) slower in 2012.

Renewable energy consumed in heating/cooling sector accounted for more than 60% of total renewable energy consumed in Denmark in 2012.

Up to 2020 the main progress is expected to take place in electricity sector with 58.3% followed by transport sector with 31.2%. Heating/cooling sector development is expected to take place with a +776 ktoe or 34.5%.

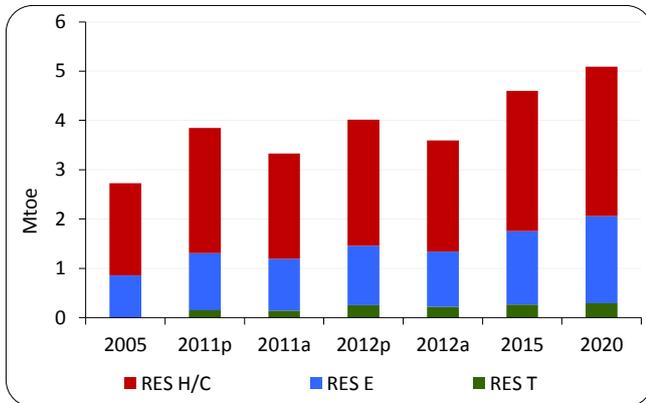


Figure 4-2. RES deployment in Denmark: projected growth and actual progress until 2020.

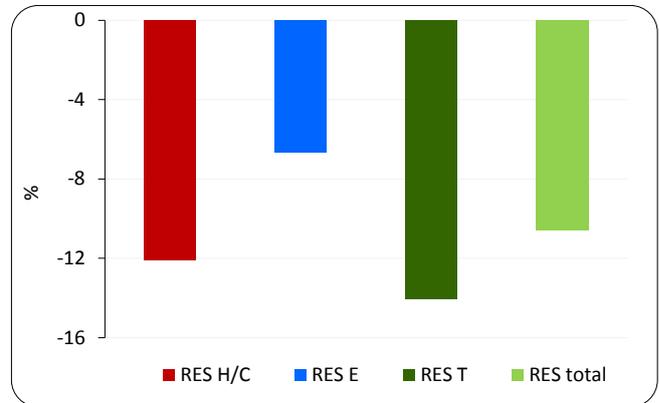


Figure 4-3. Deviation from NREAP in the RES consumption in Denmark in 2012.

4.2 Sources of renewable energy

Biomass was the main renewable energy source in Denmark with a 67% contribution in renewable mix in 2012, followed by wind with 23%, biofuels with 6% and heat pumps with 3% and solar thermal with 1%.

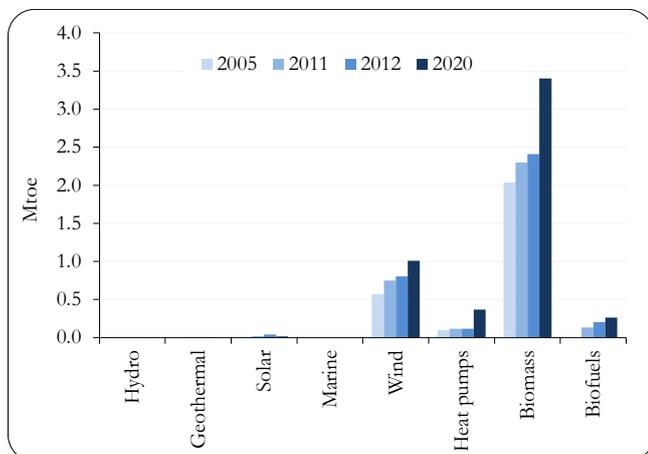


Figure 4-4. Contribution of renewable energy sources in Denmark: actual and projected in 2020

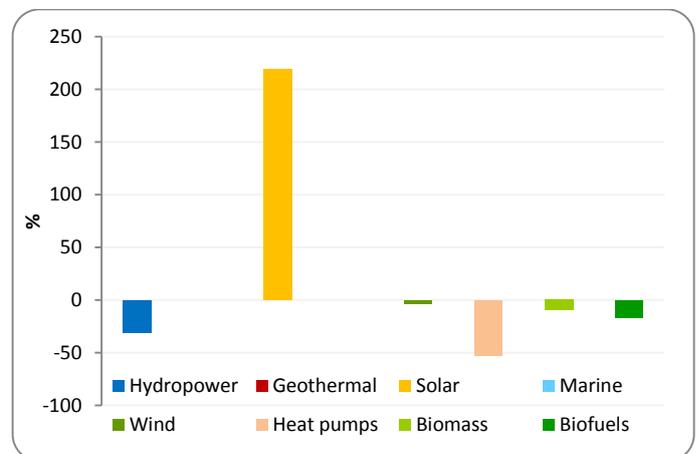


Figure 4-5. Deviation from NREAP in the contribution of renewable sources in Denmark in 2012

Solar (electricity and thermal) had the fastest development between 2005 and 2012 with 40.3% per annum in average (+28.7 ktoe) over the level of 10.2 ktoe (0.4 PJ) in 2005. The development was faster than planned exceeding in both years the NREAPs levels: 65% (+7.69 ktoe) over in 2011 and 219% (+26.7 ktoe) over in 2012.

Biomass used in electricity and heating/cooling sector developed with 2.6% per annum in average (+369.4 ktoe) in 2012 over the level of 2037.8 ktoe (85.3 PJ) in 2005. This

development was slower than the NREAP projected one missing both 2011 and 2012 levels: 13.4% (-355.5 ktoe) less in 2011 and 9.7% (-257.8 ktoe) less in 2012.

Biofuels use in transport sector reached 134.1 ktoe (5.9 PJ) increasing then further with 52% (+69.6 ktoe) in 2012. Comparing with expected NREAP levels these uses were found under the respective planned uses in both 2011 and 2012: 4.2% (-5.9 ktoe) less in 2011 and 16.9% (-41.3 ktoe) less in 2012.

While no planned the contribution of geothermal¹⁴ source reached 2 ktoe (0.08 PJ) in 2011 increasing then further with 70% (+1.4 ktoe) in 2012.

In 2020, the share of renewable energy sources in renewable energy mix in Denmark is expected to remain almost the same as in 2012: biomass with 67%, wind with 20%, heat pumps with 7%, biofuels with 5% and solar with 1%.

4.3 Renewable energy share

The overall renewable energy contribution in Gross Final Energy Consumption in Denmark reached 23.53% in 2011 and 25.97% in 2012. Comparing with the expected shares for 2011 and 2012 the overall share of RES was over by 0.1% points in year 2011 and 1.8% points in 2012. The 2020 target that Denmark has to reach for the overall RES share is 30.4%.

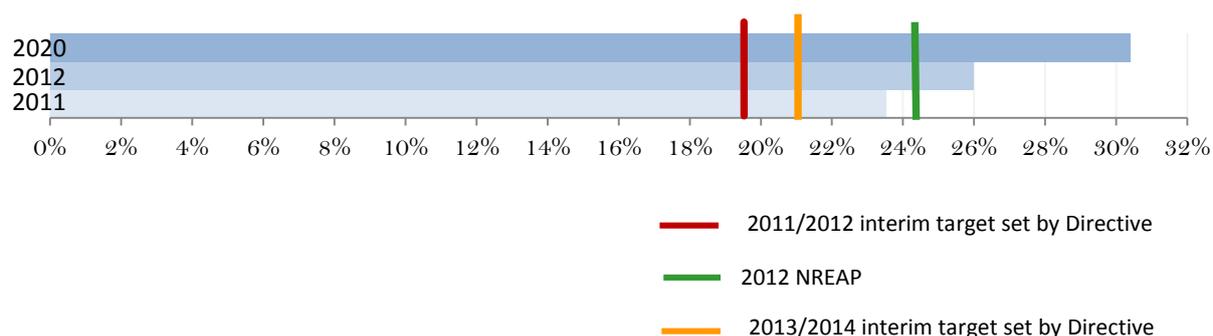


Figure 5-6. Overall RES share in Denmark, 2011-12

In 2011 Denmark met the 2011 NREAP planned share and exceeded the indicative trajectory for 2011/2012. In 2012 the Danish overall RES share was above the 2012 NREAP planned value. Moreover, as the NREAP trajectory is set well above the minimum indicative trajectory defined in RED Directive the indicative trajectory for 2013/2014 was also overcome. Based on reported overall RES shares in 2011 and 2012 Denmark seems to be in good position for the achievement of 2020 RES share target.

Renewable energy share in electricity sector experienced a highest absolute increase during period 2005-12 with +11.89% points. Nevertheless in 2011 the achieved share of renewable energy in this sector missed the expected NREAP share by 1.2% points whereas surpassed it in 2012 with only 0.75 points.

¹⁴ Only geothermal thermal contribution is reported in second progress report of Denmark

The share of renewable energy in heating/cooling sector increased by +8.57% points in 2011 from the share of 23.2% in 2005, meeting almost the expected NREAP share of 33.8% for this year. The increase with 1.55% that took place in 2012 was enough to exceed the expected NREAP share of 32.1% by 1.2% points.

The increase of renewable energy share in transport sector from 2005 was with +3.58% points in 2011 and it increased further with +2.0% points in 2012. The share of renewable energy in this sector surpassed by 0.2% points the planned share in year 2011 but missed it by 0.1% points in 2012.

Major increase from year 2012 expected to be achieved until 2020, according to the NREAP, will be in electricity (from 38.69% to 51.9%) and in heating/cooling (from 33.32% to 39.8%).

4.4 Renewable electricity

4.4.1 Installed capacity

The renewable energy installed capacity in Denmark increased from 3919 MW in 2005 to 4976 MW in 2011 and 5807 MW in 2012. In 2020 the expected installed renewable energy in Denmark is 6755 MW.

In 2012 wind presented 72% of renewable energy installed capacity in Denmark followed by biomass with 21% and solar with 7%.

Denmark has exceeded the expected NREAP renewable capacity capacities in both years: by 5.3% (+249 MW) in 2011 and by 6.9% (+1006 MW) in 2012.

Solar photovoltaic had fastest development between 2005 and 2012 with 1885.7% per annum in average (+396 MW) over the very low level of 3 MW in 2005. The 2011 and 2012 exceedances from NREAP planned capacities were respectively 466.7% (+14 MW) and 13200% (+396 MW).

Solar photovoltaic installed capacity in Denmark in year 2012 was 66.5 times higher the 2020 planned value of 6 MW

The progress from year 2005 in wind capacity had an average growth rate of 4.7% (+1034 MW) reaching 4163 MW in 2012. In 2012 wind installed capacity in Denmark surpassed with 5% the 2020 plan of 3960 MW. Comparing with NREAP planned capacities this technology was over by 4.6% in 2011 and 8.4% in 2012.

Biomass installed capacity increase from baseline year with an average growth rate of 8.4% (+459 MW) reaching 1236 MW being over the 2011 and 2012 NREAP plans respectively +6.7% in 2011 and +30.5% in 2012.

Hydropower capacity decreased with 10% (-1 MW) during period 2005-12 from the level of 10 MW in the baseline year. It missed with the same amount the expected 2011 and 2012 NREAP capacities: 10% (-1 MW) under in each year.

In 2020 the picture of renewable energy sources shares might change due to the fast development of solar photovoltaic. According to actual NREAP in 2020 renewable installed capacity will be composed by 59% wind and 41% biomass.

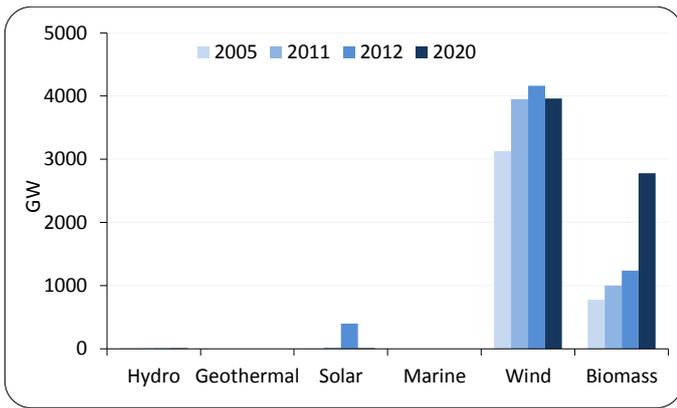


Figure 4-7. RES capacity deployment and progress until 2020 in Denmark.

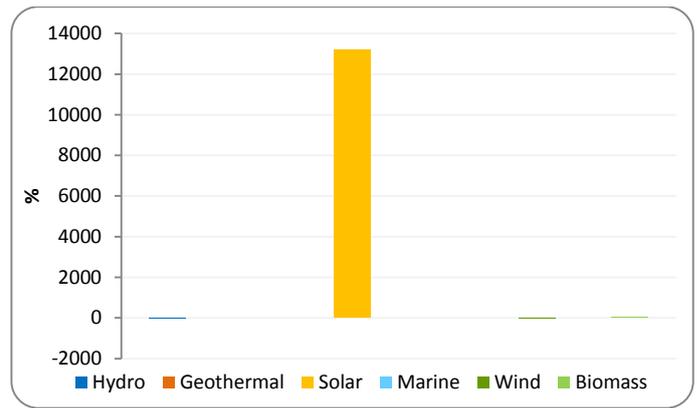


Figure 4-8. Deviation from NREAP in the RES installed capacity in Denmark in 2012.

4.4.2 Consumption

Renewable electricity consumption in Denmark amounted to 12163 GWh (43.8 PJ) in 2011 and 13011 GWh (46.8 PJ) in 2012 from 9882 GWh (35.6 PJ) in 2005. In 2020 renewable electricity consumption in Denmark is expected to amount to 20594 GWh (74.1 PJ).

In 2012 wind provided 71.7% of total renewable electricity and the rest was 27.3% biomass, 0.8% solar photovoltaic and 0.2% hydropower.

Renewable electricity consumption in Denmark did not reach the NREAP planned values missing it by 9.9% (-1337 GWh) in 2011 and by 6.6% (-927 GWh) in 2012.

Renewable electricity from solar photovoltaic developed very fast between 2005 and 2012 with an average growth rate of 728% (+102 GWh) reaching 104 GWh (0.4 PJ). The exceedances from expected 2011 and 2012 NREAP plans were respectively 650% (+13 GWh) and 5100% (+102 GWh).

Renewable electricity from solar photovoltaic in Denmark in 2012 was 26 times larger than the 2020 planned value of only 4 GWh, showing a 2011-2012 growth rate of 593.3%. Development of solar photovoltaic in Denmark up to 2012 might change the 2020 picture of renewable electricity sources shares.

Wind power developed with 5.9% per annum in average (+2718 GWh) between 2005 and 2012 over the level of 6614 GWh (23.8 PJ) in 2005. Nevertheless this source didn't reach the expected 2011 and 2012

NREAP consumptions: 6.8% (-636 GWh) less in 2011 and 3.7% (-361 GWh) less in 2012.

Biomass electricity increased with 1.4% per annum in average (+311 GWh) between 2005 and 2012, reaching 3554 GWh (12.8 PJ). This development was not enough to surpass the expected NREAP consumptions in both 2011 and 2012: 17% (-709 GWh)

Almost two-third of the additional renewable electricity consumption between 2011 and 2012 in Denmark was provided by wind power technology.

less in 2011 and 15.6% (-657 GWh) less in 2012.

Even that an increase was planned in renewable electricity from hydropower during period 2005-12 in fact a slightly decrease by 1 GWh from the baseline level of 23 GWh took place. This source missed both 2011 and 2012 NREAP levels: 26.8% (-8.3 GWh) less in 2011 and 30.5% (-9 GWh) less in 2012.

According to actual NREAP in 2020 the two main contributors are wind with 56.9% and biomass with 43%. The share of hydropower is set to 0.2%.

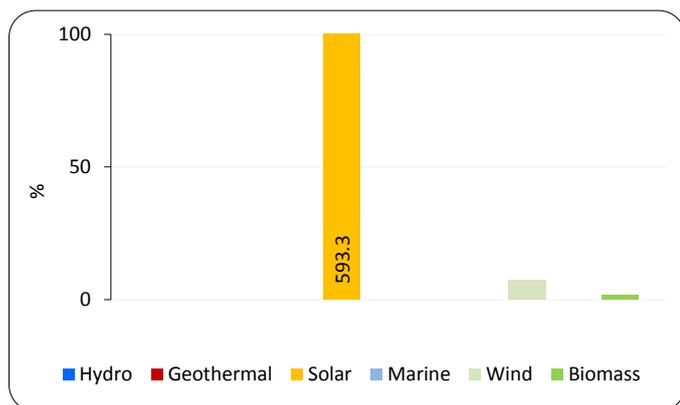


Figure 4-9. Relative increase/decrease of RES electricity sources in Denmark, 2011-12

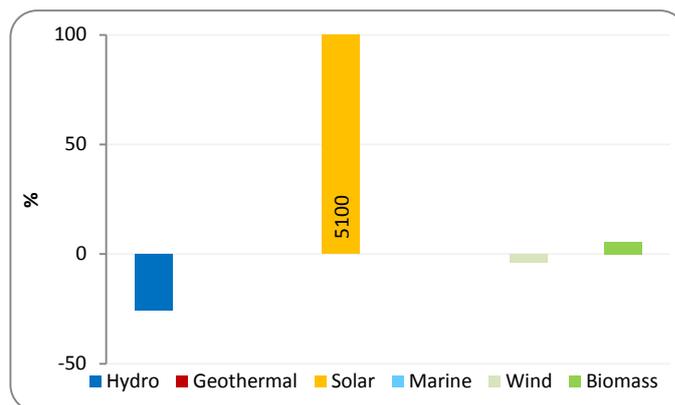


Figure 4-10. Deviation from NREAP in the RES electricity consumption in Denmark in 2012.

4.5 Renewable energy in heating & cooling

The use of renewable energy in heating and cooling in Denmark increased 14.5% (+ 270 ktoe) during 2005-11 over 1869 ktoe (78.3 PJ). The heat coming from renewable energy sources is expected to reach 3029 ktoe (126.8 PJ) in 2020.

Renewable energy consumed in heating/cooling sector in Denmark missed the NREAP planned value by 15.6% (-396 ktoe) in 2011 and by 12.1% (-309 ktoe) in 2012.

In 2012 biomass provided 93.3% of total renewable heat production and the rest was covered by heat pumps with 5.2%, solar with 1.3% and geothermal with 0.2%.

Heat production from solar thermal made the fastest increase by 28.4% per annum in average (+20 ktoe) between 2005 and 2012 reaching nearly 30 ktoe (1.3 PJ). The contribution of solar thermal exceeded since in 2011 the 2020 planned level of 16 ktoe (0.67 PJ). Comparing with expected NREAP levels for 2011 and 2012 this contribution was over respectively by 56.7% (+6.8 ktoe) and 149.2% (+18 ktoe).

Heat pumps contribution increased in 2012 with 16.6% per annum in average (+17 ktoe) over the level of 100 ktoe (4.2 PJ) in 2005. Despite the increase the heat pumps missed the NREAP planned heat in both years: 48.7% (-110 ktoe) under in 2011 and 52.6% (-129 ktoe) under in 2012.

Biomass heat developed with 2.8% per annum in average (+343 ktoe) between 2005 and 2012 over 1759 ktoe (73.6 PJ) in the baseline year. Heat coming from this source was found to be under the 2011 and 2012 NREAP plans respectively with 12.8% (-295 ktoe) and 8.7% (-201 ktoe).

While no heat was planned to be produced from geothermal, Denmark reported an amount of 2 ktoe in 2011 and 3.4 ktoe in 2012. This technology had the highest relative increase (+70%) during period 2011-12.

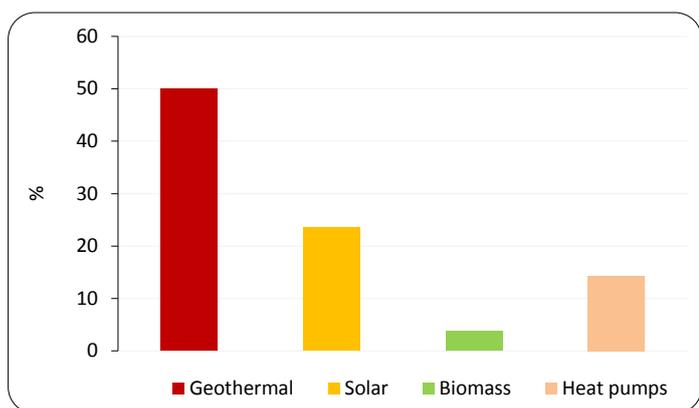


Figure 4-11. Relative increase/decrease of RES heating/cooling sources in Denmark, 2011-12.

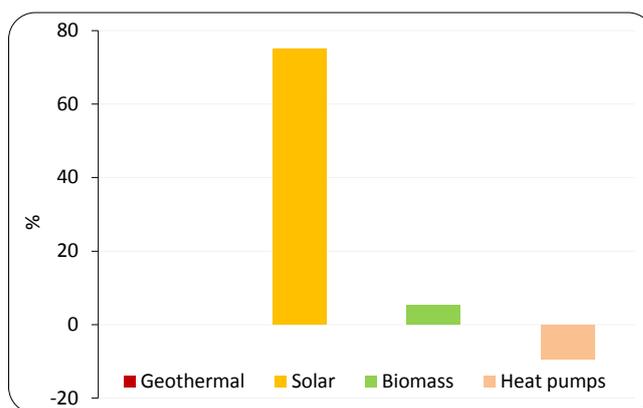


Figure 4-12. Deviation from NREAP in the RES heat consumption in Denmark in 2012.

In 2020 biomass is expected to produce 87.3% of total renewable heat and the rest will be 12.2% heat pumps and 0.5% solar thermal.

4.6 Renewable energy in transport

The consumption of renewable energy in transport reached 147.3 ktoe (6.2 PJ) in 2011 and 221.8 ktoe (9.3 PJ) in 2012. The consumption of renewable energy in transport sector in 2020 is expected to be 290 ktoe (12.1 PJ).

Renewable energy use in transport sector in Denmark missed both 2011 and 2012 NREAP plans respectively by 3.1%(-4.7 ktoe) and 14%(-36 ktoe).

Denmark¹⁵ reported the total amount of biofuel consumed in transport sector during period 2011-12 without dividing it in subcategories.

The use of renewable electricity in transport increased with 14.4% per annum in average (+9 ktoe) in period 2005-2012. Comparing with NREAP the use of renewable electricity in sector was 10% (+1.2 ktoe) and 39.2% (+5 ktoe) over the respective planned values in 2011 and 2012.

¹⁵ See Section 5.2 for more detailed analysis of total biofuels used in transport sector in Denmark between 2011 and 2012.

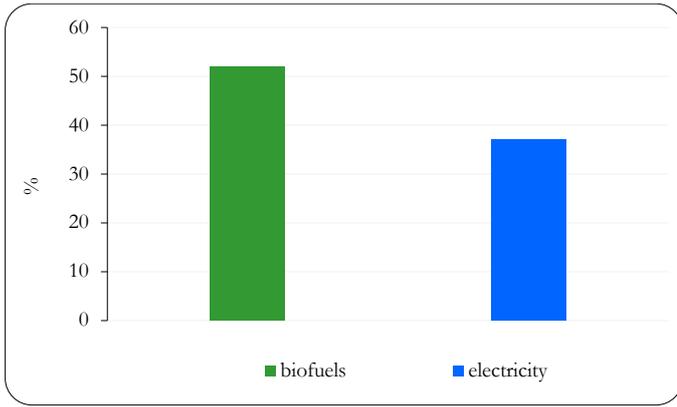


Figure 4-13. Relative increase/decrease of RES transport uses in Denmark, 2011-12.

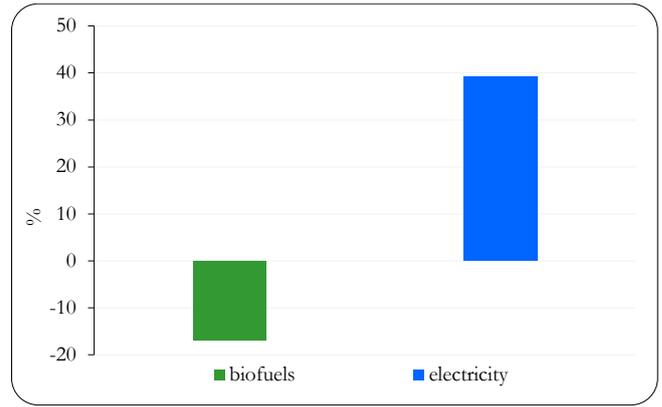


Figure 4-14. Deviation from NREAP in the RES use in transport in Denmark in 2012.

In 2020 biodiesel share in total renewable energy consumed in this sector is expected to be 57.6% followed by bioethanol/bio-ETBE with 32.4% and renewable electricity with 10%.

5. Renewable energy in Germany

5.1 Deployment of renewable energy

Renewable energy consumed in Germany increased from 15.1 Mtoe (632 PJ) in 2005 to 24 Mtoe (1006 PJ) in 2011 and 26.2 Mtoe (1096.3 PJ) in 2012. The renewable energy consumption in Germany is expected to further increase to 39.2 Mtoe (1642.4 PJ) until 2020 (Figure 5-1).

Comparing with NREAP Germany did not meet in 2011 the expected value of 24.3 Mtoe (116.6 PJ) of consumed renewable energy, being 1% (-253 ktoe) behind the plan. Nevertheless, renewable energy development between 2011 and 2012 was fast enough to lead to the exceedance of the planned value by 3.6% (+918 ktoe).

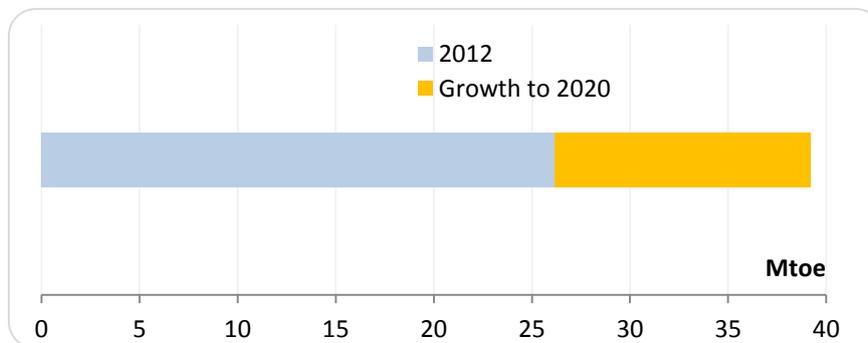


Figure 6-1 RES total in Germany in 2012 and the expected growth to 2020 target

Renewable energy developed faster in electricity sector between 2005 and 2011 (16% per annum in average) amounting to 10.3 Mtoe (433.5 PJ). The increase during 2011-12 was also the fastest among sectors with 1380 ktoe more (+13.3%). Comparing with expected renewable electricity according to NREAP, Germany exceeded it in both years: 3.7% (+368 ktoe) more in 2011 and 8.9% (+962.1 ktoe) more in 2012.

The development of renewable energy in heating/cooling sector between 2005 and 2011 had a yearly average growth rate of 6.4% (+2980 ktoe) reaching 10.7 Mtoe (447.4 PJ). During 2011-12 the heat coming from renewable energy sources in Germany increased by nearly 6% with an additional amount of 634 ktoe (26.5 PJ). The expected NREAP planned heat were exceeded in both years: 2.2% (+230 ktoe) more in 2011 and 4.0% (+437 ktoe) more in 2012.

Renewable energy consumed in Germany in heating/cooling and electricity sector accounted for respectively 43% and 45% of total renewable energy consumed in 2012

The use of renewable energy in transport sector reached 3131 ktoe (131 PJ) in 2012 increasing yearly by 7.1% with an additional use between 2011 and 2012 of 144 ktoe (+4.8%). This development was not enough to meet the expected use according to German

NREAP in both 2011 and 2012: 22.2% (-850 ktoe) less in 2011 and 13.3% (-480 ktoe) less in 2012.

The fastest development up to 2020 is expected in transport sector by 12% per annum in average (+3009 ktoe) followed by electricity sector by nearly 7.4% per annum in average (+6922 ktoe). The expected increase in heating/cooling sector in 2020 is 3110 ktoe with an average growth rate of 3.4%.

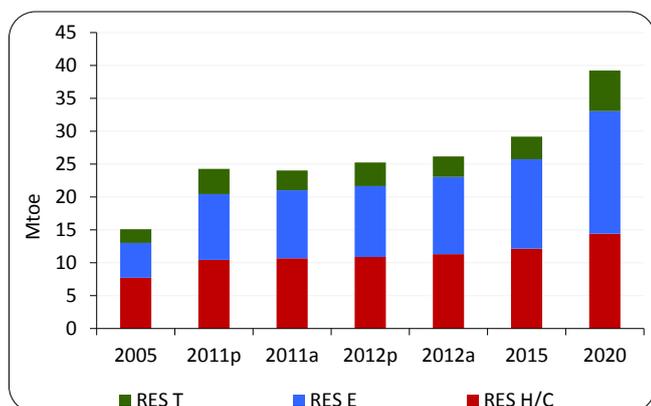


Figure 5-2. RES deployment in Germany: projected growth and actual progress until 2020.

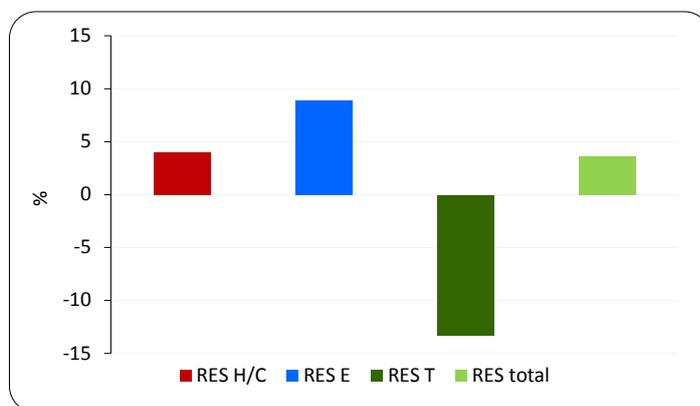


Figure 5-3. Deviation from NREAP in the RES consumption in Germany in 2012.

5.2 Sources of renewable energy

Almost 52% of renewable energy mix in Germany in 2012 was biomass (13.4 Mtoe or 561 PJ). In this year wind technology presented 16% of total renewable energy consumed. Solar and biofuels had nearly the same contribution, 11%, in total renewable energy consumed in Germany in this year. Hydropower¹⁹ share reached only 7% while the shares of heat pumps and geothermal were respectively 2.6% and 0.3%.

In 2012 biomass share in total renewable energy mix reached 51.5% followed by wind with 16.3%, biofuels 11.3%, solar 10.9%, hydropower 7%, heat pumps 2.6% and geothermal 0.3%.

Solar source had the most significant progress between 2005 and 2012 with 102.4% per annum in average (+2496 ktoe) over the level of 348.2 ktoe (14.6 PJ) in the baseline year. Comparing with the expected values solar source was found over the NREAP in both 2011 and 2012: 32% (+538 ktoe) more in 2011 and 38% (+789 ktoe) more in 2012.

In relative terms geothermal technology was placed behind solar with an average growth rate between 2005 and 2012 of 66.7% (+56 ktoe). Nevertheless Germany missed the NREAP planned values in both electricity and heating/cooling sectors and in both years: 21.5% (-17 ktoe) less in 2011 and 44.3% (-54.2 ktoe) less in 2012.

Biomass had the highest absolute increase during 2005-2012 period with +4933 ktoe (+8.3%). Nevertheless in 2011 Germany used less biomass comparing with NREAP plan for this year: 0.4% (-49.4 ktoe) less. Between 2011 and 2012 the use of biomass for energy in

Germany experienced an increase of 9.1% much enough to exceed by 5.0% the expected level of 2012.

Biofuels use in transport sector in Germany increased with 7.6% per annum in average during period 2005-12, reaching 2943 ktoe. Their use in transport sector was lower than what was expected from the NREAP in both years: 21.9% (-787 ktoe) less in 2011 and 11.9% (-396 ktoe) less in 2012.

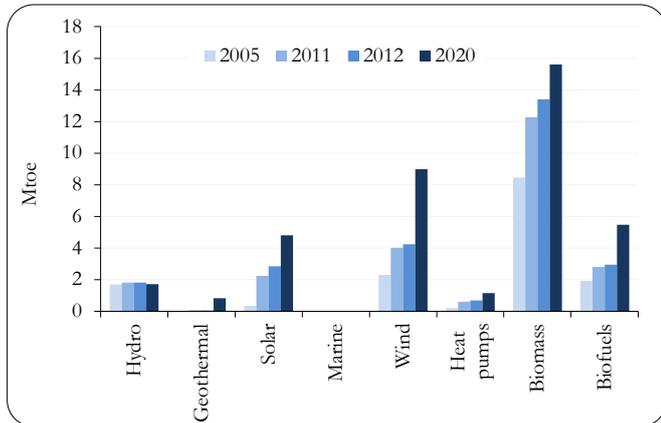


Figure 5-4. Contribution of renewable energy sources in Germany: actual and projected in 2020

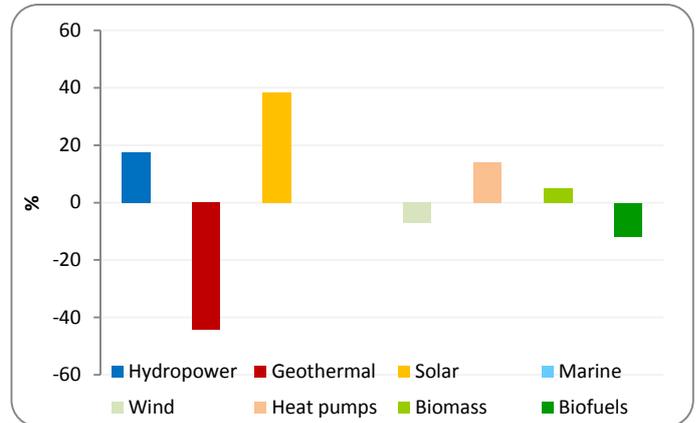


Figure 5-5. Deviation from NREAP in the contribution of renewable sources in Germany in 2012

In 2020, the share of biomass in renewable mix is expected to decrease by 10% points remaining still the main source of renewable energy in Germany. The share of wind, biofuels and solar technologies in total renewable energy consumed in Germany in 2020 will increase respectively to 23%, 14% and 12%.

5.3 Renewable energy share

The overall renewable energy contribution in Gross Final Energy Consumption in Germany reached 11.6% in 2011 and 12.4% in 2012. Comparing with the expected shares for 2011 and 2012 the overall share of RES was over by 0.8% points in year 2011 and 1.0% points in 2012. The 2020 target that Germany has to reach for the overall RES share is 19.6%.

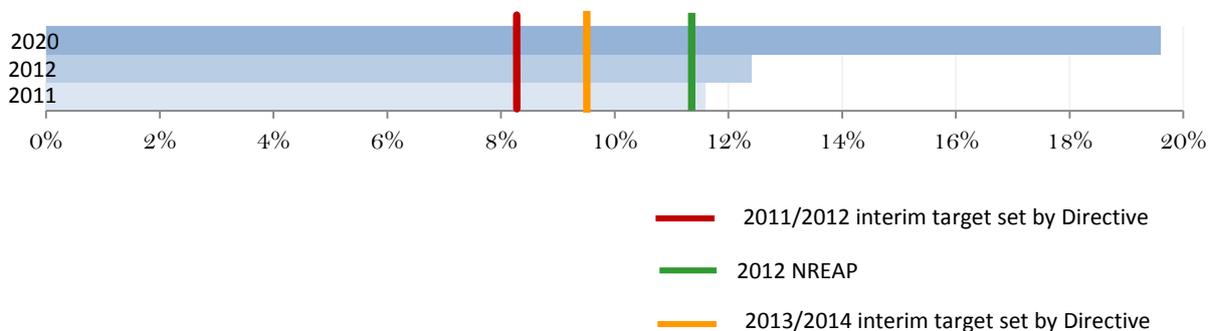


Figure 5-6. Overall RES share in Germany, 2011-12

Germany doubles in 2012 the renewable energy share in electricity sector comparing with 2005 level of 10.2%. Comparing with expected NREAP shares this sector was over in both 2011 and 2012: 1.4% points over in 2011 and 1.1% points over in 2012.

Renewable energy share in transport sector almost doubled between 2005 and 2012 reaching 7.8% over 3.9% in the baseline year. Germany missed the NREAP renewable energy share in this sector in year 2011 being 1.5% points under but exceeded it in 2012 with 0.1% points.

Heating/cooling sector reported an increase with +4.5% points between 2005 and 2012 over 6.6% in the baseline year. This share was found to be over the expected NREAP plane in both 2011 and 2012 respectively with 1.4% points and 1.1% points.

The overall RES shares in Germany in 2011 and 2012 were both higher than the NREAP trajectory for this period. The NREAP planned share for 2012 was exceeded already in 2011 (by 0.2% points) together with both the 2011/2012 and 2013/2014 indicative RES trajectories. Based on reported overall RES shares in 2011 and 2012 Germany seems to be in a good position for the achievement of 2020 RES share target.

Major increase from year 2012 is expected to be achieved until 2020, according to the NREAP, in electricity sector with +15% points followed by transport sector with 5.9% points and heating/cooling sector with 4.4% points.

5.4 Renewable electricity

5.4.1 Installed capacity

Renewable energy installed capacity in Germany increased from 27.9 GW in 2005 to 64.2 GW in 2011 and 74.2 GW in 2012. In 2020 Germany has planned to reach a capacity of 111 GW in renewable energy.

In 2012 photovoltaic capacity covered 44% of total renewable energy capacity in Germany followed by wind with 41.8%, biomass with 8.2% and hydropower with 6%.

The increase of installed renewable electricity capacity in Germany was fast enough to exceed the NREAP planned capacities in both years: by 5.9% (+3587 MW) in 2011 and by 12.1% (+8002 MW) in 2012.

The main progress from year 2005 was made in photovoltaic technology with an increase in capacity by +23 GW in 2011 increasing further with +7.6 GW in 2012. The development was faster than what Germany planned in the NREAP for both years: 23.4% (+4755 MW) more in 2011 and 37.3% (+8860 MW) more in 2012.

The additional solar electricity capacity installed between 2011 and 2012 accounted for 74% of renewable energy additional capacity installed in Germany for the same time span.

Germany has planned to decrease the hydropower capacity during period 2005-2020. Despite of this hydropower installed capacity is getting slightly higher year by year. It exceeded the 2020 planned capacity. 4309 MW, since in 2010 (4400 MW) increasing further with +51 MW in 2012. Hydropower capacity was found to be over the NREAP planned capacities for both 2011 and 2012: 9.9% (+401 MW) more in 2011 and 8.9% (+363 MW) more in 2012.

Wind installed capacity increased from the baseline year with +10.6 GW in 2011 and only +2 GW more in 2012. However the final capacities in 2011 and 2012 were under the expected NREAP capacities: 1.8% (-547 MW) less in 2011 and 1.0% (-324 MW) less in 2012.

Biomass installed capacity reached 5.6 GW in 2011 increasing further with only +445 MW in 2012. The development of biomass capacity in Germany was slower than what was planned in the NREAP for both years: 15.3% (-1013 MW) less in 2011 and 12.7% (-882 MW) less in 2012.

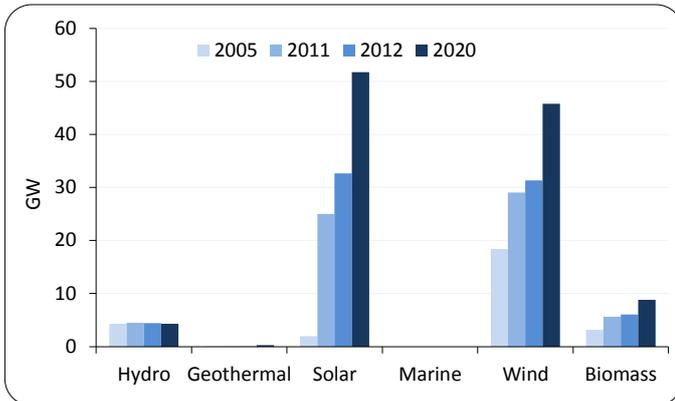


Figure 5-7. RES capacity deployment and progress until 2020 in Germany.

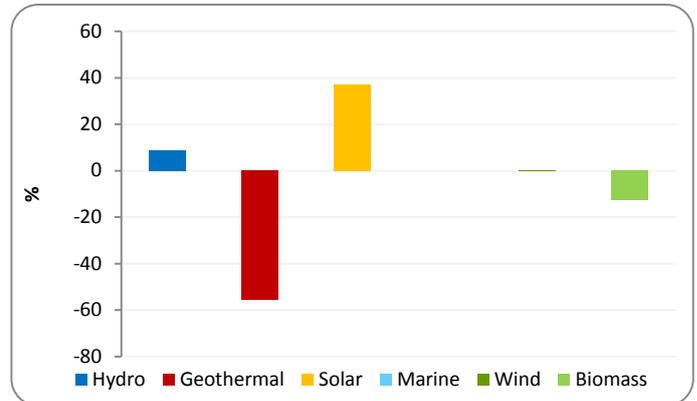


Figure 5-8. Deviation from NREAP in the RES installed capacity in Germany in 2012.

In 2020 photovoltaic and wind power will still have the main contribution in renewable installed capacities in Germany with 47% and 41% followed by biomass with 8% and hydropower with 4%.

5.4.2 Consumption

Renewable electricity consumption in Germany almost doubled between 2005 and 2012: from 61.6 TWh (222 PJ) in 2005 to 136.4 TWh (491 PJ) in 2012. In 2020 the renewable electricity consumption in Germany is expected to amount to 217 TWh (781 PJ).

Renewable electricity consumption in Germany was higher than NREAP planned values in both years: by 3.7% (+4278 GWh) in 2011 and by 8.9% (+11187 GWh) in 2012.

In 2012 the main contribution in renewable electricity in Germany was coming from wind, 36.2% followed by biomass (29%), solar (19.3%) and hydropower (15.5%).

Renewable electricity from hydropower in year 2012 exceeded by 6% (+1126 GWh) the 2020 plan of 20 TWh (72 PJ). Comparing with NREAP plans for 2011 and 2012 Germany was over in both years: 17.8% (+3196 GWh) more in 2011 and 17.4% (+3126 GWh) more in 2012. The fastest development among renewable electricity sources happened in photovoltaic which increased in 2012 by a factor of 20 over the 2005 level. In 2012 photovoltaic renewable electricity amounted to 26.4 TWh (95 PJ) being 51.6% over the expected NREAP value while in 2011 this deviation was 40.3% (+5632 GWh).

In 2012 renewable electricity from photovoltaics in Germany reached more than 60% of the 2020 planned value of 41.4 TWh.

Germany almost doubled the electricity coming from wind technology during period 2005-2012 reaching 49.3 TWh (177.6 PJ). This consumption increased further by 5.5% (+2589 GWh) in 2012. Nevertheless wind development in Germany was not fast enough to exceed the expected levels in both 2011 and 2012: 5.4% (-2674 GWh) less in 2011 and 7% (-3720 GWh) less in 2012.

The development of biomass for electricity was not fast enough during period 2005-2011 being 5.3% (-1842 GWh) under the expected NREAP for 2011. Nevertheless biomass use for electricity increased by 20.5% (+6741 GWh) between 2011 and 2012 exceeding by 7.8% (+2870 GWh) the expected NREAP consumption for 2012.

Geothermal was a very marginal contributor in the renewable electricity consumption in Germany amounting only to 25 GWh in 2012. The development of this technology was not at the expected level in both years: 64.2% (-34 GWh) less in 2011 and 74.2% (-72 GWh) less in 2012.

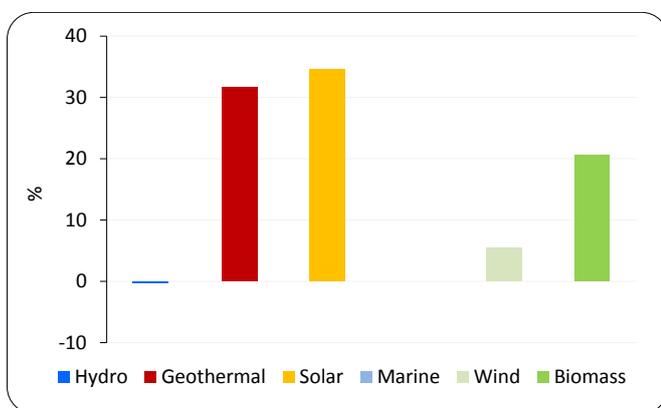


Figure 5-9. Relative increase/decrease of RES electricity sources in Germany, 2011-12

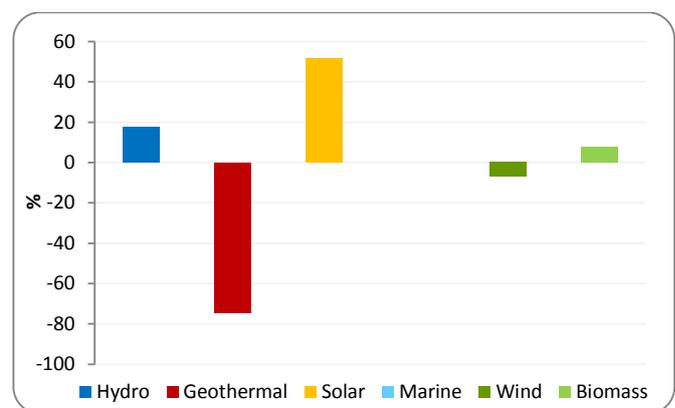


Figure 5-10. Deviation from NREAP in the RES electricity consumption in Germany in 2012.

In 2020 Germany is expected that almost half of its renewable electricity consumption will come from wind (48.2%). The contribution of photovoltaic is expected to remain at the level of 19% while hydropower and biomass will have a lower contribution respectively 9.2% and 22.8%. Geothermal technology will remain a very marginal source of renewable electricity in Germany in 2020 contributing with only 0.8%.

5.5 Renewable energy in heating/cooling

The use of renewable energy in heating/cooling in Germany increased by 6.4% per annum in average (+2980 ktoe) during 2005-2011 and the additional heat in period 2011-12 was 634 ktoe (+5.9%). In 2020 Germany is expected to have a heat originated from renewable sources equal to 14131 ktoe (604.2 PJ).

In 2012 biomass use for heat contributed with 88.3% in the total heat consumption in Germany. Heat pumps contribution reached 6% while solar thermal and geothermal contributions were respectively 5.1% and 0.6%.

The development of heat from renewable sources in Germany was fast enough to exceed the expected NREAP levels in both years: by 2.2% (+231 ktoe) in 2011 and by 4.0% (+438 ktoe) in 2012.

In relative terms the fastest development in 2011 from the baseline year (12 ktoe) happened in geothermal thermal with a yearly average growth rate of 67%. Heat coming from this technology increased more between 2011 and 2012 reaching 66 ktoe in 2012. Nevertheless this development was not enough to meet the NREAP plans in both years: 18.9% (-14 ktoe) less in 2011 and 42.1% (-48 ktoe) less in 2012.

Heat coming from solar thermal almost doubled between 2005 and 2012 amounting to 576 ktoe. The heat consumption in both 2011 and 2012 was well over the expected NREAP levels: 10.8% (+54 ktoe) more in 2011 and 2.9% (+16 ktoe) more in 2012.

In 2012 solid biomass use for heating in Germany was equal to nearly 98% of the 2020 plan of 8952 ktoe.

Biomass had the highest absolute increase between 2005 and 2011 with +2199 ktoe (+30.3%). The heat coming from this source increased further in 2012 by 5.7% (+537 ktoe). Comparing with expected NREAP heat consumptions Germany was over in both years: 1.2% (+109 ktoe) more in 2011 and 4.0% (+387 ktoe) more in 2012.

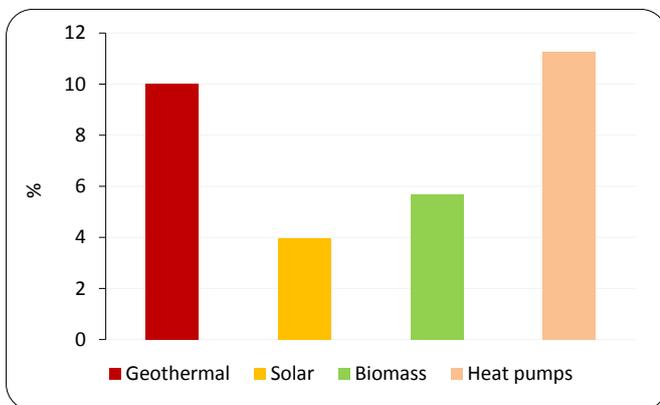


Figure 5-11. Relative increase/decrease of RES heating/cooling sources in Germany, 2011-12.

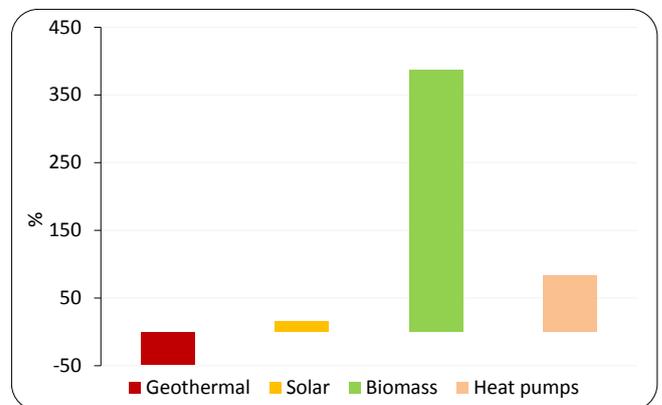


Figure 5-12. Deviation from NREAP in the RES heat consumption in Germany in 2012.

In 2020 biomass contribution in total heat consumption is expected to decrease up to 78.7% while the other technologies will increase slightly their contribution: solar thermal 8.6%, heat pumps 7.9% and geothermal 4.8%.

5.6 Renewable energy in transport

The use of renewable energy in transport reached 2987 ktoe (125.1 PJ) in 2011 and 3131 ktoe (131.1 PJ) in 2012 increasing by baseline year level of 2088 ktoe (87.4 PJ). The use of renewable energy in transport sector in 2020 is expected to be 6140 ktoe (257.1 PJ).

In 2012 biodiesel covered 65% of renewable energy consumed in transport sector followed by bioethanol/bio-ETBE with 25.3%, renewable electricity with 6% and other biofuels with 3.7%.

The development of renewable energy in transport sector in Germany was not at the expected level in both years: by 22.2% (-850 ktoe) in 2011 and by 13.3% (-480 ktoe) in 2012.

Bioethanol/bio-ETBE made the main progress in transport sector during 2005-2011 increasing with +638 ktoe but only +1.3 ktoe

between 2011 and 2012. In comparison with NREAP planned values the use of Bioethanol/bio-ETBE in Germany was lower by 34.1% (8-405 ktoe) in 2011 and 30.8% (-353 ktoe) in 2012.

Biodiesel use in this sector increased with +391 ktoe in period 2005-2011 and only with +2.3 ktoe in 2011-12 being nevertheless 13.5% (-311 ktoe) and 2.5% (52 ktoe) under the NREAP planned values for 2011 and 2012.

Other biofuels (biogas and vegetable oils) use grew with only +34 ktoe between 2005 and 2011 missing the expected NREAP value by 67.6%. Nevertheless a very fast increase by 244% (+83 ktoe) happened between 2011 and 2012 in the other biofuels use making possible the exceedance of expected values for year 2012 by 8.3% (+9 ktoe).

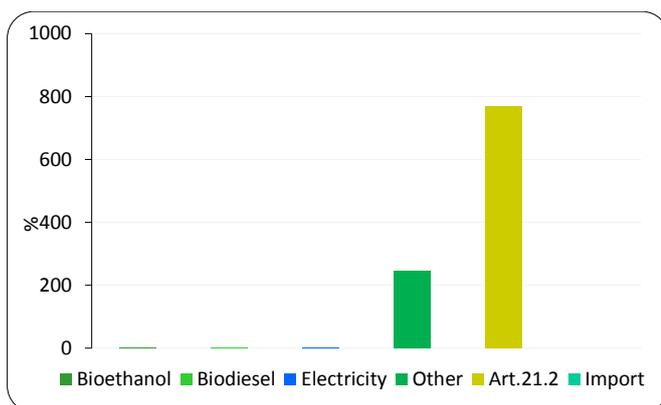


Figure 5-13. Relative increase/decrease of RES transport uses in Germany, 2011-12.

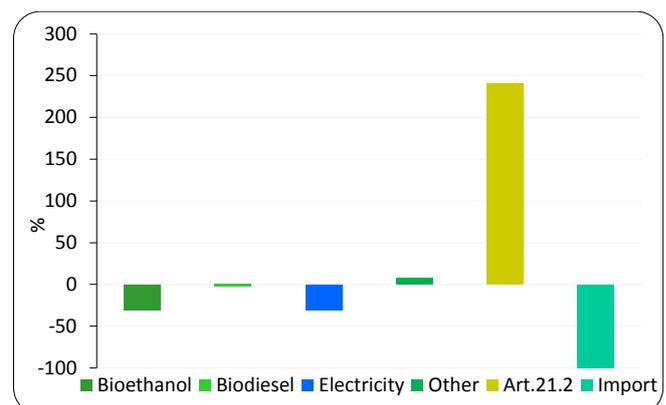


Figure 5-14. Deviation from NREAP in the RES use in transport in Germany in 2012.

The use of biofuels from wastes, residues, ligno-cellulosic material decreased between 2005 and 2012. It reached in 2011 the amount of 34 ktoe missing the NREAP level by 54.5% (-54.5 ktoe). The use of these biofuels increased very fast between 2011 and 2012, 771% (+347 ktoe), exceeding the expected NREAP level by 241% (+277 ktoe).

No imported biofuels were used in Germany during period 2011-12 even that an amount of 1666 ktoe and 1611 ktoe was found at the German NREAP for 2011 and 2012.

The use of renewable electricity in transport increased slightly during 2005-2012 period, 11.2% (+19 ktoe). This increase was not enough to meet the expected use of renewable electricity in transport sector in both years: 25.7% (-63 ktoe) less in 2011 and 30.9% (-84 ktoe) less in 2012.

In 2020 the contribution of biodiesel is expected to reach 72.4% while the bioethanol/bio-ETBE contribution is expected to decrease up to 14%. The use of renewable electricity in this sector in 2020 is planned to contribute with 10.8% while the other biofuels will count for only 2.8%.

6. Renewable energy in Estonia

6.1 Deployment of renewable energy

Renewable energy consumed in Estonia increased from 514 ktoe (21.5 PJ) in 2005 to 766 ktoe (32.1 PJ) in 2011 and 787 ktoe (32.9 PJ) in 2012. The renewable energy consumed in Estonia is expected to further increase to 862 ktoe until 2020 (Figure 6-1).

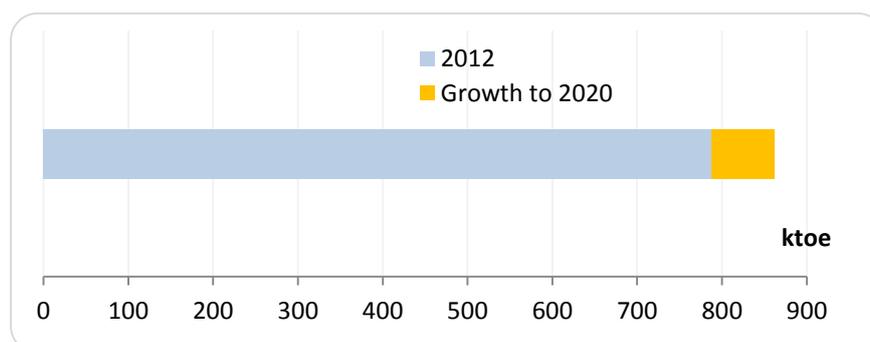


Figure 6-1 RES total in Estonia in 2012 and the expected growth to 2020 target

Electricity sector experienced the fastest development in Estonia during period 2005-2012 with a yearly average growth rate of 189%. Comparison with NREAP showed that the renewable electricity in Estonia was over the expected development in both years: 65% (+38.7 ktoe) in 2011 and 115.3% (+70.2 ktoe) in 2012.

The development of renewable energy in Estonia exceeded the expected values by 11.3% (+77.6 ktoe) in 2011 and by 12.3% (+86.1 ktoe) in 2012.

Heat coming from renewable sources had the highest absolute increase during 2005-2011 period with +162 ktoe but it slowed down during 2011-12 with 1.8% (-12 ktoe). The increase was more than what was planned in the NREAP: +7.2% in 2011 and +4.6% in 2012, exceeding the 2020 expected renewable consumption.

Due to the sustainability criteria no biofuels use in transport sector was reported in Estonia during period 2011-12. Only development of renewable electricity used in road and non-road transport was reported. Due to this the deviation from NREAP expected use of renewable energy in this sector was significant: -87.1% in 2011 and -93.6% in 2012.

Up to 2020 renewable energy use in transport sector is expected to have the main development with 89.1 ktoe (3.7 PJ) more than the 2012 level. The development in electricity sector is expected to take place with an increase by 25.5% (+33.5 ktoe) to reach the 2020 plan of 164.5 ktoe (6.9 PJ).

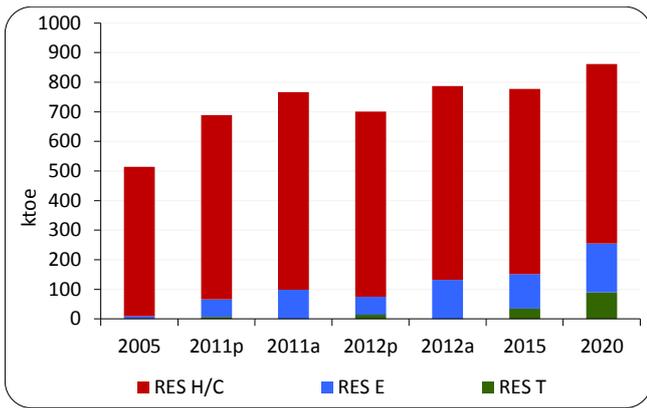


Figure 6-2. RES deployment in Estonia: projected growth and actual progress until 2020.



Figure 6-3. Deviation from NREAP in the RES consumption in Estonia in 2012.

6.2 Sources of renewable energy

Renewable energy mix in Estonia in 2012 was composed only by biomass (94.3%), wind (5.5%) and hydropower (0.3%). No use of other renewable technologies in Estonia was registered in this year.

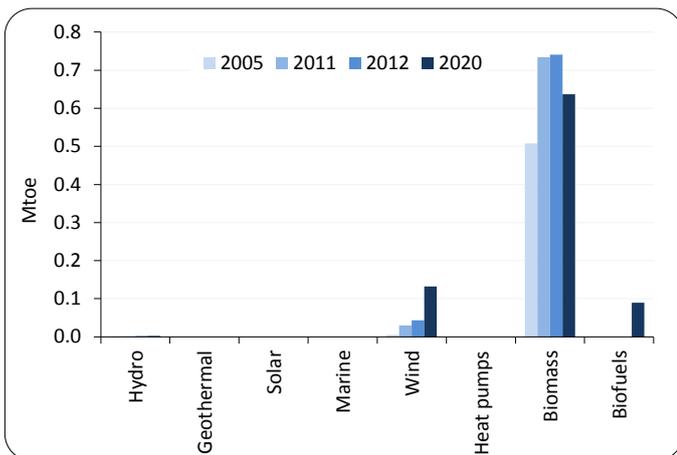


Figure 6-4. Contribution of renewable energy sources in Estonia: actual and projected in 2020

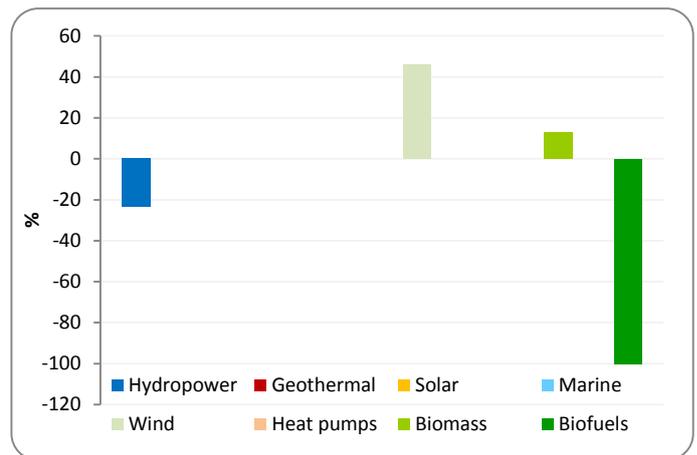


Figure 6-5. Deviation from NREAP in the contribution of renewable sources in Estonia in 2012

During period 2005-2012, biomass used for electricity and heating/cooling increased fast exceeding by 16.4% the 2020 planned level of 636.8 ktoe. The NREAP plans on biomass use in Estonia were exceeded by 13.2% in both years.

No contributions from geothermal, solar and biofuels in total renewable energy mix were registered in Estonia during period 2011-12.

Due to sustainability criteria (Article 17 of RED) no biofuels use in transport sector was reported for Estonia for period 2011-12.

According to Estonia NREAP in 2020, the share of biomass in RES mix is expected to decrease up to 74%, while the contributions of wind and biofuels will be increased respectively to 15.3% and 10.4%. The contribution of hydropower is expected to remain the same, 0.3%.

6.3 Renewable energy share

The overall renewable energy contribution in Gross Final Energy Consumption in Estonia reached 25.9% in 2011 decreasing then slightly to 24.8%. Comparing with the expected shares for 2011 and 2012 the overall share of RES was over by 4.7% points in year 2011 and 2.8% points in 2012. The 2020 target of overall RES share in Estonia is set to 25%.

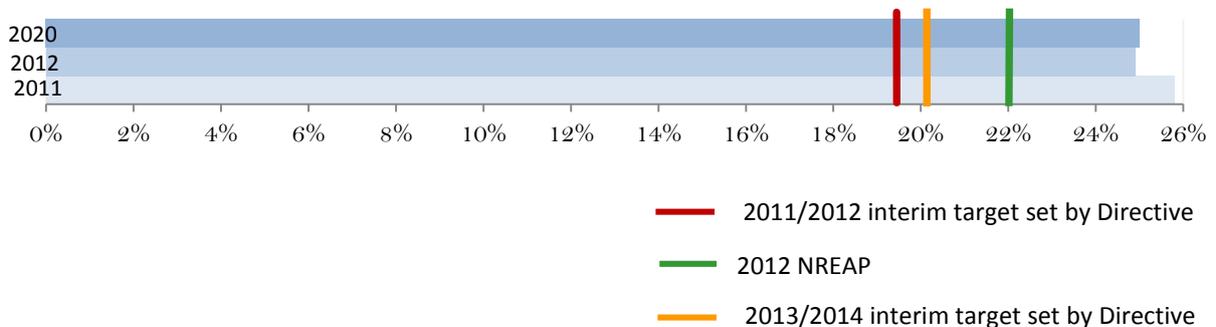


Figure 6-6. Overall RES share in Estonia, 2011-12

The overall RES share in Estonia in both 2011 and 2012 was well above the NREAP established trajectory for this period. The indicative trajectories for 2011/2012 and 2013/2014 were exceeded as well. Furthermore Estonia exceeded in 2011 (but not in 2012) the RES share 2020 target of 25% while not reaching the absolute RE planned values, also because energy consumption dropped down reaching a level 4.5% (-260 ktoe) below the baseline year of 3218 ktoe.

The development of heating and cooling sector was determinant in the fast penetration of overall renewable energy in Estonia. Estonia has planned a flat trajectory for the development of renewable energy in this sector, not exceeding 40%, but in 2011 the renewable energy share in this sector reached 48.4% being 10% points over the 2020 NREAP planned share. In 2012 this development slows down slightly, reaching 41.4%, but still remained over the 2020 planned share. Comparing with NREAP planned share the actual achieved shares were 8.9% points over in 2011 and 1.6% points in 2012.

Renewable energy share in electricity sector made a significant increase from 2005 with 11% points increasing further by 3.5% points in 2012. Renewable energy share in this sector was found to be over the NREAP planned share in 2011, by +5.2% points and +7.6% points in 2012.

The increase of renewable energy share in transport sector from 2005 was very low, only 0.2% points in 2011 remaining unchanged in 2012. The very slow development of renewable energy in this sector is due to the fact that the biofuels used in this sector didn't fulfil the sustainability criteria established by Article 17 of the 2009/28/EC Directive. The deviation from NREAP planned shares was by 0.7% points under in 2011 and 1.5% points under in 2012.

The main development in Estonia up to 2020 is expected to happen in transport sector by 9.4% points while in electricity sector the growth will be with 1.9% opoints.

6.4 Renewable electricity

6.4.1 Installed capacity

The renewable energy installed capacity in Estonia increased from 36 MW in 2005 to 252 MW in 2011 and 341 MW in 2012. Comparing with expected capacities in these years Estonia exceeded them by 35.6% (+66.2 MW) in 2011 and 7% (+22.2 MW) in 2012.

In 2012 wind covered 78% of total renewable energy capacity in Estonia and the rest was biomass (19.6%) and hydropower (2.4%).

Wind power had the highest increase during period 2005-2012, by +108% per annum in averages. Comparing with expected NREAP developments this technology was found to be over the plan in year 2011 with +1.1% (+2 MW) whereas missed it in 2012 being 14.85% (-45 MW) lower than the expected capacity.

The additional wind power capacity installed in Estonia in 2011-2012 was equivalent to 18.6% of the total wind power additional capacity in EU-28 in the same period.

While no biomass capacities was expected to be installed in Estonia according the NREAP since in 2009 a capacity of 37 MW was found in place. This increased to 67 MW in 2010 but no other development took place during period 2011-12.

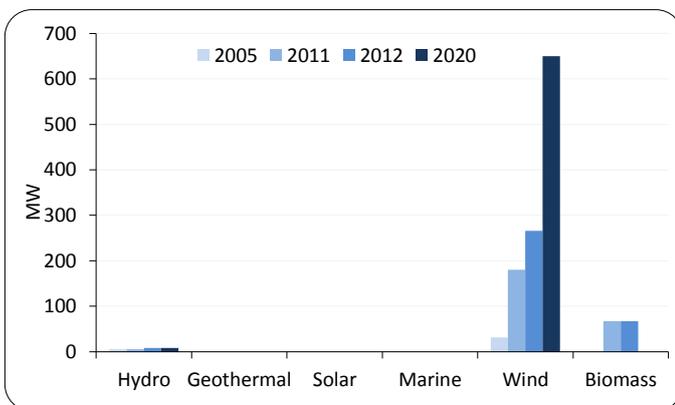


Figure 6-7. RES capacity deployment and progress until 2020 in Estonia.

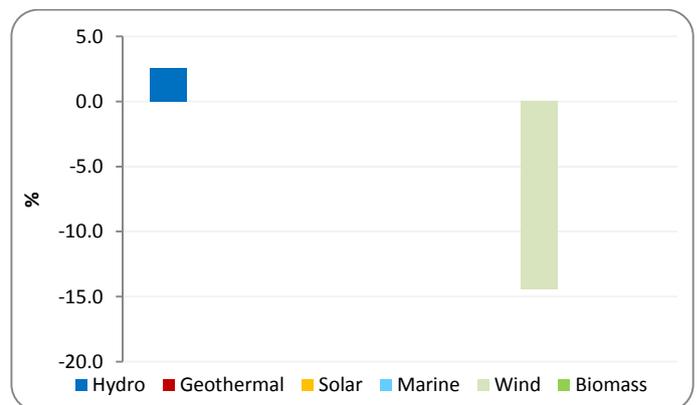


Figure 6-8. Deviation from NREAP in the RES installed capacity in Estonia in 2012.

No progress resulted in hydropower capacity during period 2005-2011 while an additional capacity of only +3 MW resulted in 2012. In 2011 the hydropower capacity was 35.6% (-3 MW) lower the expected capacity whereas it exceeded slightly, +2.6% (+0.2 MW), the planned capacity in year 2012.

In 2020 wind power is expected to be increased by 18% per annum in average keeping the first place in total renewable energy installed capacity in Estonia. The unexpected development of biomass capacity in period 2011-12 the main contribution in renewable installed capacities with 44% followed by hydropower with 41%, solar with 9%, biomass with 5% and marine with 1%.

6.4.2 Consumption

Renewable electricity consumption in Estonia amounted to 1142 GWh in 2011 and 1524 GWh in 2012 from 107 GWh in 2005. Renewable electricity consumption in Estonia was found to be over the NREAP planned values during period 2011-12: +65% (+450 GWh) in 2011 and +115.3% (+816 GWh) in 2012. In 2020 the renewable electricity consumption in Estonia is expected to amount to 1913 GWh.

In 2012 biomass provided 65.7% of total renewable electricity followed by wind with 32.8% and hydropower with 1.5%.

Renewable electricity from biomass increased very fast during period 2005-2012, with 420% per annum in average (+968 GWh), reaching an amount of almost 3 times higher than the 2020 planned consumption of 346 GWh (1.2 PJ). The exceedance from 2011 and 2012 NREAP planned consumptions were respectively 154% (+474 GWh) and 198% (+665 GWh).

Additional renewable electricity coming from biomass accounted for more than two-third of the additional renewable electricity consumption in Estonia in 2011- 2012

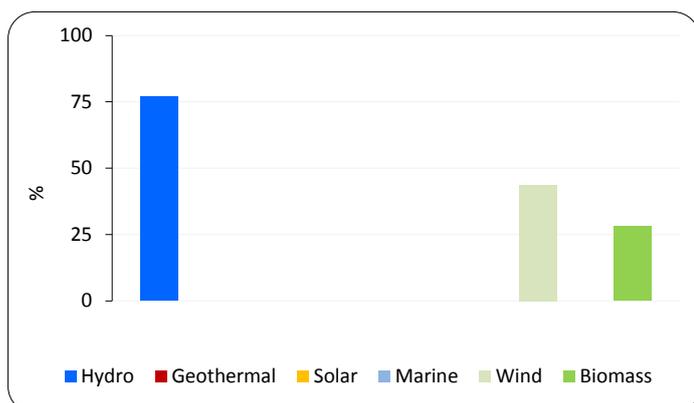


Figure 6-9. Relative increase/decrease of RES electricity sources in Estonia, 2011-12

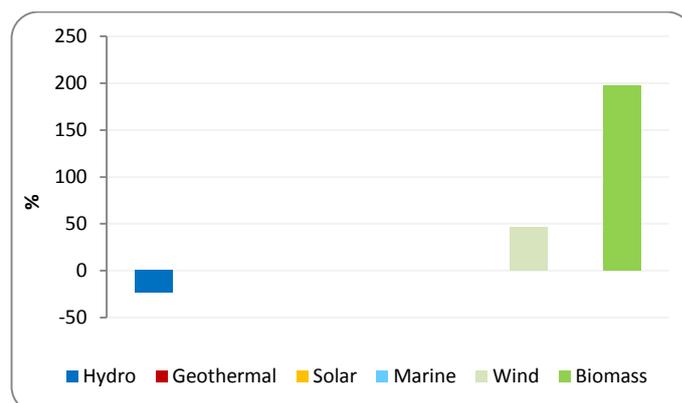


Figure 6-10. Deviation from NREAP in the RES electricity consumption in Estonia in 2012.

Wind power had a fast development during 2005-2012 with an average growth rate of 118% (+446 GWh) over 54 GWh (0.2 PJ) in the baseline year. This source missed the NREAP planned electricity consumption by 2% (-7 GWh) in 2011 but exceeded it in 2012 by 46.2% (+158 GWh).

Hydropower produced less renewable electricity, -35.3%, in year 2011 compared with 2005 missing also the planned value for this year: 56.7% under the 2011 NREAP. Renewable electricity comin from this technology increased in year 2012 by almost 77% being nevertheless 23.3% under the NREAP planned value.

According to Estonia NREAP the share of wind power in total renewable electricity consumption expected in year 2020 will reach 80.3% while biomass and hydropower will have a share respectively equal to 18.1% and 1.6%.

6.5 Renewable energy in heating & cooling

Renewable energy in heating/cooling sector¹⁶ in Estonia developed with 4.2% per annum in average (+150 ktoe) between 2005 and 2012 reaching 655 ktoe (27.4 PJ).

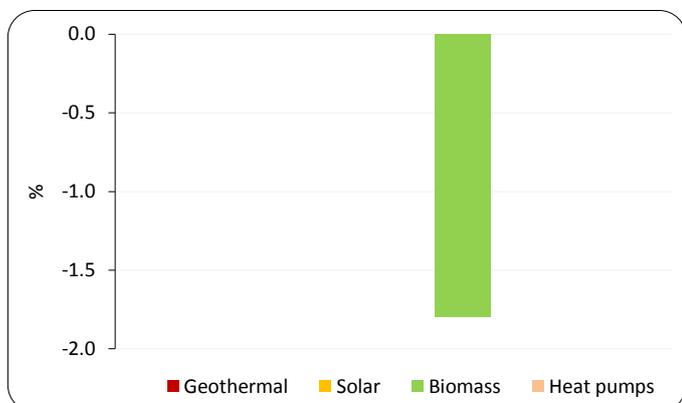


Figure 6-11. Relative increase/decrease of RES heating/cooling sources in Estonia, 2011-12.

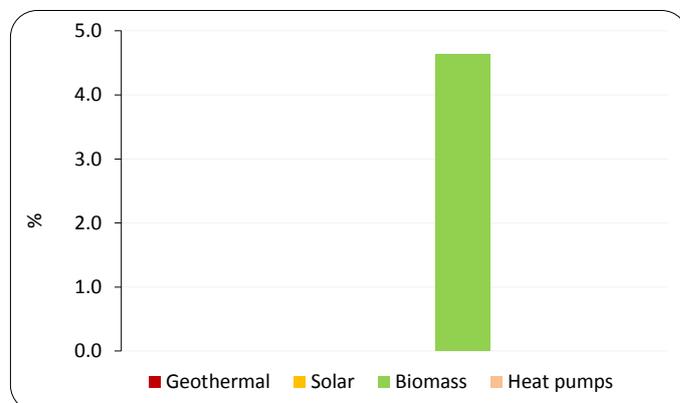


Figure 6-12. Deviation from NREAP in the RES heat consumption in Estonia in 2012.

Comparing with expected heat production in years 2011 and 2012 it was found that Estonia produced more heat than what it planned in its NREAP: 7.2% (+45 ktoe) more in 2011 and 4.6% (+29 ktoe) more in 2012. In 2020 heat production from renewable energy sources in Estonia is expected to decrease to 607 ktoe (25.4 PJ).

6.6 Renewable energy in transport

Renewable energy consumed in transport sector¹⁷ in Estonia reached only 0.9 ktoe in 2011 remaining then unchanged till 2012. Comparing with expected NREAP levels the current developments were found to be under the plans with 87.1% (-6.1 ktoe) in 2011 and 93.6% (-13 ktoe) in 2012 putting Estonia not in good position for the achievement of the 10% target in 2020.

The use of renewable electricity in transport increased in year 2011 by 800% (+0.8 ktoe) compared with the expected NREAP level of 0.1 ktoe. During period 2011-12 no change took place in the use of renewable electricity in this sector.

¹⁶ Renewable energy in heating/cooling sector in Estonia in period 2011-2012 was totally biomass

¹⁷ Estonia reported no use of biofuels in transport since they didn't fulfil the criteria of sustainability as required by Article 17 of Directive 2009/28/EC.

7. Renewable energy in Ireland

7.1 Deployment of renewable energy

Renewable energy consumed in Ireland increased from 407 ktoe (17 PJ) in 2005 to 738.9 ktoe (30.9 PJ) in 2011 and 786.1 ktoe (32.9 PJ) in 2012. The renewable energy consumption in Ireland is expected to further increase to 2306 ktoe (96.5 PJ) until 2020 (Figure 7-1).

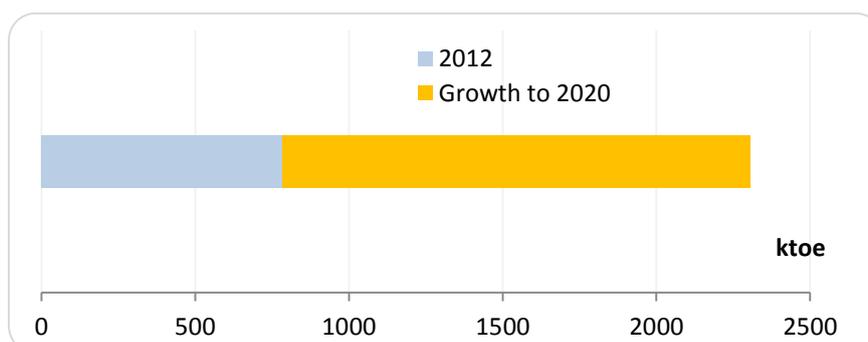


Figure 7-1. RES total in Ireland in 2012 and the expected growth to 2020 target

Renewable energy consumed in transport sector made the most significant progress from year 2005. It experienced a very fast increase up to 2011 with 697% per annum in average (+95.4 ktoe) but it decreased in 2012 by 12.3% (-12 ktoe). The use of renewable energy in this sector didn't meet the NREAP planned levels in both years: 42.2% (-71.3 ktoe) under in 2011 and 57.6% (-116.2 ktoe) in 2012.

Renewable energy consumed in Ireland was under the expected values in both 2011 and 2012 respectively by 28.2% (-290 ktoe) and by 31.4% (-361 ktoe).

The development of renewable energy in electricity sector had the highest absolute increase during 2005-12 period by 256.5 ktoe (+17.3% per annum in average). Nevertheless this development was not enough to meet the NREAP planned consumptions in both years having the highest absolute negative deviations among sectors: 30.3% (-184 ktoe) under in 2011 and 26% (-165.4 ktoe) under in 2012.

The development of renewable energy in heating/cooling sector was faster in period 2011-12 (+6.4%) compared with the development during 2005-12 period (2.9% per annum in average). Even this sector didn't develop faster enough to exceed the NREAP planned values in both 2011 and 2012: respectively 13.8% (-35 ktoe) and 25.4% (-79 ktoe) under the plans.

Up to 2020 the fastest development is expected to be seen in transport sector with an average growth rate of 63.2% (+433.2 ktoe). The development in heating/cooling and electricity sectors is expected to be developed with an average growth rate of nearly 19.4% each.

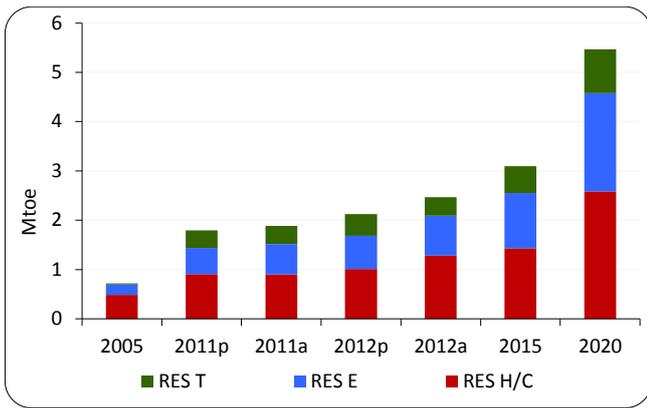


Figure 7-2. RES deployment in Ireland: projected growth and actual progress until 2020.

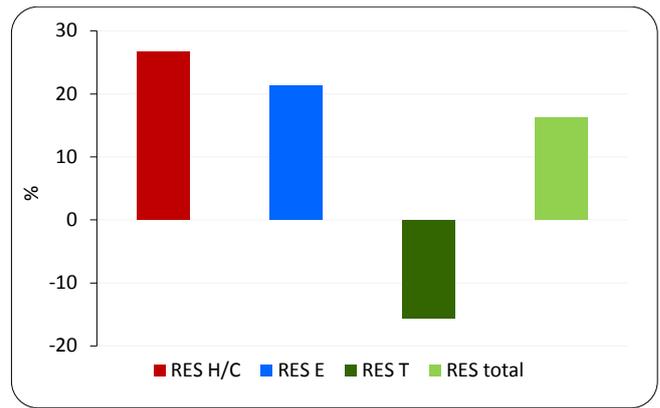


Figure 7-3. Deviation from NREAP in the RES consumption in Ireland in 2012.

7.2 Sources of renewable energy

Wind was the main renewable energy source in Ireland in 2012 with a 46.5% contribution in renewable energy consumed, followed by biomass with 30.8%, biofuels with 10.8%, hydropower with 8.3%, heat pumps with 2.3% and solar with 1.3%.

Biofuels used in transport sector in Ireland had the fastest development between 2005 and 2012 with 935.3% per annum in average (+83.8 ktoe) over the very low level of 1.3 ktoe in baseline year. Despite of this increase biofuels use during 2011-12 period didn't reach the expected NREAP levels being under with 42.2% (-70.8 ktoe) and 57.7% (-115.8 ktoe).

Biomass in electricity and heating/cooling sectors reached 241.8 ktoe (3.6 PJ) in 2012 developing with an average growth rate of 3.6% over 2005 level. Nevertheless this source missed both 2011 and 2012 NREAP plans respectively with 13.7% (-35.1 ktoe) and 23% (-72.4 ktoe).

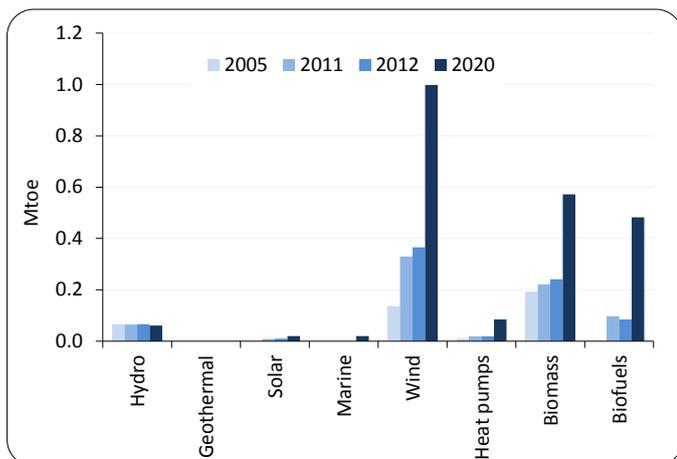


Figure 7-4. Contribution of renewable energy sources in Ireland: actual and projected in 2020

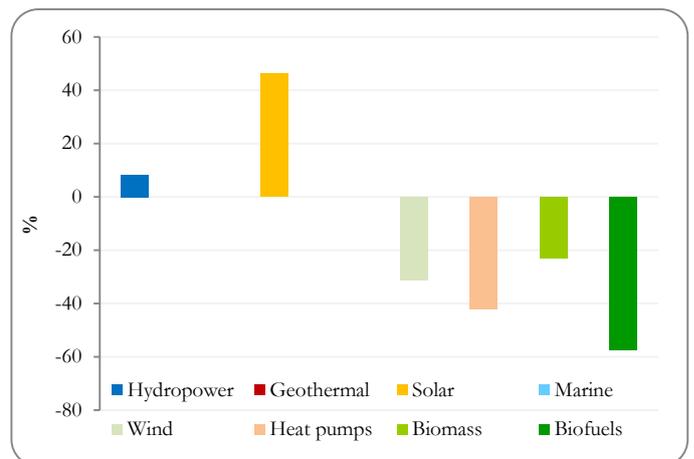


Figure 7-5. Deviation from NREAP in the contribution of renewable sources in Ireland in 2012

Solar source reached 8.14 ktoe (0.3 PJ) in 2011 increasing further in 2012 with 25.9% (+2.1 ktoe). Comparing with expected NREAP plans this source surpassed both 2011 and 2012 levels: 62.8% (+3.14 ktoe) more in 2011 and 46.3% (+3.24 ktoe) more in 2012.

In 2020 wind will still remain the main source of renewable energy in Ireland even that the share in RES mix will decrease slightly to 45.4%. Biofuels use in Ireland is expected to double their share in RES mix in 2020 while the biomass contribution will decrease up to 25.2%. The contributions of hydropower and solar are expected also to decrease in 2020 respectively to 2.7% and 0.9%.

7.3 Renewable energy share

Renewable energy share in Gross Final Energy Consumption in Ireland reached 6.5% in 2011 and 7.1% in 2012. Nevertheless the development of renewable energy in Ireland during 2011-12 period was not enough to meet the expected NREAP shares for these years. Ireland missed by 0.2% points the expected overall RES share in 2011 and by 0.5% points in 2012. In 2020 the target that Ireland has to reach for the overall RES share is 16%.

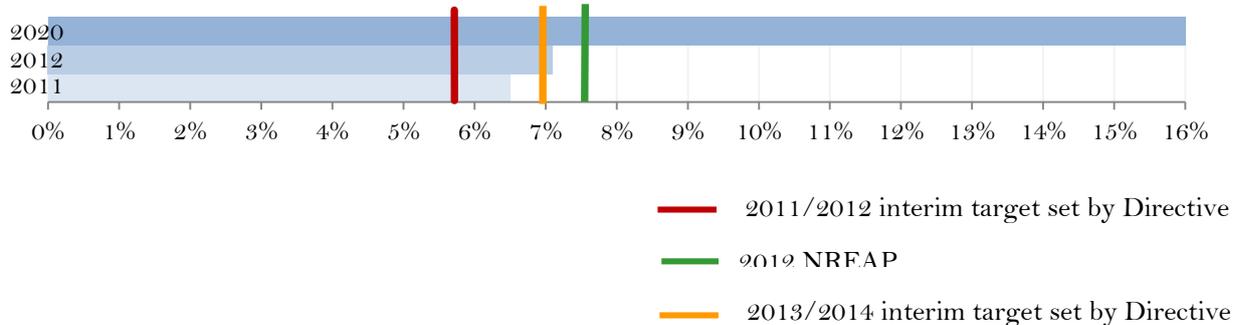


Figure 7-4. Overall RES share in Ireland, 2011-12

The overall RES share in Ireland in 2011-2012 was higher than the indicative trajectories for both 2011/2012 and 2013/2014 but the quite higher NREAP values were missed. Although RES share remains well above the minimum trajectories, Ireland in 2011-12 seems needing a faster renewable energy development in order to achieve the 2020 overall RES share target.

Renewable electricity share in Ireland increased with 12.7% points between 2005 and 2012. Nevertheless it missed the expected NREAP shares in both years: 7% points under in 2011 and 5.7% points under in 2012. Ireland has set an ambitious 2020 target for the RES share in this sector, 42.5% of Gross Final Electricity Consumption. The growth by 22.7% points of RES share in this sector is expected to happen up to 2020.

Even the development of renewables in heating/cooling sector was not enough to meet the NREAP planned share in both years. Renewable energy share in this sector increased with only 1.7% points during period 2005-2012. In 2011 renewable energy share in this sector was 0.2% points under the NREAP planned share while in 2012 this negative deviation was 0.9% points.

The share of renewable energy in transport sector experienced a significant increase between 2005 and 2012 exceeding the NREAP planned share by 3.0% points in 2011 and by 3.0% points in year 2012. An increase of 2.3% points is expected in the RES share of this sector up to 2020.

7.4 Renewable electricity

7.4.1 Installed capacity

Renewable energy installed capacity in Ireland increased from 748 MW in 2005 to 1907 MW in 2011 and 2060 MW in 2012. Nevertheless these capacities were found to be under the respective NREAP planned capacities for 2011 (-27.8%) and 2012 (-23.4%). In 2020 renewable energy capacity is expected to reach 5111 MW.

Wind technology was the main source of renewable energy in Ireland contribution in 2012 with more than 86% in the total renewable electricity capacity. Hydropower followed with 11% in contribution while biomass with only 3%.

Added capacity in wind power in Ireland accounted for 86.3% of its total additional renewable capacity during period 2011-12.

The main progress from year 2005 was made in wind technology with an increase in capacity by +1269 MW in 2012. Nevertheless this development was not enough to exceed the NREAP capacities planned for 2001 and 2012:

29.8% (-694 MW) less in 2011 and 25.6% (-607 MW) less in 2012.

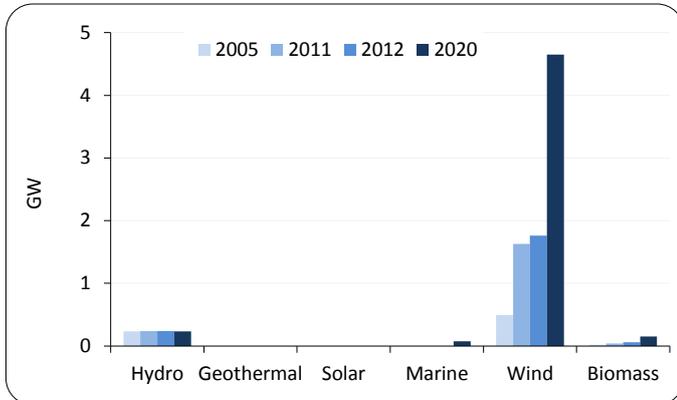


Figure 7-7. RES capacity deployment and progress until 2020 in Ireland.

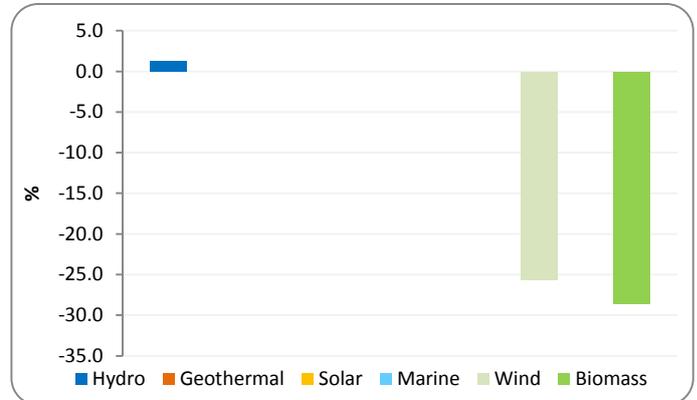


Figure 7-8. Deviation from NREAP in the RES installed capacity in Ireland in 2012.

Biomass installed capacity developed fast during 2011-12 period by 53.8% being nevertheless under the expected capacities in both years: 51.9% (-41 MW) less in 2011 and 28.6% (-24 MW) less in 2012.

Ireland has planned no changed in hydropower capacity up to 2020. Nevertheless a slightly increase (+1.3%) happened since in 2010 over the 2005 level (234 MW). Hydropower capacity remained unchanged during period 2011-12 at 237 MW exceeding so the NREAP plans in both years.

While no contributions were planned in solar technology Ireland reported since in 2009 a capacity of 0.61 MW. A slightly increase happened since then reaching in 2012 the capacity of 0.73 MW.

In 2020 wind power is expected to remain the main contribution in renewable installed capacities covering more than 90% of it. Contributions of hydropower, biomass and marine technologies are expected to be limited respectively at 5%, 3% and 1%.

7.4.2 Consumption

Ireland doubled its renewable electricity consumption during period 2005-2011, reaching 4921 GWh (17.7 PJ). A further increase of 10.7% (+526 GWh) happened during period 2011-12. Despite of this development renewable electricity consumption in Ireland missed the NREAP plans in both 2011 and 2012: 30.3% (-2139 GWh) less in 2011 and 26.1% (-1923 GWh) less in 2012. In 2020 the renewable electricity consumption in Ireland is expected to amount to 13907 GWh (50.1 PJ).

In 2012 wind provided 78% of total renewable electricity followed by hydropower with 13.9% and biomass with 8.1%.

Biomass had the fastest development between 2005 and 2012 increasing with an average growth rate of 40% (+325 GWh) over the level of 116 GWh (0.4 PJ) in the baseline year. Despite this development biomass produced 13.7% (-54 GWh) less in 2011 and 7.9% (-38 GWh) less in 2012 compared with expected NREAP consumptions for these years.

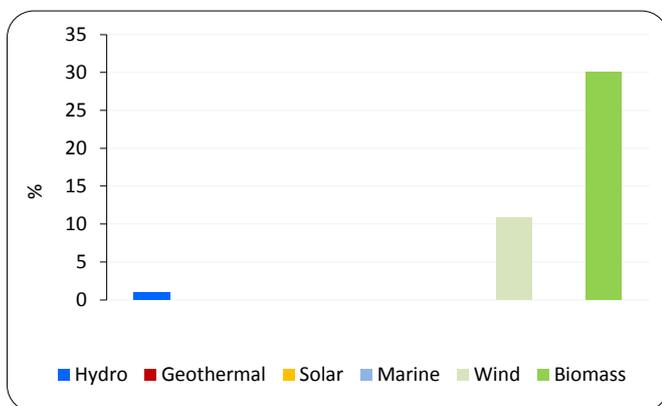


Figure 7-9. Relative increase/decrease of RES electricity sources in Ireland, 2011-12

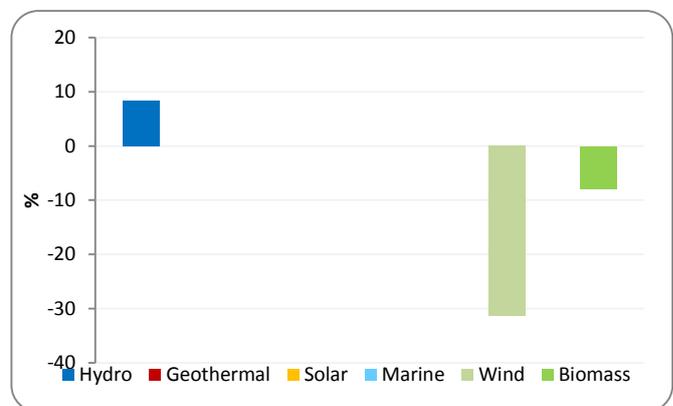


Figure 7-10. Deviation from NREAP in the RES electricity consumption in Ireland in 2012.

Renewable electricity from wind developed with 24% per annum in average (+2659 GWh) during period 2005-2012 reaching 4247 GWh (15.3 PJ). Nevertheless wind was found to be 35.8% (-2134 GWh) under in 2011 and 31.4% (-1943 GWh) under in 2012 comparing with expected NREAP plans.

While a decrease with 0.1% (-1 GWh) in renewable electricity from hydropower took place between 2005 and 2012 Ireland consumed more than planned in both 2011 and 2012: 7% (+49 GWh) more in 2011 and 8.3% (+58 GWh) more in 2012.

While no renewable electricity consumption was planned to come from solar it grew to 0.5 GWh in 2011 remaining then unchanged till 2012.

In 2020 wind is expected to increase its share to 86.1% while biomass and hydropower will decrease their shares respectively to 7.2% and 5%. A contribution with 1.7% is expected by marine source.

7.5 Renewable energy in heating & cooling

The use of renewable energy in heating/cooling sector developed with an average growth rate of 2.8% (+39 ktoe) during period 2005-2012 over the level of 193 ktoe (8.1 PJ) in the baseline year. Nevertheless renewable energy consumed in this sector was under the NREAP planned use with 13.6% (-34 ktoe) in 2011 and 25.4% (-79 ktoe) in 2012. The renewable heat consumption in Ireland is expected to reach 590 ktoe (24.7 PJ) in 2020.

In 2012 biomass share in total renewable heat consumption was 87.9% and the rest heat pumps 7.9% and solar 4.4%.

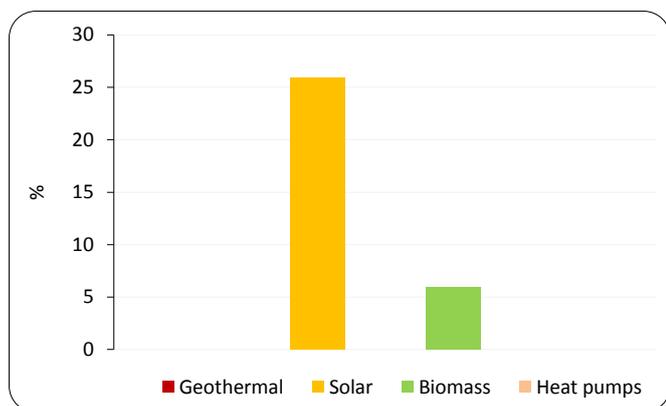


Figure 7-11. Relative increase/decrease of RES heating/cooling sources in Ireland, 2011-12.

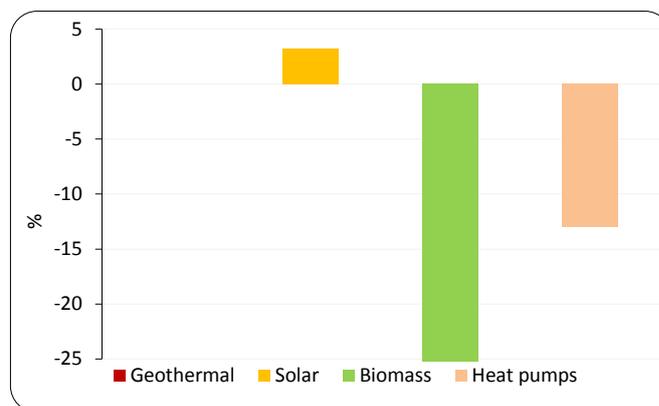


Figure 7-12. Deviation from NREAP in the RES heat consumption in Ireland in 2012.

Heat pumps had the highest relative increase between 2005 and 2012 with an average growth rate of 11.4% (+8 ktoe) over the level of 10 ktoe (0.4 PJ) in 2005. Nevertheless heat consumptions were found under the expected NREAP consumptions in both 2011 and 2012: 28% (-7 ktoe) under in 2011 and 41.9% (-13 ktoe) under in 2012.

Biomass used for heat developed with an average growth rate of 1.6% (+21 ktoe) in 2012 over the level of 183 ktoe (7.7 PJ) in the baseline year. This development was slower than the NREAP projected one missing both 2011 and 2012 expected consumptions: 13.7% (-3.7 ktoe) less in 2011 and 25.3% (-69 ktoe) less in 2012.

Solar thermal reached 10.2 ktoe (0.43 PJ) in 2012 increasing with 25.9% (+2.1 ktoe) over 2011 level. Only heat coming from solar thermal was more than planned during period 2011-12: 62% (+3.1 ktoe) more in 2011 and 45.7% (+3 ktoe) more in 2012.

In 2020 the share of biomass in total heat expected to be consumed will reach 82.4% followed by heat pumps with 14.2% and solar with 3.4%.

7.6 Renewable energy in transport

The use of renewable energy in transport reached 97.7 ktoe (4.1PJ) in 2011 decreasing then with 12.3% (-12 ktoe) in 2012. Renewable energy consumed in this sector missed the NREAP planned levels in both years: 42.2% (-71.3 ktoe) less in 2011 and 57.6% (-116 ktoe) less in 2012. In 2020 renewable energy consumed in transport sector is expected to reach 518.9 ktoe (21.7 PJ).

In 2012 biodiesel covered 65.4% of total renewable energy consumed in transport sector followed by bioethanol/bio-ETBE with 33.9%, renewable electricity with 0.7% and other biofuels with 0.1%.

The highest relative increase happened in bioethanol use in this sector, from 0.01 ktoe in 2005 to 29 ktoe (1.2 PJ) in 2012 (+41414% per annum in average). Nevertheless bioethanol use in transport sector didn't meet the NREAP planned levels in both 2011 and 2012: 42% (-21 ktoe) under in 2011 and 51.7% (-31 ktoe) under in 2012.

Biodiesel had the main absolute increase during 2005-2012, by 55 ktoe even that a decrease by 17.6% (-12 ktoe) happened during 2011-12 period. In comparison with NREAP planned values the use of biodiesel in Ireland was under by 41.9% (-49 ktoe) in 2011 and 60% (-84 ktoe) in 2012.

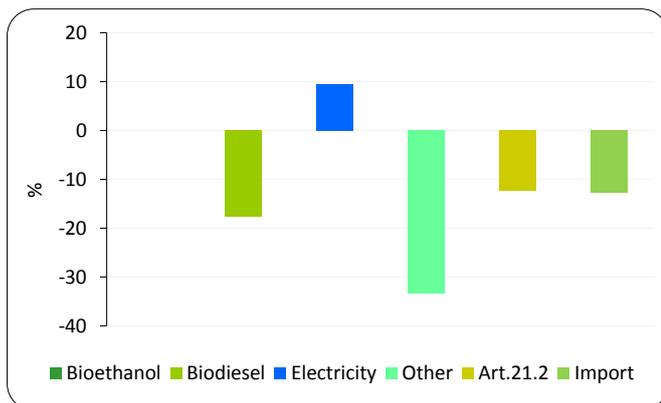


Figure 7-13. Relative increase/decrease of RES transport uses in Ireland, 2011-12.

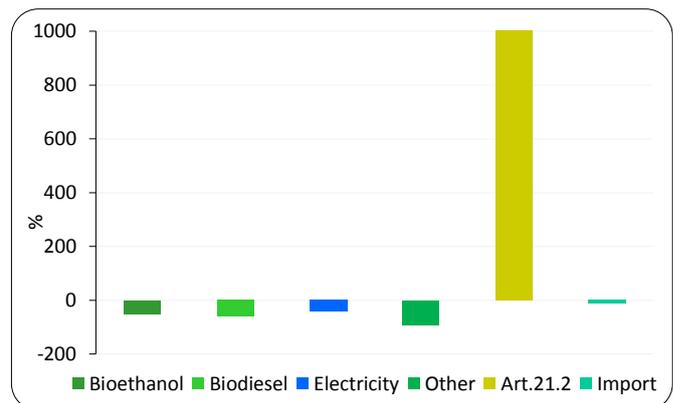


Figure 7-14. Deviation from NREAP in the RES use in transport in Ireland in 2012.

The use of other biofuels was under the expectations in both years: 86.7% under in 2011 and 91.1% under in 2012. Imported biofuels increased more than expected during 2005-2011 period being 92% over the plan but then their use decreased by 12.7% in 2011-12 period missing the NREAP plan by 11.4% (-8 ktoe).

No change happened in the use of renewable electricity in transport during period 2005-2011 meeting the NREAP plans of 1 ktoe in both 2011 and 2012.

The role of biofuels from wastes, residues, ligno-cellulosic material was expected to be very marginal in Ireland. In contrary their use increased very fast by 2416% per annum in average reaching 85.1 ktoe in 2012 over 0.5 ktoe in 2005. Due to this fast development they had the

Additional use of biofuels in Ireland accounted for 22% of its additional renewable energy consumption during

highest deviation over the NREAP expected level in both years: 10691% (+96.2 ktoe) over in 2011 and 9353% (+84 ktoe) in 2012.

Imported biofuels reached 71 ktoe (3 PJ) in 2011 decreasing then with 12.7% (-9 ktoe) in 2012. This development was enough to exceed only the 2011 NREAP level with 91.9% (+34 ktoe) being then under the 2012 expected use with 11.4% (-8 ktoe).

In 2020 biodiesel and other biofuels are expected to keep almost the same share as in 2012 (65.9% and 0.2%) while renewable electricity is expected to 10 fold its share reached 7.1%. The share of bioethanol is expected to decrease to 26.8%.

8. Renewable energy in Greece

8.1 Deployment of renewable energy

Renewable energy consumed in Greece increased with a larger growth rate during period 2011-12 (+12.4%) comparing with period 2005-12 (+6.7% per annum in average). It reached in 2012 the amount of 2369.7 ktoe (99.2 PJ) over the 1616 ktoe (67.6 PJ) in 2005. Renewable energy consumed in Greece is expected to further increase to 5034 ktoe (210.8 PJ) until 2020 (Figure 8-1).

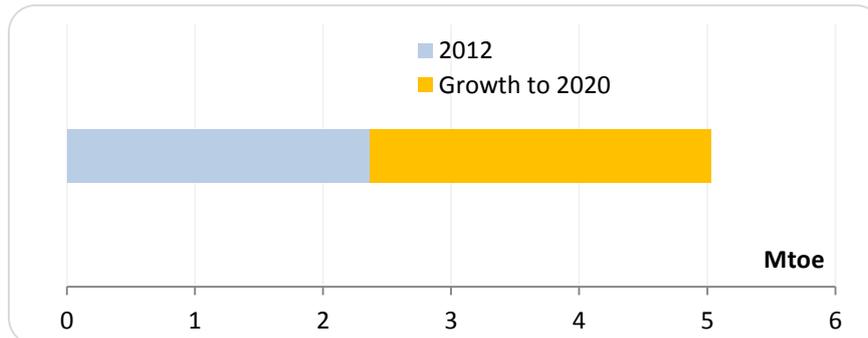


Figure 8-1. RES total in Greece in 2012 and the expected growth to 2020 target

Renewable energy consumed in transport sector made the fastest progress in 2012 from year 2005 increasing yearly by 310% even that its absolute increase was the lowest. Nevertheless it missed the NREAP plans in both 2011 and 2012 having the highest absolute negative deviations: 89.1% (-190.7 ktoe) less in 2011 and 89.5% (-230.8 ktoe) less in 2012.

Renewable energy consumption in Greece was found to be lower than expectations in both 2011 and 2012 respectively by 12.5% (-302 ktoe) and 11% (-292 ktoe).

The development of renewable energy in heating/cooling sector had the highest absolute increase during period 2005 – 2012 by 426 ktoe (5.7% per annum in average). The development was faster enough to surpass the NREAP plans in both 2011 and 2012: 4.7% (+62 ktoe) over in 2011 and 9.9% (+134 ktoe) over in 2012.

Renewable electricity developed faster during period 2011-12 (+19.5%) compared with period 2005-2012 (+7.9% per annum in average). Nevertheless this development doesn't produce more renewable electricity than what was planned in the Greece NREAP for years 2011 and 2012.

Despite that the renewable energy development that was seen in the transport sector, up to 2020 this sector is expected to have the fastest increase with a yearly average growth rate of 279% (+606.8 ktoe). Electricity sector is expected to have the highest additional renewable energy up to 2020 with +1641.4 ktoe (+68.7 PJ). The additional renewable energy expected to come from heating/cooling sector in 2020 present almost one-third of 2020 planned value in this sector.

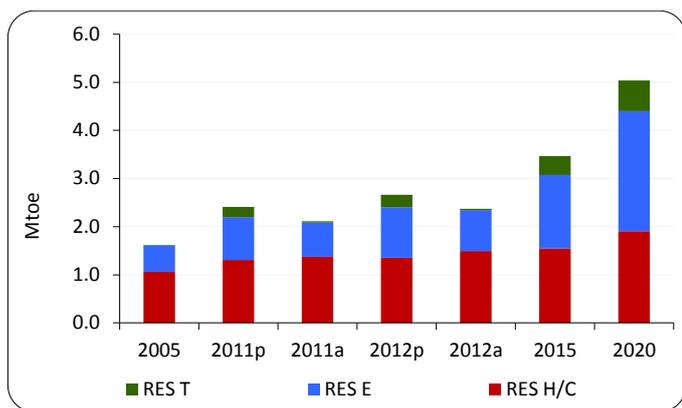


Figure 8-2. RES deployment in Greece: projected growth and actual progress until 2020.

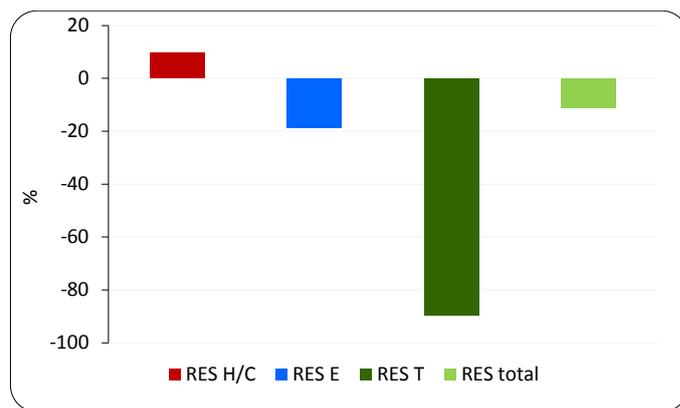


Figure 8-3. Deviation from NREAP in the RES consumption in Greece in 2012.

8.2 Sources of renewable energy

Biomass was the main renewable energy source in Greece with a 51% contribution in RES use in 2012, followed by hydropower with 15%, wind with 14.1%, solar with 13.9%, heat pumps with 4.3%, biofuels with 1% and geothermal with 0.5%.

Biofuels use in transport sector developed very fast during period 2005-2012 with an average growth rate of 271.4% (+22.8 ktoe) from the very marginal level of 1.2 ktoe (0.1 PJ) in the baseline year. Nevertheless this development was slower than planned missing both 2011 and 2012 NREAP plans respectively with 90.5% (-191 ktoe) and 90.6% (-230 ktoe).

Solar technology used for electricity and heat developed with 32.3% per annum in average (+228.6 ktoe) between 2005 and 2012 reaching 329.7 ktoe (13.8 PJ). Comparing with

Additional renewable energy coming from solar technology in Greece provided 36% of additional renewable energy consumption during period 2011-12.

expected developments solar technology missed the planned levels in 2011 by 11.6% (-31 ktoe) but in 2012 an exceedance by 13.7% (+39.6 ktoe) took place.

The increase of biomass consumption in both electricity and heat sectors took place with only 3.7% per annum in average (+251 ktoe) during period 2005-2012. This development was fast enough to surpass the NREAP plans in both years: 5.0% (+53 ktoe) over in 2011 and 12% (+130 ktoe) over in 2012.

Geothermal technology in electricity and heat sectors experienced during period 2005-2012 an average yearly increase of 4.3% (+3.0 ktoe) reaching only 13 ktoe in 2012. This development was slower than planned missing both 2011 and 2012 NREAP plans respectively with 23.8% (-5.0 ktoe) and 38.1% (-8.0 ktoe).

In 2020, the renewable energy mix in Greece is expected to be dominated by wind technology with a share of 29% followed by biomass with 27%, solar with 13%, biofuels with 12%, hydropower with 11%, heat pumps with 6% and geothermal with 2.3%.

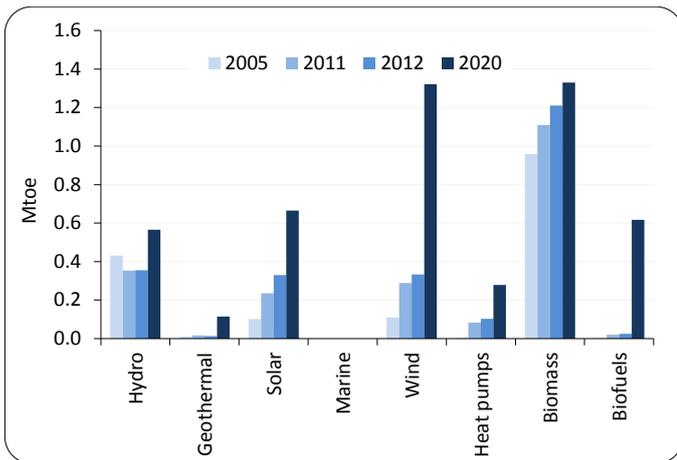


Figure 8-4. Contribution of renewable energy sources in Greece: actual and projected in 2020

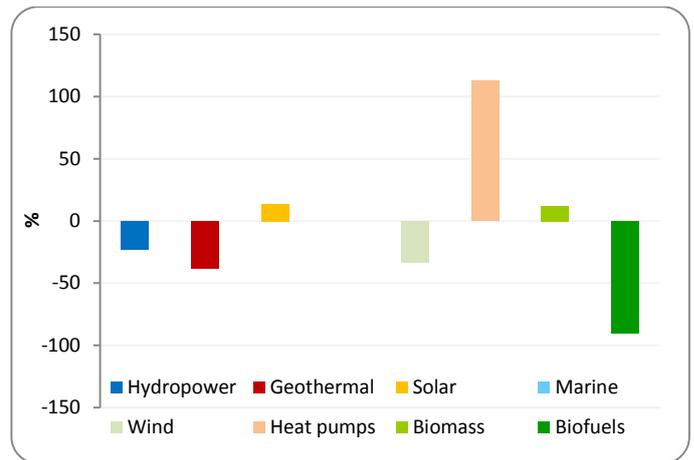


Figure 8-5. Deviation from NREAP in the contribution of renewable sources in Greece in 2012

8.3 Renewable energy share

The overall renewable energy contribution in Gross Final Energy Consumption in Greece reached 11.03% in 2011 and 13.83% in 2012. Comparing with the expected shares for 2011 and 2012 the overall share of RES was over by 2.2% points in year 2011 and 4.3% points in 2012. The 2020 target that Greece has to reach for the overall RES share is 18%.

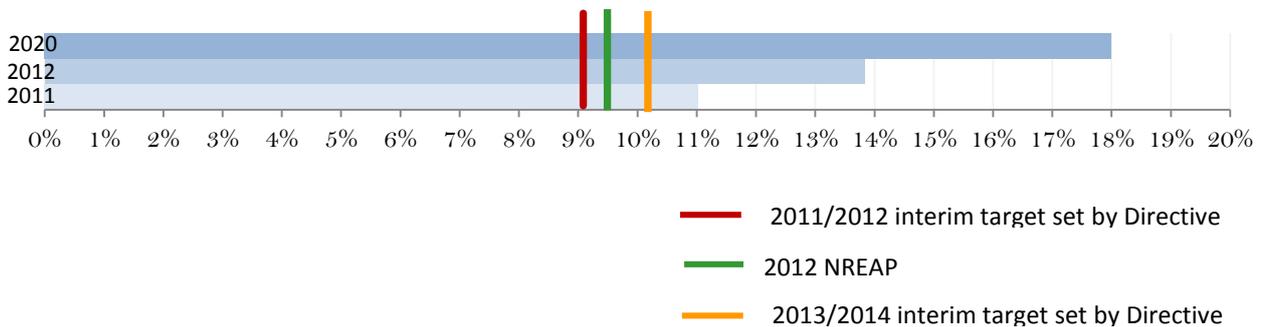


Figure 8-6. Overall RES share in Greece, 2011-12

The overall RES share in Greece exceeded in 2011 and 2012 both the 2011/2012 and 2013/2014 indicative trajectories as well as the 2012 NREAP planned value. Based on reported overall RES shares in 2011 and 2012 Greece seems to be in a good position for the achievement of 2020 RES share target.

Renewable energy share in heating/cooling sector had the fastest development during period 2005-2012 exceeding since in 2011 the 2020 NREAP planned share by 0.5% points. The deviation from 2011 and 2012 NREAP planned shares was respectively by 4.5% points and 8.03% points.

In electricity sector the share of renewable energy doubled between 2005 and 2012. Nevertheless this sector missed the NREAP planned shares for both 2011 and 2012 respectively by 1.9% points and 2.32% points.

The share of renewable energy in transport sector increased slowly, by only 2.1% points between 2005 and 2012. Comparing with NREAP planned shares Greece didn't meet them in this sector in both 2011 and 2012: 1.9% points under in 2011 and 2% points under in 2012.

Major increase from year 2012 is expected to be achieved until 2020, according to the NREAP, in electricity sector (from 16.5% to 39.8%) followed by transport sector (from 2.1% to 10.1%).

8.4 Renewable electricity

8.4.1 Installed capacity

The renewable energy installed capacity in Greece increased in 2012 by 62% from 3623 MW in 2005. Nevertheless this increase was not enough to meet the NREAP planned capacities in both 2011 and 2012: 13.7% (-763 MW) under in 2011 and 10.4% (-684 MW) under in 2012.

Hydropower is the main contributor of renewable installed capacity in Greece in 2012 with 43% followed by wind with 30% and solar with 26%. Biomass contributed only with 1% in total renewable installed capacity in Greece in this year.

Hydropower installed capacity registered a decrease during period 2005-2012 by 18.3% (-570 MW) remaining under the expectations for period 2011-12: 22.2% and 26.1% respectively even that an increase by 0.5% happened during this period.

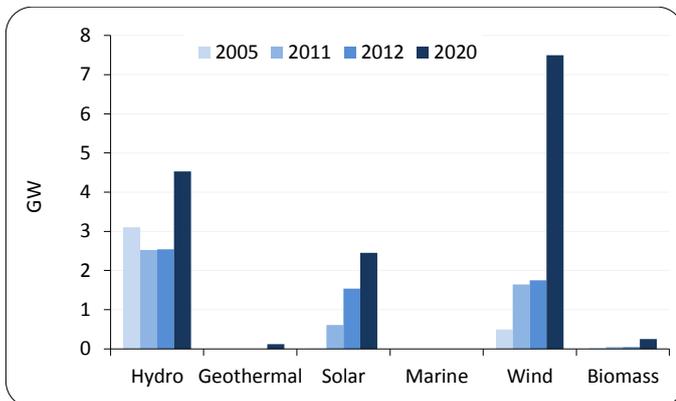


Figure 8-7. RES capacity deployment and progress until 2020 in Greece.

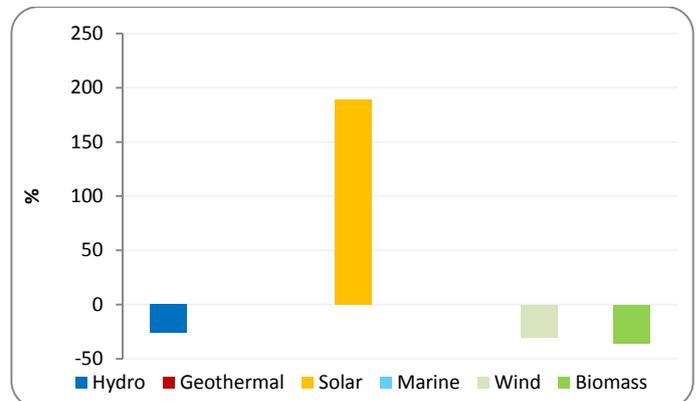


Figure 8-8. Deviation from NREAP in the RES installed capacity in Greece in 2012.

Solar technology (photovoltaic) made the main progress in 2012 increasing the installed capacity by a factor of 1536 over 1MW of year 2005. The development was fast enough to exceed the NREAP expected capacities for both 2011 and 2012: 71.4% (+255 MW) and 189.3% (+1005 MW).

Solar additional capacity installed between 2011 and 2012 was equivalent to 88.1% of the whole additional renewable electricity capacity in Greece and to 5.1% of the additional solar capacity in EU28.

Wind had the second highest increase in capacity in 2005 by 1262 MW (32% per annum in average) over the 2005 level. Nevertheless these capacities remained under the expected NREAP capacities in both years: 14.8% (-284 MW) under in 2011 and 30.5% (-768 MW) under in 2012.

The increase in biomass capacity resulted with only 21 MW (11% per annum in average) during this 8 year period from 2005. The increase didn't follow the planned growth rate established in the NREAP missing the respective capacities in 2011 and 2012: 25% (-15 MW) under in 2011 and 35.7% (-25 MW) under in 2012.

In 2020 wind power is expected to present half of renewable installed capacity in Greece while the contribution of hydropower will decrease to 31%. The share of solar is expected also to decrease to 16% while biomass will increase its contribution to only 2%.

8.4.2 Consumption

Renewable electricity consumption in Greece amounted to 8271 GWh (29.8 PJ) in 2011 and 9887 GWh (35.6 PJ) in 2012 from 6379 GWh (23 PJ) in 2005. Nevertheless renewable electricity consumption in Greece didn't reach the NREAP planned consumption missing the respective values by 19.6% in 2011 and 18.6% in 2012. In 2020 renewable electricity consumption in Greece is expected to amount to 28973 GWh (104.3 PJ).

In 2012 hydropower covered 41.7% of renewable electricity consumption followed by wind with 39.1%, solar with 17.1% and biomass with 2.0%.

35.7% of additional renewable electricity consumption between 2011 and 2012 in Greece was provided by solar photovoltaic.

Solar technology (totally photovoltaic) had the fastest development between 2005 and 2012 with an average growth rate of 26875% (+1693 GWh) from the very low level of 0.9 GWh in the baseline year. The exceedances from NREAP planned levels are 29.8% (+140 GWh) more in 2011 and 142.7% (+996 ktoe) more in 2012.

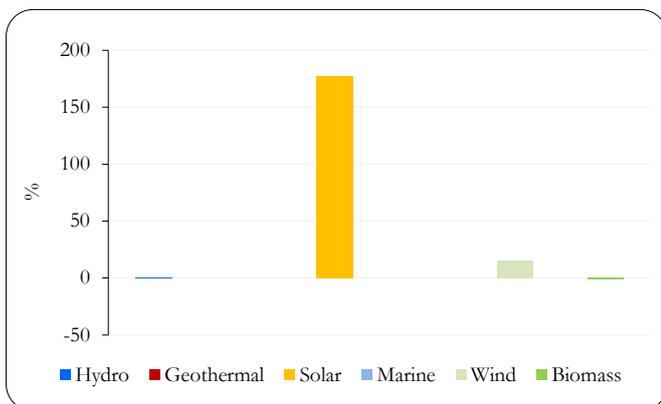


Figure 8-9. Relative increase/decrease of RES electricity sources in Greece, 2011-12

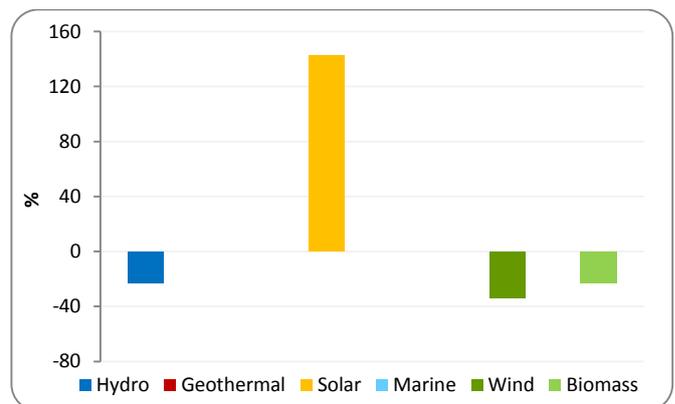


Figure 8-10. Deviation from NREAP in the RES electricity consumption in Greece in 2012.

Wind power had the highest absolute increase during period 2005-2012 with +2603 GWh (+29.3% per annum in average) from the level of 1267 GWh (4.6 PJ) in the baseline year.

Nevertheless this development was slower than planned missing both 2011 and 2012 NREAP planned levels: 25.4% (-1145 GWh) less in 2011 and 33.7% (-1968 GWh) less in 2012. The development of biomass in this sector took place with 15.7% per annum in average (+103 GWh) during period 2005-2012. This development was slower than planned missing the NREAP plans in both years: 22% (-56 GWh) under in 2011 and 23% (-59 GWh) under in 2012.

Hydropower decreased between 2005 and 2012 with 2.5% per annum in average (-891 GWh) from the baseline level of 5017 GWh (18.1 PJ). This downward trend produced negative exceedances from the NREAP plans in both 2011 and 2012: 18.9% (-957 GWh) under in 2011 and 23% (-1234 GWh) under in 2012.

Additional renewable energy coming from wind accounted for almost 75% of the additional renewable energy consumption in Greece between 2005 and 2012.

In 2020 wind power is expected to be the main source in renewable energy mix in Greece a contribution of 58%. Hydropower is expected to decrease significantly its contribution reaching 22.7% being followed by solar with 12.4%, biomass with 4.3% and geothermal with 2.5%.

8.5 Renewable energy in heating & cooling

The use of renewable energy in heating and cooling in Greece reached 1492 ktoe (62.5 PJ) in 2012 increasing by only 118 ktoe (+8.6%) over 2011. The average growth rate of heat development from 2005 happened with 5% per year with an additional heat consumption of 426 ktoe. Heat consumption in Greece in period 2011-12 was found to be over the expected NREAP consumptions in both years respectively by 4.8% (+63 ktoe) and 9.9% (+135 ktoe). Heat from renewable energy sources is expected to reach 1907 ktoe (79.8 PJ) in 2020.

In 2012 biomass covered 80% of total renewable heat consumed in Greece. Solar thermal was found to have a contribution of 12.3% followed by heat pumps with 6.8% and geothermal with 0.9%.

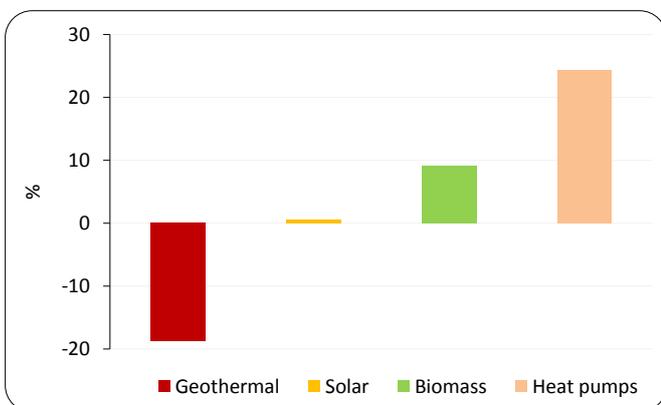


Figure 8-11. Relative increase/decrease of RES heating/cooling sources in Greece, 2011-12.

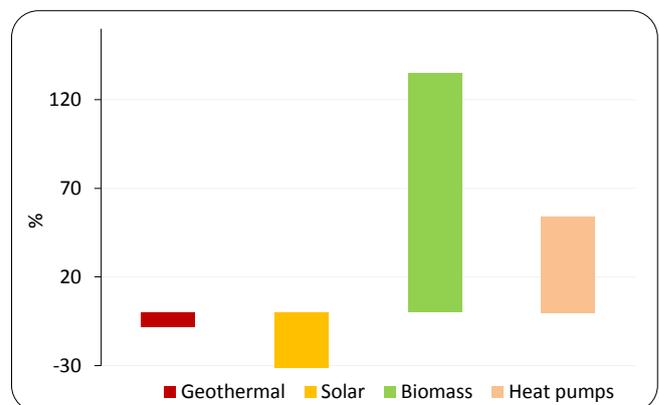


Figure 8-12. Deviation from NREAP in the RES heat consumption in Greece in 2012.

The fastest progress from 2005 happened in heat pumps which increased by 306% per annum in average (+98 ktoe) reaching 102 ktoe in 2012. This technology had also the highest positive deviations from the NREAP plans in both years: 182.8% (+53 ktoe) over in 2011 and 112.5% (+54 ktoe) over in 2012.

Solar thermal was the second technology having the fastest development in Greece during period 2005-2012, 10% per annum in average. Nevertheless the heat consumption during period 2011-12 was lower than what Greece had planned in the NREAP: 19% (-43 ktoe) under in 2011 and 20% (-46 ktoe) under in 2012.

Additional use of biomass between 2005 and 2011 accounted for almost 60% of additional heat consumption in Greece during the same time span.

Consumption of heat originated from biomass had the highest absolute increase (+242 ktoe) from year 2005 reaching in 2012 the amount of 1193 ktoe. This development was enough to exceed the expected heat production for period 2011-12: 5.6% (+58 ktoe) over in 2011 and 12.8% (+138 ktoe) over in 2012.

Geothermal had a slowly development between 2005 and 2011 compare to what was expected decreasing even further during period 2011-12 by 18.8% (-3 ktoe). In 2011 this technology was found to be 23.8% (-5 ktoe) under the NREAP while in 2012 this deviation was 38% (-8 ktoe).

In 2020 biomass will still remain the main source of renewable heat consumption even that its share will decrease up to 64.1%

8.6 Renewable energy in transport

The use of renewable energy in Greece reached in 2012 the amount of 27.2 ktoe increasing by a yearly growth rate of 271% over 2005 level. Despite expectations of Greece, a fast development of renewable energy in this sector during period 2005-2012 didn't happen. Transport sector was found to be under the NREAP plans in both 2011 and 2012: 89% (-191 ktoe) under in 2011 and 89.5% (-231 ktoe) under in 2012.

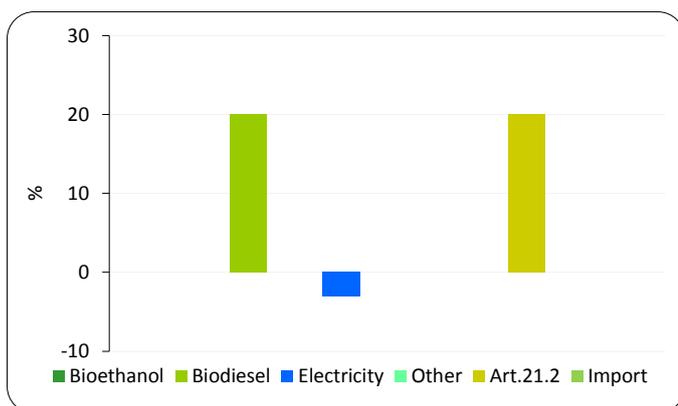


Figure 8-13. Relative increase/decrease of RES transport uses in Greece, 2011-12.

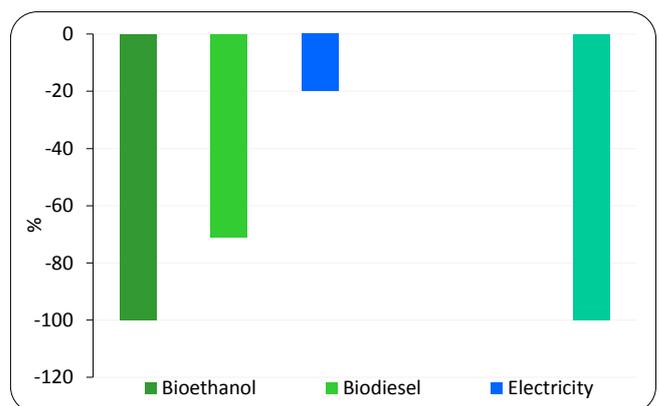


Figure 8-14. Deviation from NREAP in the RES use in transport in Greece in 2012.

Use of bioethanol in transport sector in Greece was expected to happen since in year 2010. Despite of this expectation no use of bioethanol in transport sector was reported in Greece up to 2012.

Biodiesel use in this sector didn't developed with the expected growth rate, reaching in 2012 only 24 ktoe over 1.2 ktoe of 2005. Comparing with NREAP the use of biodiesel in this sector was found to be 71% under in both 2001 and 2012.

While no contribution was expected in both years for the use of biofuels from wastes, residues, ligno-cellulosic material, their use grew to 20 ktoe in 2011 increasing by 20% in 2011-12 time span.

No other biofuels (biogas and vegetable oils) were used in Greece in 2011 and 2012. No use of imported biofuels was reported for Greece between 2011 and 2012.

The use of renewable electricity in transport remained at the level of 3.3 ktoe in both 2011 and 2012. Comparing with expected use of renewable electricity in this sector it met the expected use in 2011 but missed it by 20% in 2012.

9. Renewable energy in Spain

9.1 Deployment of renewable energy

Renewable energy consumed in Spain increased from 8410 ktoe (352 PJ) in 2005 to 11656 ktoe (488 PJ) in 2011 and 12115 ktoe (507.4 PJ) in 2012. Renewable energy consumption in Spain is expected to further increase to 21028 ktoe (880.4 PJ) until 2020 (Figure 9-1).

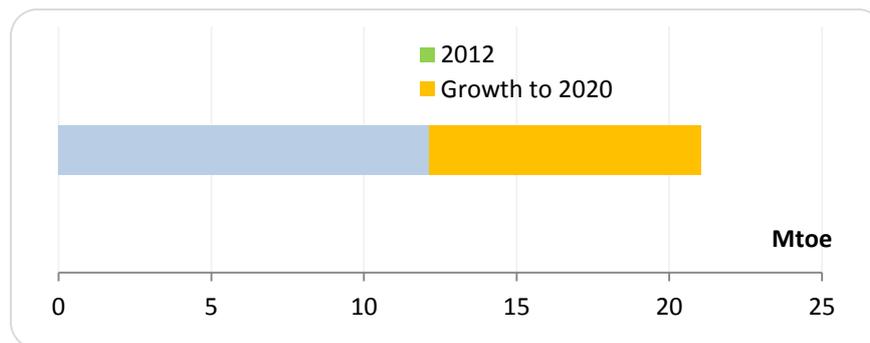


Figure 9-1. RES total in Spain in 2012 and the expected growth to 2020 target

Renewable energy in electricity sector made the main progress during period 2005-2011 increasing with an average growth rate of 10.2% (+2831 ktoe) over 4624 ktoe (193.6 PJ) in the baseline year. This sector experienced further in 2012 the highest additional increase with +401 ktoe (+5.4%). Nevertheless this development was not faster than the one

Renewable energy consumption in Spain missed the expected NREAP values in both 2011 and 2012 respectively by 16.9% (-2370 ktoe) and by 17.6% (-2589.2 ktoe).

projected in the NREAP missing the respective expected consumptions in both 2011 and 2012: 5.2% (-404.8 ktoe) less in 2011 and 5.8% (-438.3 ktoe) less in 2012.

Heating/cooling sector in Spain increased the use of renewable energy sources during period 2005-2011 with an average growth rate of 2.6% (+101 ktoe) over the 3540.4 ktoe (148.2 PJ) in the baseline year. A slightly increase took place later in 2012 with 1.3% (+52 ktoe). This development was fast enough to surpass the expected NREAP plans in both 2011 and 2012: 2.5% (+101 ktoe) more in 2011 and 2.8% (+111 ktoe) more in 2012.

Transport sector in Spain experienced a decrease in the consumption of renewable energy sources between 2005 and 2011 decreasing with 9.3% per annum in average (-137 ktoe) from 245 ktoe (10.3 PJ) in the baseline year.

Even that an increase with 5.6% (+6.0 ktoe) took place during 2011-12 period renewable energy in this sector missed significantly the expected NREAP plans in both 2011 and 2012: 95% (-2066.4 ktoe) less in 2011 and 95.1% (-2217 ktoe) less in 2012.

In 2020 the share of renewable energy used in transport sector in total renewable energy mix in Spain will be increased significantly from 1% in 2012 to 15% in 2020

The fastest progress until 2020 is expected to happen in transport sector (340% per annum in average) followed by electricity sector (7.3% per annum in average) and heating/cooling sector (3.7% per annum in average).

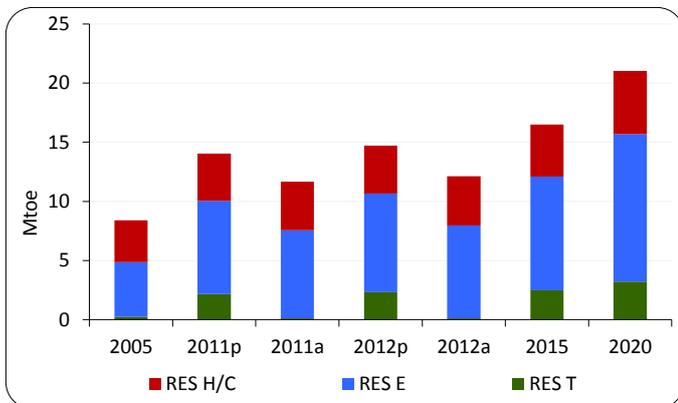


Figure 9-2. RES deployment in Spain: projected growth and actual progress until 2020.

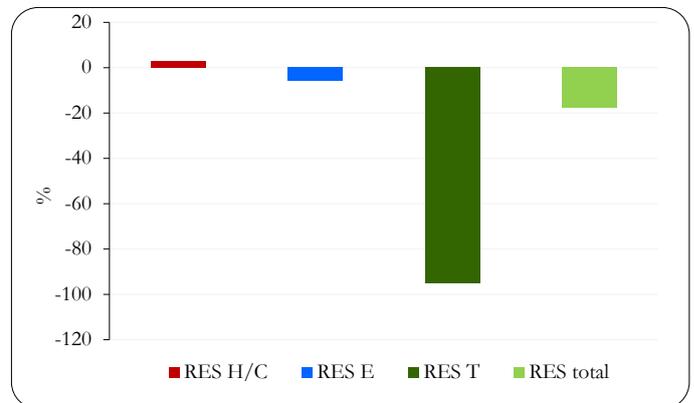


Figure 9-3. Deviation from NREAP in the RES consumption in Spain in 2012.

9.2 Sources of renewable energy

Biomass was the main renewable energy source in Spain with a 35.6% contribution in renewable energy mix in 2012, followed by wind with 34.1%, hydropower with 19.8% and solar with 10.4%.

Solar source had the fastest development among renewable energy sources in Spain increasing between 2005 and 2011 with an average growth rate of 245% (+948.7 ktoe) from 64.5 ktoe (2.7 PJ) in the baseline year. It increased further in 2012 with a rate of 23% (+233.2 ktoe). Comparing with projected NREAP development for years 2011 and 2012 this source was found over the respective plans with 0.1% (+60.2 ktoe) more in 2011 but 1.3% (-15.8 ktoe) under in 2012.

Almost one-third of the Spanish additional renewable energy consumption in Spain during period 2005-12 came from solar technology.

Biomass for energy in Spain increased with only 2.3% per annum in average during period 2005-2011 from 3696 ktoe (154.7 PJ) in the baseline year. The further increase up to 2012 took place with 2.2% (+15.6 ktoe). Despite of this increase the biomass use for energy purposes in Spain developed slower than what was planned in the NREAP missing the respective levels in both 2011 and 2012: 1.3% (-55.4 ktoe) under in 2011 and 1.2% (-50.5 ktoe) under in 2012.

Geothermal in electricity and heating/cooling sector developed also fast in relative terms between 2005 and 2011 with 58% per annum in average reaching 17 ktoe (0.7 PJ) in 2011. An increase with 5.9% (+1.0 ktoe) took place during period 2011-12 in the use of this technology for energy consumption. This development was faster than the NREAP one surpassing significantly the expected plans in both 2011 and 2012: 347.4% (+13.2 ktoe) more in 2011 and 373.7% (+14.2 ktoe) more in 2012.

Even than planned no use of biofuels in transport sector was reported in the second progress report of Spain.

In 2020 wind power is expected to have the highest contribution with 30.4% followed by biomass with 27.8%, solar with 14.3%, hydropower with 13.7%, biofuels with 13.2%, geothermal and heat pumps with 0.2% each and marine with 0.1%.

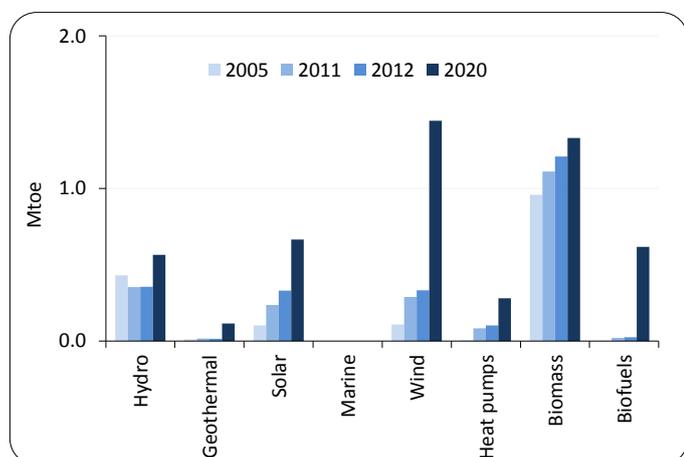


Figure 9-4. Contribution of renewable energy sources in Spain: actual and projected in 2020

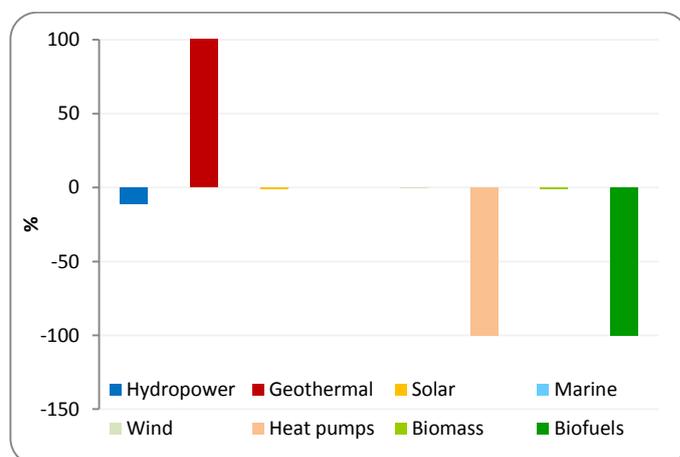


Figure 9-5. Deviation from NREAP in the contribution of renewable sources in Spain in 2012

9.3 Renewable energy share

The overall renewable energy contribution in Gross Final Energy Consumption in Spain reached 13.2% in 2011 and 14.3% in 2012. Nevertheless comparing with the expected shares for 2011 and 2012 the overall share of RES in Spain was under by 1.2% points in year 2011 and 0.8% points in 2012. The 2020 target that Spain has to reach for the overall RES share is 20.8%.

The overall RES share in Spain in 2012 exceeded the indicative trajectory for both 2011/2012 and 2013/2014 period. Nevertheless the trajectory of renewable energy in Spain in 2011-2012 fell below the NREAP expected values for this period. Although RES share remains well above the minimum trajectories, based on reported overall RES shares in 2011 and 2012 Spain seems needing a faster RES deployment in order to achieve the overall 2020 RES share target.

Renewable energy share in electricity sector had the highest absolute increase in 2012 with +15.1% points over the 2005 share of 18.4%. Renewable energy share in this sector was found to be over the NREAP planned share in both years: +0.6% points in 2011 and +1.5% points in 2012.

The increase of RES share in heating/cooling sector from 2005 was with +5.1% points in 2012 over 8.9% share of year 2005. The development of this sector was fast enough to exceed the NREAP planned shares by 2.3% points in both years.

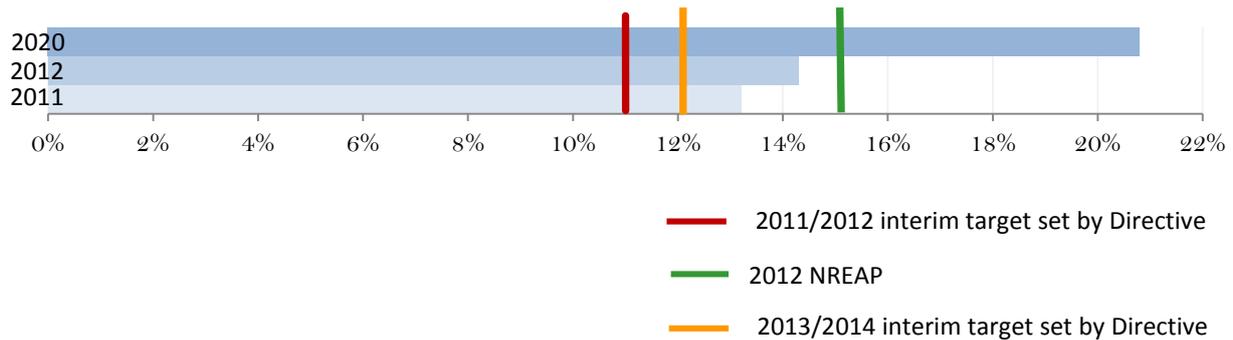


Figure 9-6. Overall RES share in Spain, 2011-12

The share of renewable energy in transport sector in Spain during period 2005-2011 was not at the expected levels decreasing by 0.4% points over 0.8% share of year 2005. No changes happened in the renewable energy share in transport during period 2011-12 keeping this share under the expected NREAP planned shares: 6.7% points under in 2011 and 7.2% points under in 2012.

Major increase from year 2012 is expected to be achieved until 2020, according to the NREAP, in transport (from 0.4% to 11.3%), followed by electricity sector (from 33.5% to 39%) and heating/cooling (from 14% to 17%).

9.4 Renewable electricity

9.4.1 Installed capacity

The renewable energy installed capacity in Spain increased from 23.7 GW in 2005 to 41.1 GW in 2011 and 43.5 GW in 2012. Nevertheless these capacities were found 1.7% (-706 MW) under in 2011 and 2.5% (-1115 MW) under in 2012 the respective NREAP planned capacities for these years. In 2020 the installed capacity of renewable energy sources is expected to reach 63.8 GW.

In 2012 more than 52% of renewable installed capacity in Spain was wind power and the rest was hydropower (30.5%), solar photovoltaic (15.2%) and biomass (2.0%)

Solar photovoltaic had the fastest development with an average growth rate of 1192% (+4292 MW) from 60 MW in the baseline year. This capacity increased further in 2012 with 5.8% (+251 MW). This development was faster than what was planned in the NREAP for year 2011 surpassing the expected capacity with 2.0% (+87 MW) but not enough to meet the 2012 planned capacity being 1.4% (-66 MW) under.

CSP technology provided nearly 35% of additional renewable capacity in Spain between 2011 and 2012

Concentrated solar power (CSP) technology in Spain reached 1149 MW in 2011 increasing then further in 2012 with 74.1% (+851 MW). Despite of this increase the capacity of CSP technology was found to be under the expected NREAP levels in both 2011 and 2012: 16.7% (-230 MW) under in 2011 and 1.3% (-26 MW) under in 2012.

Biomass capacity for electricity consumption increased with 28.5% (+171 MW) between 2005 and 2011 over 601 MW in the baseline year increasing then further in 2012 with 11% (+84 MW). Nevertheless these capacities were found to be under the expected NREAP levels: 16.5% (-152 MW) under in 2011 and 12.8% (-126 MW) under in 2012.

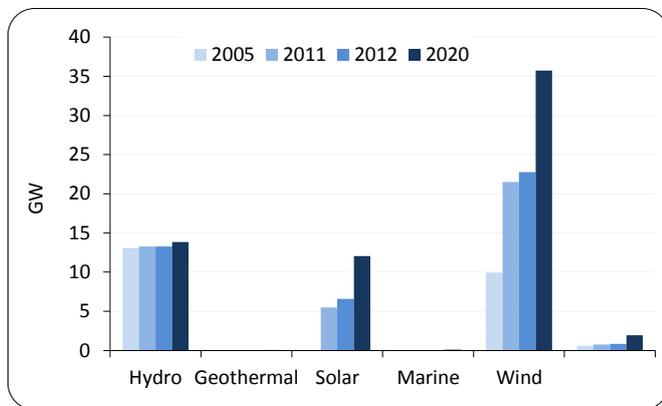


Figure 9-7. RES capacity deployment and progress until 2020 in Spain.

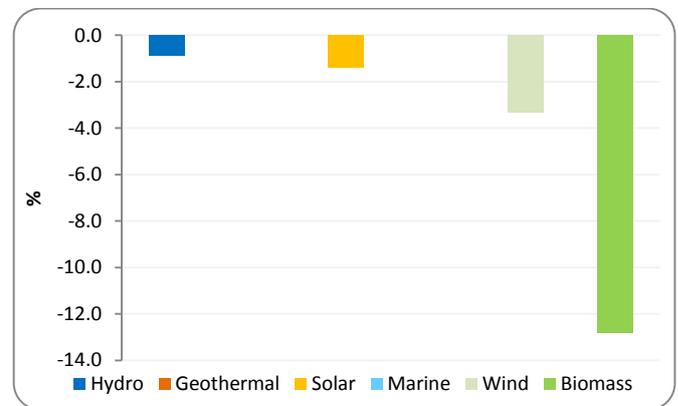


Figure 9-8. Deviation from NREAP in the RES installed capacity in Spain in 2012.

More than half of additional renewable energy capacity in Spain between 2011 and 2012 was provided by wind power

The capacity of wind power also developed fast during period 2005-2011 increasing with 19.5% per annum in average (+11611 MW) over 9918 MW in 2005 increasing then further in 2012 with 5.8% (+1246 MW). Nevertheless this technology didn't met the expected NREAP

levels being under in both 2011 and 2012: 1.5% (-326 MW) under in 2011 and 3.3% (-780 MW) under in 2012.

Hydropower capacity remained almost unchanged during period 2011-12 after the increase that took place in 2011 with 1.5% (+199 MW) over the 13084 MW of the baseline year. This source missed also the the expected NREAP levels in both 2011 and 2012: 0.6% (-85 MW) less in 2011 and 0.9% (-115 MW) less in 2012.

In 2020 wind power is expected to reach a contribution of 56.1% followed by hydropower with 21.7%, solar with 18.9%, biomass with 3.1%, marine 0.2% and geothermal 0.1%.

9.4.2 Consumption

Renewable electricity consumption in Spain amounted to 86.7 TWh (312.1 PJ) in 2011 and 91.3 TWh (329 PJ) in 2012 from 53.8 TWh (193.6 PJ) in 2005. Nevertheless the renewable electricity consumption in Spain didn't reach the NREAP planned values missing the respective values by 5.2% (-4707 GWh) in 2011 and 5.8% (-5619 MW) in 2012. In 2020 the renewable electricity consumption in Spain is expected to amount to 144.8 TWh (521.4 PJ).

In 2012 wind power provided 52.1% of renewable electricity in Spain followed by hydropower with 30.2%, solar with 13.1% and biomass with 4.7%.

Solar photovoltaic had the fastest development during period 2005-2011 increasing with 3008% per annum in average (+7400 GWh) from 41 GWh (0.1 PJ) in 2005 increasing then

further in 2012 with 9.7% (+922 GWh). Comparing with expected NREAP developments this source was found to be over the respective levels in both years: 7.6% (+525 GWh) over in 2011 and 6.5% (+496 GWh) over in 2012.

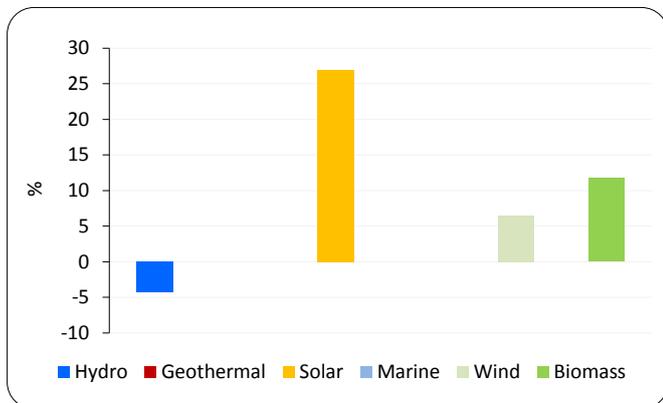


Figure 9-9. Relative increase/decrease of RES electricity sources in Spain, 2011-12

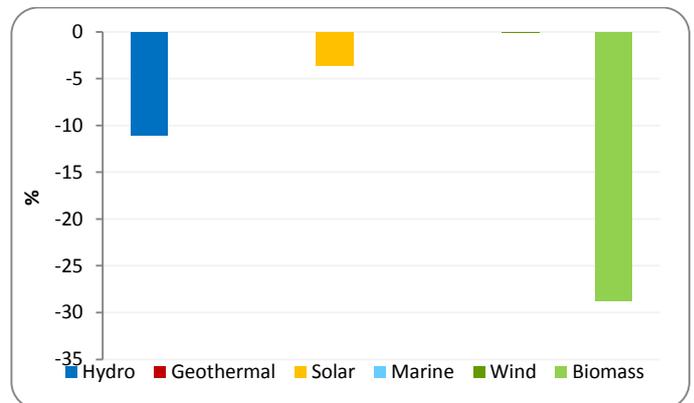


Figure 9-10. Deviation from NREAP in the RES electricity consumption in Spain in 2012.

Wind power had the highest additional renewable energy consumption between 2005 and 2011 with +24 TWh (+2056.3 ktoe) from 20.7 TWh (1782.4 ktoe or 74.6 PJ) in the baseline year. It increased further in 2012 with 6.5% (+2916 GWh). Despite of this development this source missed in both 2011 and 2012 the respective expected NREAP levels: 0.5% (-239 GWh) less in 2011 and 0.1% (-25 GWh) less in 2012.

Renewable electricity from CSP in Spain reached 1959 GWh (7.1 PJ) in 2011 increasing then in 2012 with 92.7 (+1816 GWh). Despite these increases the achieved consumption was found to be under the NREAP levels in both years: 26% (-689 GWh) less in 2011 and 19.9% (-936 GWh) less in 2012.

Nearly 40% of additional renewable electricity consumption in Spain during 2011-12 was covered by CSP technology

Biomass use in electricity sector developed with 43.8% (+1162 GWh) between 2005 and 2011 reaching 3814 GWh (13.7 PJ) increasing then further in 2012 with 11.7% (+448 GWh). Nevertheless the renewable electricity consumption achieved from this source was under the expected NREAP consumptions in both 2011 and 2012: 31% (-1714 GWh) less in 2011 and 28.7% (-1715 GWh) less in 2012.

Hydropower produced in 2011 almost 5% (-1517 GWh) less renewable electricity compared with 30350 GWh (109.3 PJ) in the baseline year. This trend followed even during period 2011-12 decreasing with 4.3% (-1239 GWh). Comparing with expected development this source missed the NREAP plans in both 2011 and 2012: 8.2% (-2589 GWh) less in 2011 and 11.1% (-3439 GWh) less in 2012.

In 2020 the contribution of wind power will cover half of renewable electricity consumption expected and the other half will be shared among hydropower (22.7%), solar (18.1%), biomass (8.4%), marine and geothermal (0.2% each).

9.5 Renewable energy in heating & cooling

The use of renewable energy in heating and cooling in Spain increased to 4093 ktoe (171.4 PJ) in 2011 and 4144 ktoe (173.5 PJ) over 3540.4 ktoe (148.2 PJ) in the baseline year. The

achieved development in this sector was faster than the development projected in the NREAP surpassing the respective levels in both 2011 and 2012: 2.5% (+101 ktoe) more in 2011 and 2.8% (111 ktoe) more in 2012. In 2020 the use of renewable energy in this sector is expected to reach 5357.3 ktoe (224.3 PJ).

In 2012 biomass provided 94.3% of total renewable heat consumed in Spain and the rest was covered by solar thermal (5.3%) and geothermal (0.4%).

The fastest progress from 2005 happened in geothermal source which increased to 17 ktoe (0.7 PJ) in 2011 over 3.8 ktoe (0.2 PJ) exceeding so the 2020 planned level of 9.5 ktoe (0.4 PJ) for heat consumption from this source. It was found 347.4% (+13.2 ktoe) over the 2011 plan and 373.7 ktoe (+14 ktoe) over the 2012 plan.

Biomass had between 2005 and 2012 the highest additional use for heating purposes with +438 ktoe (+18.3 PJ), 12.6% higher than the baseline level of 3468 ktoe (145.2 PJ). Comparing with expected NREAP development this source was found 2.4% (+92 ktoe) over in 2011 and 2.5% (+96 ktoe) over in 2012.

One-third of the additional heat consumed in Spain between 2011 and 2012 was provided by solar thermal.

Solar thermal had between 2011 and 2012 the fastest increase with +7.3% (+15 ktoe) exceeding the expected NREAP levels in both years: 7.9% (+15 ktoe) more in 2011 and 11.1% (+22 ktoe) more in 2012.

Even that a contribution of 19.7 ktoe (0.8 PJ) and 22.2 ktoe (0.9 PJ) was planned for years 2011 and 2012 no developments in heat pump use for heating purposes

was reported for Spain.

In 2020 solar thermal is expected to more than double its share in total renewable heat expected to be consumed this year while the share of biomass will decrease up to 86.9%. Contributions of geothermal and heat pumps will be very marginal respectively with 0.2% and 0.9%.

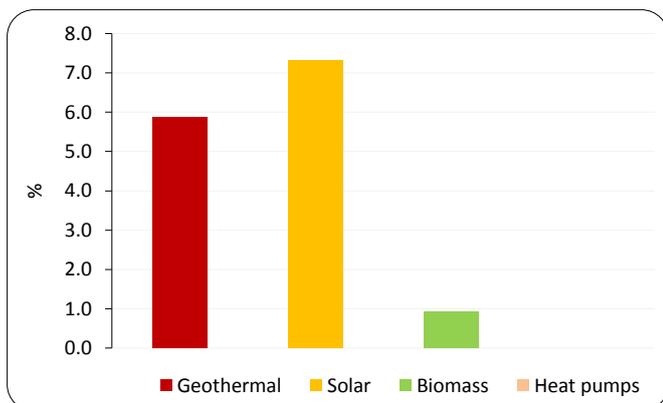


Figure 9-11. Relative increase/decrease of RES heating/cooling sources in Spain, 2011-12.

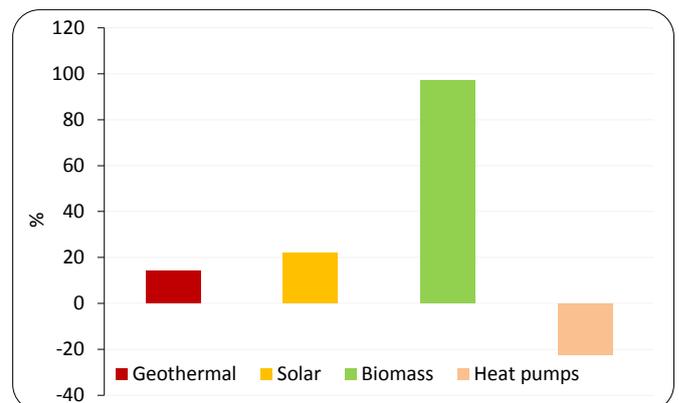


Figure 9-12. Deviation from NREAP in the RES heat consumption in Spain in 2012.

9.6 Renewable energy in transport

According to its NREAP Spain had planned a significant increase during period 2005-12 with an average growth rate of 122%. In contrary the use of renewable energy in transport decreased from 245 ktoe (10.2 PJ) in the baseline year amounting to 108 ktoe (4.5 PJ) in 2011 and 114 ktoe (4.8 PJ) in 2012. This development missed the respective NREAP levels with 95% (-2066.4 ktoe) in 2011 and 95.1% (-2217 ktoe) in 2012. In 2020 the use of renewable energy in transport sector is expected to reach 3215.6 ktoe (134.6 PJ).

In 2012 only the use of renewable electricity in transport sector was reported in the Spain second progress report. Comparing with baseline year use renewable electricity in Spain increased in 2012 with 6.1% reaching 114 ktoe (4.8 PJ). No changes happened in renewable electricity use between 2005 and 2011 keeping the level of ~108 ktoe (4.5 PJ) of the baseline year. Comparing with expected NREAP uses this development was slower in both 2011 and 2012: 14.6% (-18.4 ktoe) less in 2011 and 33.8% (-58 ktoe) less in 2012.

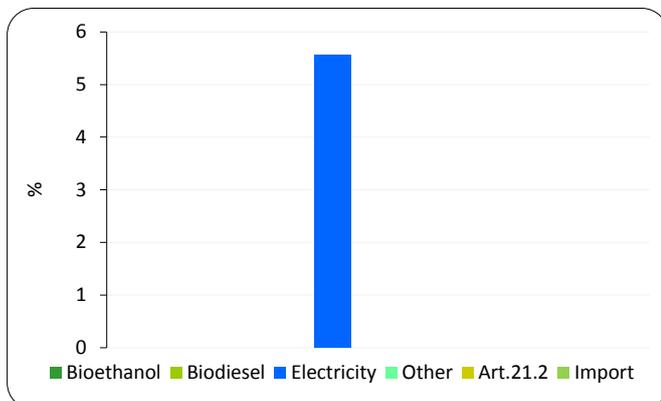


Figure 9-13. Relative increase/decrease of RES transport uses in Spain, 2011-12.

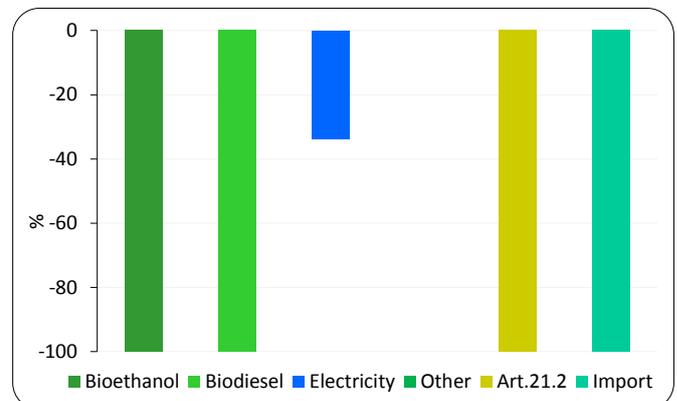


Figure 9-14. Deviation from NREAP in the RES use in transport in Spain in 2012.

In 2020 the contribution of renewable energy sources used in transport sector in Spain is expected to be shared between biodiesel (71.9%), bioethanol/bio-ETBE (12.4%) and renewable electricity (15.6%).

10. Renewable energy in France

10.1 Deployment of renewable energy¹⁸

The renewable energy consumed in France increased from 16.4 Mtoe (683.3 PJ) in 2005 to 20.1 Mtoe (842.2 PJ) in 2011 and 22.1 Mtoe (924 PJ) in 2012. The renewable energy consumption in France is expected to further increase to 37.1 Mtoe (1555 PJ) until 2020 (Figure 10-1).

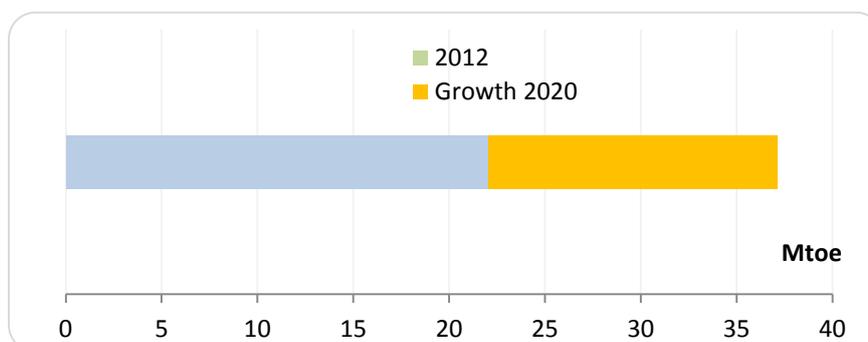


Figure 10-1 RES total in France in 2012 and the expected growth to 2020 target

Renewable energy consumed in transport sector made the most significant progress from year 2005. It experienced a very fast increase up to 2011 with 74.6% per annum in average (+2.45 Mtoe) but the increase in 2012 took place with was only 2.35% (+70 ktoe). Nevertheless this development was slower than what was planned in the NREAP missing the respective uses in both 2011 and 2012: 0.4% (-11 ktoe) under in 2011 and 2% (-61 ktoe) under in 2012.

Renewable energy consumption in France was lower than expected developments in both 2011 and 2012 respectively by -10.6% (-2.4 Mtoe) and by -6.5% (-1.5 Mtoe).

The development of renewable energy in heating/cooling sector was faster in period 2011-12 with 15.6% (+1.6 Mtoe) compared with the development during 2005-2011 period +1.4% per annum in average or +0.8 Mtoe). Nevertheless the development of renewable energy in this sector was slower than the one projected at the NREAP missing the respective expected levels in both 2011 and 2012: 12.8% (-1.5 Mtoe) less in 2011 and 3.8% (-0.46 Mtoe) less in 2012.

A faster development in electricity sector happened during period 2011-12 with 4.25% (+296 ktoe) compared with the increase of +1.1% per annum in average (+437 ktoe) during period 2005-2011. This development was not fast enough to met the respective NREAP levels in both 2011 and 2012: 11.3% (-886.7 ktoe) less in 2011 and 12.3% (-1013.7 ktoe) less in 2012.

The major increase up to 2020 in renewable energy consumption in France is expected to take place in heating/cooling sector (+7969 ktoe) followed by electricity sector (6099.5 ktoe) and transport sector (+1011 ktoe).

¹⁸ Estimated data for year 2012

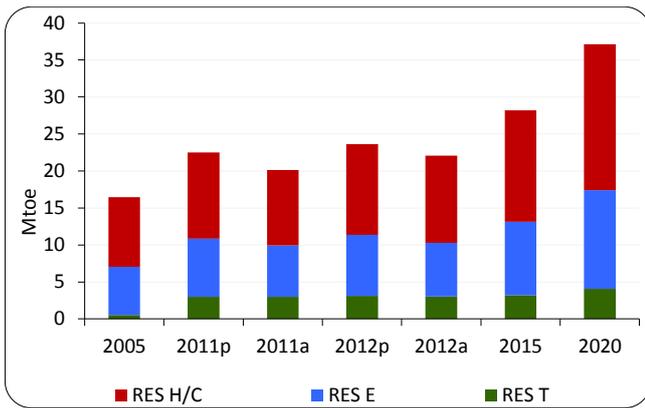


Figure 10-2. RES deployment in France: projected growth and actual progress until 2020.

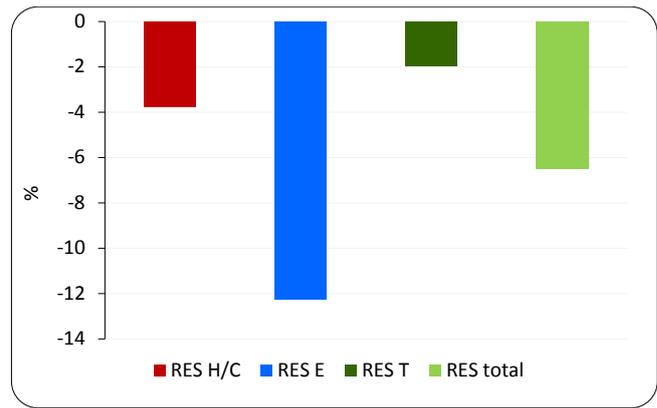


Figure 10-3. Deviation from NREAP in the RES consumption in France in 2012.

10.2 Sources of renewable energy

Biomass was the main renewable energy source in France with a 49% contribution in renewable energy mix consumption in 2012, followed by hydropower with 23%, biofuels with 13%, heat pumps with 6%, wind with 6%, solar with 2%, geothermal with 0.4% and marine energy with 0.2%.

Biofuels had the highest additional use between 2005 and 2011 with +2382 ktoe (+98.5% per annum in average) reaching 2785 ktoe (116.6 PJ). The use of biofuels in transport sector in France increased then further in 2012 with only 2.0% (+57 ktoe). Nevertheless these uses didn't meet the expected NREAP uses missing them in both 2011 and 2012: 0.5% (-15 ktoe) less in 2011 and 2% (-58 ktoe) less in 2012.

Biomass use in electricity and heating/cooling sectors in France remained almost unchanged between 2005 and 2011, ~9.5 Mtoe, while an increase with 13.8% (+1308.8 ktoe) took place later during 2011-12 period. This development was not fast enough to meet the expected NREAP uses in both years: 11.8% (-1272 ktoe) less in 2011 and 2.7% (-300 ktoe) less in 2012.

Two-third of additional renewable energy produced in France between 2011 and 2012 was provided by biomass

Geothermal technology use for energy decreased during period 2005 - 2011 with 5.4% per annum in average (-44.4 ktoe) reaching 93.8 ktoe (3.9 PJ) in 2011. Even that an increase with 4.9% (+4.6 ktoe) took place between 2011 and 2012 this technology missed in both 2011 and 2012 the respective expected NREAP levels: 51% (-97.1 ktoe) less in 2011 and 54% (-115.4 ktoe) less in 2012.

Renewable energy from solar technology in electricity and heating/cooling sectors developed with an average growth rate of 118.6% (+284 ktoe) between 2005 and 2011 reaching 323.8 ktoe (13.6 PJ). The use of this technology increased further during period 2011-12 with 59.2% (+191.5 ktoe) reaching 515.3 ktoe (21.6 PJ) in 2012. This development was found faster than what was planned in the NREAP exceeding the respective expected levels in both 2011 and 2012: 36.9% (+87.3 ktoe) more in 2011 and 71.1% (+214.2 ktoe) more in 2012.

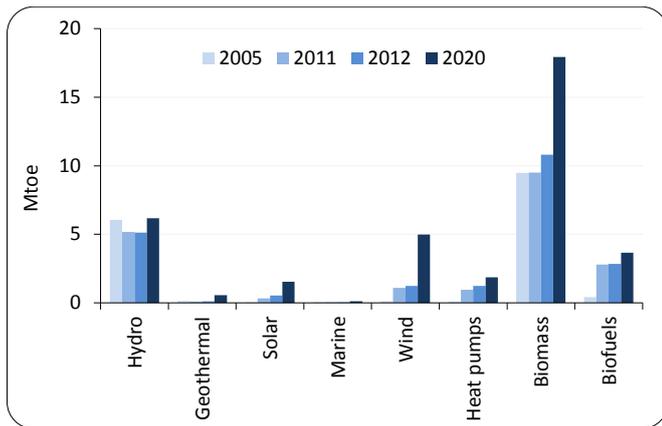


Figure 10-4. Contribution of renewable energy sources in France: actual and projected in 2020

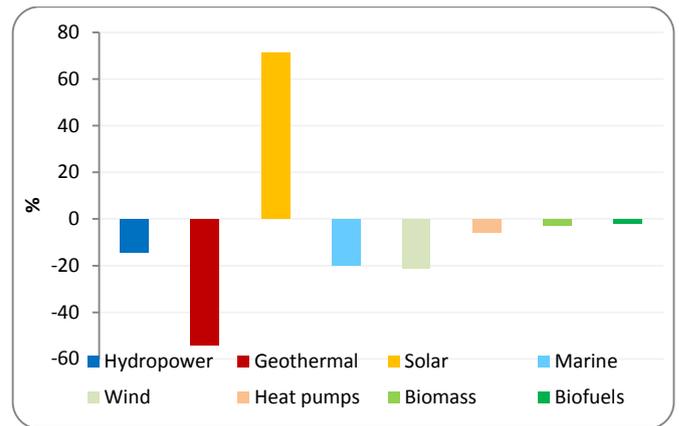


Figure 10-5. Deviation from NREAP in the contribution of renewable sources in France in 2012

In 2020, the share of biomass in renewable energy mix in France is expected to remain at 49%, followed by hydro with 17%, wind with 14%, biofuels with 10%, heat pumps with 5%, solar with 4%, geothermal with 1%, and marine energy with 0.3%.

10.3 Renewable energy share

The overall renewable energy contribution in Gross Final Energy Consumption in France reached 1.7% in 2011 and 13.7% in 2012. Comparing with the expected shares for 2011 and 2012 the overall share of RES was under by 0.8% points in year 2011 and 0.3% points in 2012. The 2020 target that France has to reach for the overall RES share is 23%.

In 2011, the overall RES share in France was lower than the 2011 NREAP planned RES share as well as the indicative trajectory for 2011/2012. In 2012 the French overall RES share exceeded the indicative trajectory for 2011/2012 but remained below the NREAP planned value. Although RES share remains well above the minimum trajectory, based on reported overall RES shares in 2011 and 2012 France seems needing a faster RES deployment in order to achieve the overall 2020 RES share target

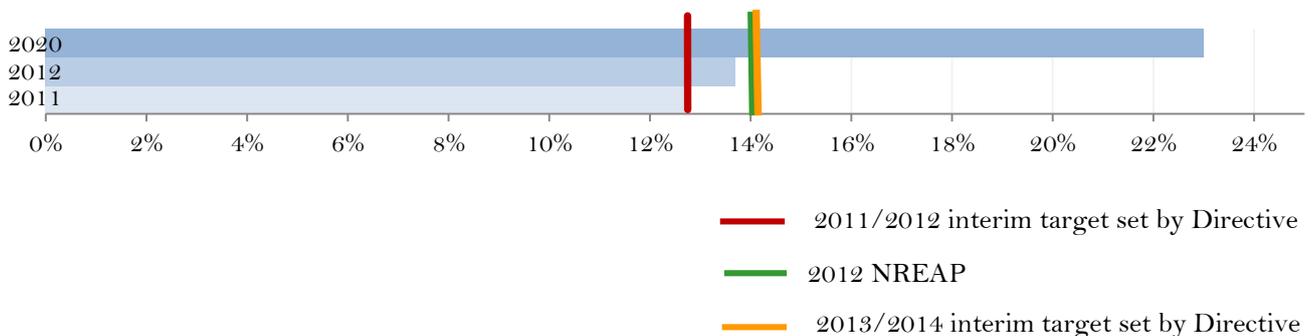


Figure 10-6. Overall RES share in France, 2011-12

The share of renewable energy in transport sector increased by +6.5% points in 2011 compared with 2005 but in 2012 this share decreased by 0.3% points compared with 2011. Nevertheless the share of RES in this sector was found to be over the expected shares in both years: +1.1% points in 2011 and +0.4% points in 2012.

The increase of RES share in heating/cooling sector from 2005 was with +2.2% points in 2011 and it increased further with +1.4% points in 2012. Nevertheless the share of renewable energy in this sector was under the planned shares in both years, respectively by 2.2% points and 1.8% points.

In electricity sector the share of renewable energy increased with +2.9% points in 2011 but only with +0.3% points more in 2012. Renewable energy share in this sector was found to be over the NREAP planned share in 2011, by +0.4% points whereas in 2012 it was 0.3% points under the planned share.

Major increase from year 2012 is expected to be achieved until 2020, according to the NREAP, in heating/cooling (from 17.2% to 33%), followed by electricity sector (from 16.7% to 27%) and transport (from 7.4% to 10.2%).

10.4 Renewable electricity

10.4.1 Installed capacity

The renewable energy installed capacity in France increased from 22.8 GW in 2005 to 29.6 GW in 2011 and 31.7 GW in 2012. Nevertheless these capacities are 3.3% and 3.1% under the respective NREAP planned capacities for these years.

In 2012 the hydropower presented 59% of renewable energy installed capacity in France followed by wind with 24%, solar with 13%, biomass 3% and marine 1%.

Solar photovoltaic had the fastest development in relative terms between 2005 and 2011 increasing with 1945% per annum in average reaching 2942 MW in 2011. The solar photovoltaic installed capacity continues growing further between 2011 and 2012 with 37.9% (+1114 MW). This development was faster than the one projected in the NREAP exceeding in both 2011 and 2012 the respective expected capacities: 278% (+2164 MW) more in 2011 and 268.7% (+2956 MW).

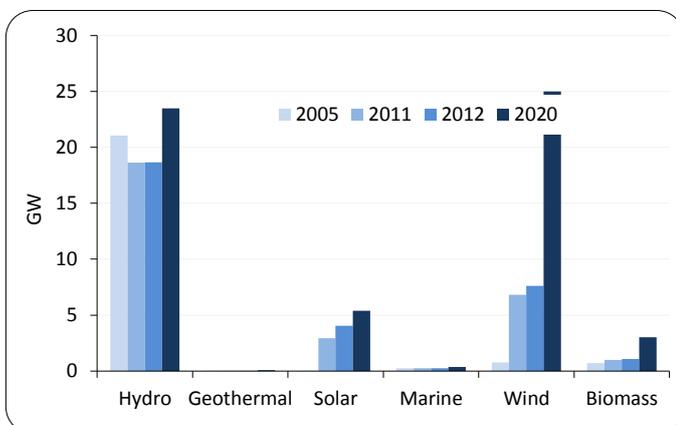


Figure 11-7. RES capacity deployment and progress until 2020 in France.

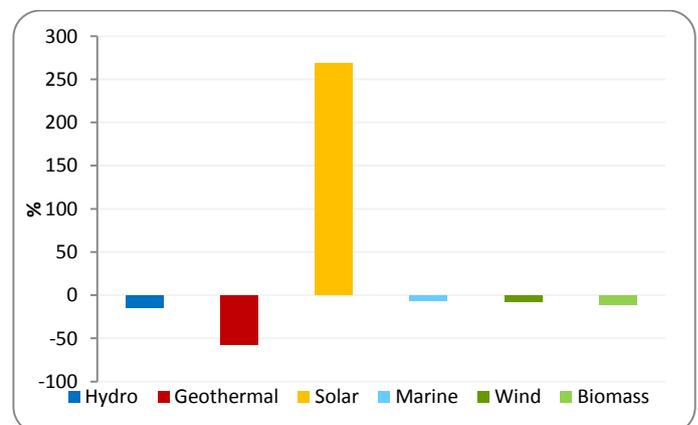


Figure 11-8. Deviation from NREAP in the RES installed capacity in France in 2012.

Wind technology had the highest additional capacity between 2005 and 2011, +6056 MW (134.2% per annum in average), reaching 6808 MW in 2011. This technology increased further the installed capacity between 2011 and 2012 with 12% (+815 MW). Nevertheless this development was not fast enough to met the expected NREAP capacities in both 2011 and 2012: 0.3% (-22 MW) less in 2011 and 7.8% (-642 MW) less in 2012.

93.5% of the additional renewable electricity capacity in France during 2011-2012 came from solar (54%) and wind

Biomass installed capacity increase from baseline year level of 707 MW with only +286 MW (6.7% per annum in average) in 2011 and +97 MW (+9.8%) more in 2012. Despite of these increases the achieved capacities were found to be under the respective NREAP ones in both 2011 and 2012: 12.8% (-146 MW) under in 2011 and 11.2% (-137 MW) under in 2012.

Hydropower capacity decreased between 2005 and 2011 with nearly 2% per annum in average (-2414 MW) increasing then slightly in 2012 with only 0.2% (+37 MW). Due to this downward trend this technology was found to be under the respective NREAP capacities in both 2011 and 2012: 13.9% (-2996 MW) under in 2011 and 14.5% (-3166 MW) under in 2012.

No changes happened in marine technology installed capacity during period 2005-2012 reaching the NREAP planned capacity for year 2011 but missing it in year 2012 being under with 6.3% (-16 MW) .

In 2020 wind power is expected to have the main contribution in renewable installed capacities with 44% followed by hydropower with 41%, solar with 9%, biomass with 5% and marine with 1%.

10.4.2 Consumption

Renewable electricity consumption in France amounted to 80.9 TWh (291.3 PJ) in 2011 and 84.4 TWh (303.7 PJ) in 2012 from 75.8 TWh (273 PJ) in 2005. Nevertheless the renewable electricity consumption in France didn't reach the NREAP planned values missing the respective values by 11.3% (-10.3 TWh) in 2011 and 12.3% (11.8 TWh) in 2012. In 2020 the renewable electricity consumption in France is expected to amount to 155.3 TWh (559 PJ).

In 2012 hydropower technology provided 70.5% of total renewable electricity consumption in France. The rest of renewable electricity consumption was coming from wind (16.8%), biomass (6.8%), solar photovoltaic (5.3%), marine (0.5%) and geothermal (0.1%).

Hydropower was the only renewable source that had a negative additional renewable electricity during period 2005-2011 with 14.6% (-10252 GWh) from 70239 GWh (253 PJ) in the baseline year. This trend continued even during 2011-12 with a rate of 0.8% (-477 GWh). Due to this decreases the renewable electricity from this source remained under the expected NREAP plans in both 2011 and 2012: 13.4% (-9304 GWh) under in 2011 and 14.4% (-10049 GWh) under in 2012.

More than 50% of additional renewable electricity between 2005 and 2012 was provided solar photovoltaic

Renewable electricity consumption originated from solar photovoltaic technology increased very fast between 2005 and 2011 with 1770% per annum in average (+2336 GWh) from 22

GWh in the baseline year. This type of renewable electricity increased further in 2011 with 88.5% (+2088 GWh). This development was faster than what was projected in the France NREAP exceeding the respective expected consumptions in both 2011 and 2012: 149% (+1411 GWh) over in 2011 and 229.3% (+3096 GWh) over in 2012.

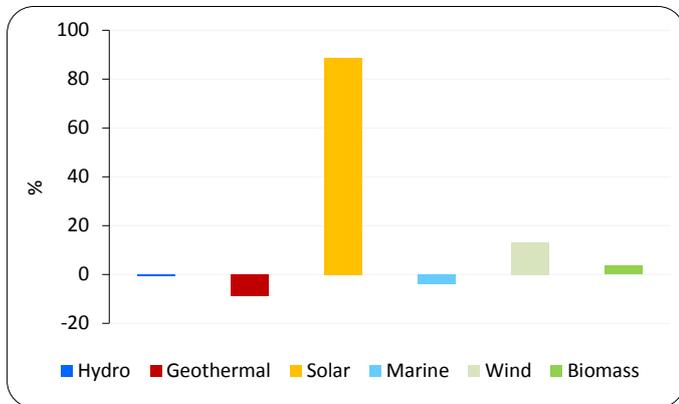


Figure 10-9. Relative increase/decrease of RES electricity sources in France, 2011-12

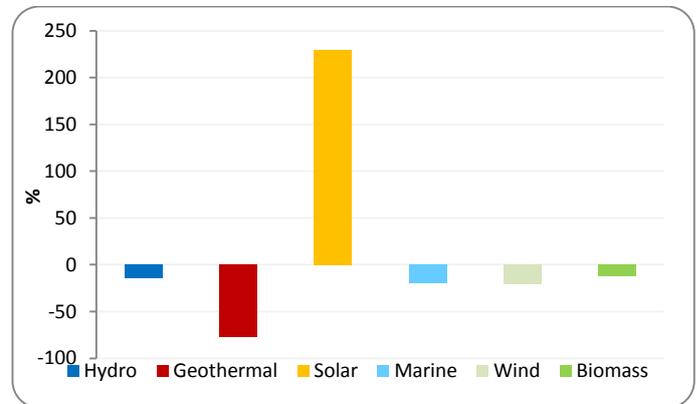


Figure 10-10. Deviation from NREAP in the RES electricity consumption in France in 2012.

Wind technology developed fast between 2005 and 2011 increasing with 168.5% per annum in average reaching 12.5 TWh (45.1 PJ) in 2011. The development of this technology continued further during 2011-12 with a growth rate of 13.2% (+1655 GWh). Nevertheless the development of wind technology in France didn't reach the expected NREAP levels in both 2011 and 2012: 12.6% (-1813 GWh) under in 2011 and 21% (-3770 GWh) under in 2012.

Biomass use for electricity reached 5513 GWh (19.8 PJ) in 2011 increasing with 44.4% from the baseline year level. Renewable electricity from this source increased further in 2012 with 3.5% (+195 GWh). Nevertheless in comparison with expected renewable electricity the current development was found to be under the NREAP levels in both 2011 and 2012: 7.6% (+453 GWh) under in 2011 and 12.1% (+783 GWh) under in 2012.

Renewable electricity from geothermal decreased with 7% per annum in average (-39 GWh) between 2005 and 2011 reaching only 56 GWh (0.2 PJ) in 2011. The decrease of renewable electricity from this source continued further in 2012 with 8.9% (-5 GWh) missing in this way the expected NREAP plans in both 2011 and 2012: 69.7% (-129 GWh) less in 2011 and 76.6% (-167 GWh) less in 2012.

Marine technology used in electricity sector was found to have a negative additional renewable electricity during period 2005-2011 with 10.8% (-58 GWh) from 535 GWh (1.9 PJ) in the baseline year. The decrease continued further in 2012 with 4% (-19 GWh) missing both 2011 and 2012 expected NREAP plans: 4.6% (-23 GWh) less in 2011 and 19.9% (-114 GWh) less in 2012.

In 2020 hydropower is expected to remain still the main contributor in renewable energy mix in France even that its share will be decreased to 46.2%. Wind power is expected to follow with 37.3% together with biomass (11.1%), solar photovoltaic (4.4%), marine (0.7%) and geothermal (0.3%).

10.5 Renewable energy in heating & cooling

The use of renewable energy in heating and cooling in France increased by only +775 ktoe (+8.2%) during 2005-2011 reaching 10172 ktoe (426 PJ) and the additional heat in period 2011-12 was +1591 ktoe (+15.6%). Nevertheless the renewable energy consumed in this sector was under the NREAP plans with 12.8% (-1498 ktoe) in 2011 and 3.8% (-459 ktoe) in 2012. The renewable heat consumption in France is expected to reach 15040 ktoe (826 PJ) in 2020.

In 2020 almost 88% of renewable heat consumption was coming from biomass use and the rest was shared between heat pumps (10.4%), solar thermal (1.1%) and geothermal (0.8%).

Heat pumps technology had the fastest development in relative terms between 2005 and 2011 with 190.6% per annum in average (+869 ktoe) reaching 945 ktoe (39.6 PJ). The increase during period 2011-12 took place with 29.8% (+282 ktoe). Despite of this increase this technology was found to be under the respective NREAP level in both 2011 and 2012: 13.3% (-145 ktoe) under in 2011 and 5.6% (-73 ktoe) under in 2012.

France provided more than 40% of 2011-12 additional renewable energy in EU-28 originated from heat pumps

Solar thermal increased also fast between 2005 and 2011 with 36.4% per annum in average (+83 ktoe) reaching 121 ktoe (5.7 PJ) in 2011. During period 2011-12 the use of this source increased further with 9.9% (+12 ktoe). Despite of this the development of this source was slower than what was projected in the NREAP missing the respective uses in both 2011 and 2012: 21.9% (-34 ktoe) less in 2011 and 28.1% (-52 ktoe) less in 2012.

Biomass use for heat consumption in France decreased between 2005 and 2011 with 1.5% (-136 ktoe) reaching 9017 ktoe (377.5 PJ) in 2011. The use of this source increased during period 2011-12 with 14.3% (+1292 ktoe). Despite of this increase the use of biomass in heating/cooling sector missed in both 2011 and 2012 the projected NREAP uses: 12% (-1233 ktoe) less in 2011 and 2.2% (-233 ktoe) less in 2012.

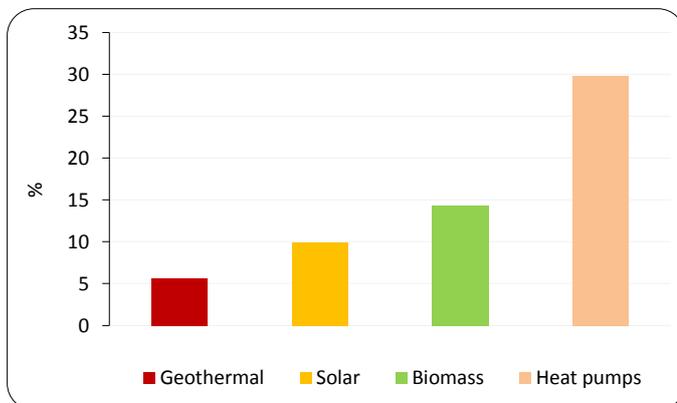


Figure 10-11. Relative increase/decrease of RES heating/cooling sources in France, 2011-12.

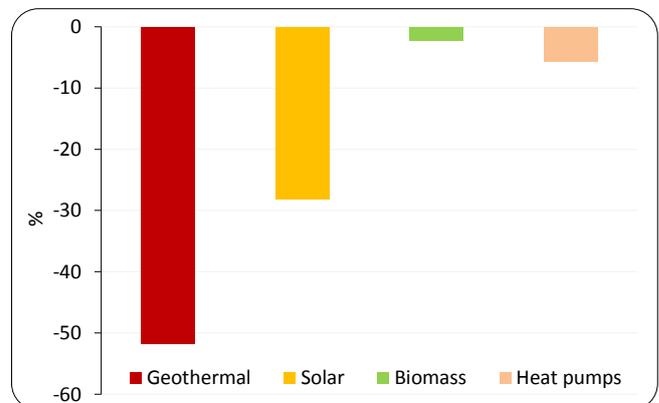


Figure 10-12. Deviation from NREAP in the RES heat consumption in France in 2012.

Geothermal use for heat consumption also decreased between 2005 and 2011 with 5.2% per annum in average (-41 ktoe) from 130 ktoe (5.4 PJ) in the baseline year. Despite an increase took place up to 2012 the use of this source was found to be under the projected NREAP levels in both 2011 and 2012: 49.1% (-86 ktoe) under in 2011 and 51.8% (-101 ktoe) under in 2012.

In 2020 the contribution of biomass is expected to decrease slightly up to 84.8% while heat pumps contribution will remain at 10.4%. Solar and geothermal are expected to increase their contributions reaspectively to 3.1% and 2.1%.

10.6 Renewable energy in transport

The use of renewable energy in transport reached 2981 ktoe (124.8 PJ) in 2011 and 3051 ktoe (127.7 PJ) in 2012 being nevertheless 0.4% and 2.0% under the respective NREAP projected values of 2992 (125.3 PJ) and 3112 ktoe (130.3 PJ). The use of renewable energy in transport sector in 2020 is expected to be 4062 ktoe (170 PJ).

In 2012 79.4% of renewable energy consumed in this sector was in the form of biodiesel and the rest was bioethanol/bio-ETBE (13.7%) and renewable electricity (6.9%).

Biodiesel made the main progress in transport sector during 2005-2011 increasing with 105% per annum in average (+2065 ktoe) from 328 ktoe (13.7 PJ) in the baseline year. This trend continued even during 2011-12 with a groeth rate of 1.3% (+31 ktoe). This development was faster than the one projected at the NREAP exceeding the expected uses in both 2011 and 2012:6.4% (+143 ktoe) over in 2011 and 3.1% (+74 ktoe⁹ over in 2012.

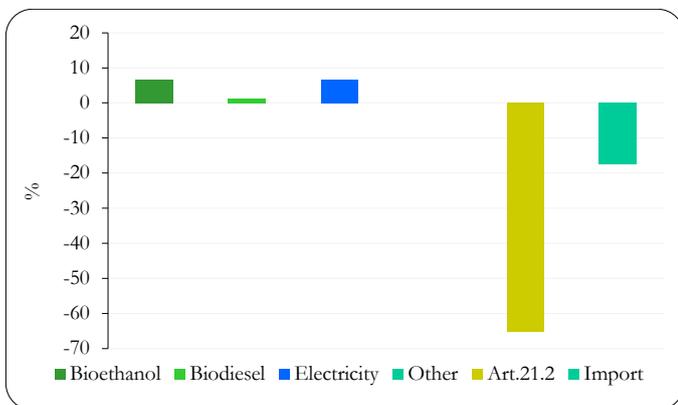


Figure 10-13. Relative increase/decrease of RES transport uses in France, 2011-12.

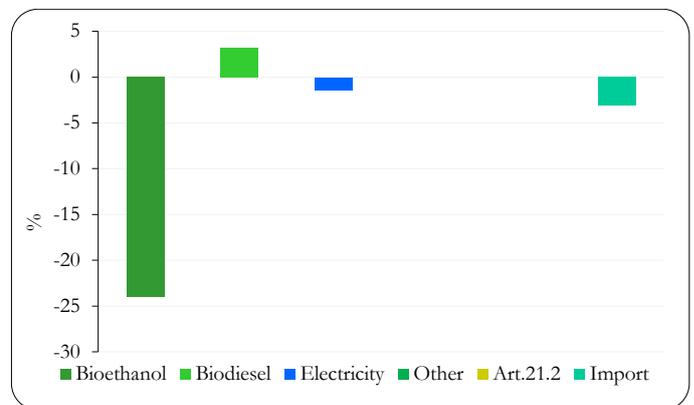


Figure 10-14. Deviation from NREAP in the RES use in transport in France in 2012.

Bioethanol/bio-ETBE increased also fast during period 2005-2011 with an average growth rate of 70.4% (+317 ktoe) from 75 ktoe (3.1 PJ) in the baseline year. The increasing trend of bioethanol use in the transport sector continued further during 2011-12 period with 6.6% (+26 ktoe). Nevertheless this development resulted slower than the one projected in the NERAP missing the respective expected uses in both 2011 and 2012: 28.7% (-158 ktoe) less in 2011 and 24% (-132 ktoe) less in 2012.

While no contribution was expected in both years for the use of biofuels from wastes, residues, ligno-cellulosic material between 2005 and 2012, their use grew since 2011 to 358 ktoe (15 PJ) but decreased then in 2012 with 65%. No other biofuels (biogas and vegetable oils) were used in France in 2011 and 2012.

Imported biofuels increased their use to 528 ktoe (22.1 PJ) in 2011 over 13 ktoe (0.5 PJ) in the baseline year. Nevertheless a decrease with 17.4% (-92 ktoe) took place in 2012. Due to this changeable trend the use of imported biofuels was found to be over the expected NREAP use in 2011 with 17.3% (+78 ktoe) but missed it in 2012 with 3.1% (-14 ktoe).

The use of renewable electricity in transport increased with an average growth rate of 6.5% (+55 ktoe) reaching 196 ktoe (8.2 PJ) in 2011 over the 2005 level. It increased furthermore during period 2011-12 with 6.6% (+13 ktoe). Despite this increase the use of renewable electricity in this sector was found to be over the expected NREAP use only in year 2011 with 2.1% (+4.0 ktoe) but under in 2012 with 1.4% (-3.0 ktoe).

In 2020 biodiesel is expected to cover 70.2% of total renewable energy planned to be used in transport sector in France. Bioethanol/bio-ETBE use is expected to reach a contribution of 16% followed by renewable electricity with 9.9% and other biofuels with 3.9%.

11. Renewable energy in Italy

11.1 Deployment of renewable energy

The renewable energy consumed in Italy increased from 7.1 Mtoe (296.5 PJ) in 2005 to 14.9 Mtoe (623.1 PJ) in 2011 to 16.3 Mtoe (682.1 PJ) in 2012. In 2020 it is expected that the renewable energy consumption in Italy will reach 23 Mtoe (962.4 PJ) 2020 (including 1.1 Mtoe or 47.2 PJ from transfer from other MS and third countries through cooperation mechanism) (Figure 11-1).

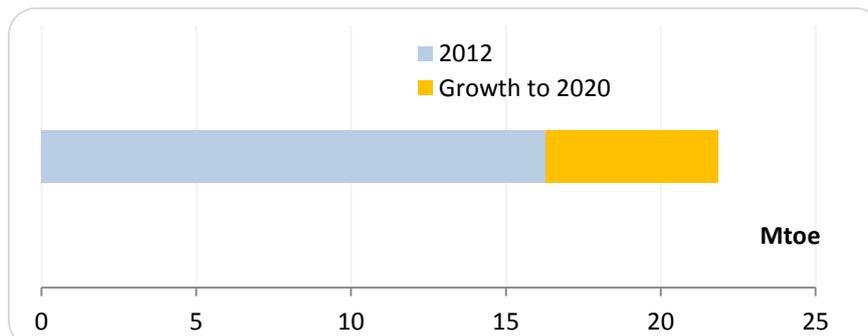


Figure 11-1 RES total in Italy in 2012 and the expected growth to 2020 target

Renewable energy in transport sector experienced the fastest progress with 55.4% per annum in average (+1233 ktoe) during period 2005-12 over the level of 318 ktoe (13.3 PJ) in the baseline year being respectively 15.3% (+209 ktoe) and 1.3% (+20 ktoe) over the plans for 2011-12 period.

The use of renewable in heating/cooling sector increased with an average growth rate of 40.8% (+5471 ktoe) between 2005 and 2012 over the level of 1917 ktoe (80.3 PJ) in 2005. Comparing with NREAP developments the use of renewable energy in this sector was found over the respective uses in both 2011 and 2012: 72% (+3022 ktoe) over in 2011 and 61.2% (+2805 ktoe) over in 2012.

Renewable electricity reached 7353 ktoe (307.9 PJ) increasing with 4.3% per annum in average (+2506.5 ktoe) over the baseline level of 4847 ktoe (203 PJ). This development was enough to surpass both 2011 and 2012 expected NREAP plans: 0.9% (+53.2 ktoe) more in 2011 and 17.1% (+1074.6 ktoe) more in 2012.

In 2011 and 2012 renewable energy consumed in Italy has exceeded by 28.3% (+3.3 Mtoe) and 31.5% (3.9 Mtoe) respectively the NREAP planned values.

Up to 2020 Italy is expected to speed up the use of renewable energy in transport sector with nearly 11% per annum in average. In heating/cooling sector the additional renewable energy for the 8 year coming period present almost one-third of 2020 plan of 10456 ktoe (437.8 PJ) with an average growth rate of 5.2%. Up to 2020 renewable electricity consumption in Italy is expected to increase with +15.7% (+13384 GWh /+1151 ktoe).

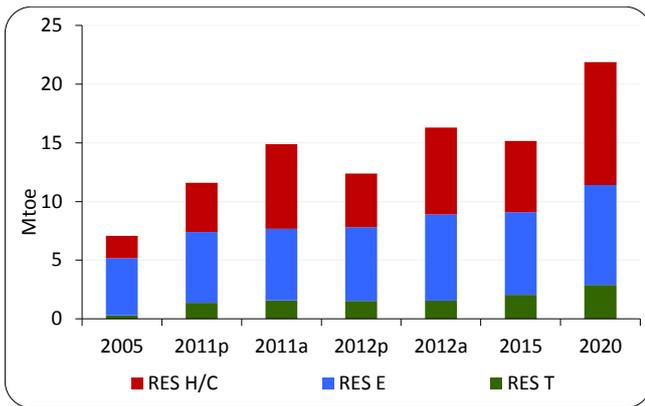


Figure 11-2. RES deployment in Italy: projected growth and actual progress until 2020.

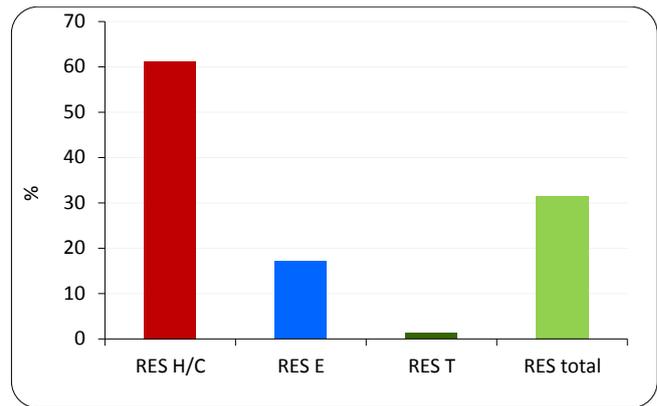


Figure 11-3. Deviation from NREAP in the RES consumption in Italy in 2012.

11.2 Sources of renewable energy

The use of biomass was the major contributor to RES use in 2012 with a 34.4% share, followed by hydropower with 19.4%, solar with 11%, heat pumps with 16.2%, biofuels with 8.5%, wind with 6.6% and geothermal with 3.8%.

Solar source developed with an average growth rate of 841.4% (+1747 ktoe) between 2005 and 2012 over the baseline level of 29.7 ktoe (1.2 PJ). The development was fast enough to surpass the NREAP plans in both 2011 and 2012: 146.1% (+634.2 ktoe) more in 2011 and 229% (+1236.7 ktoe) more in 2012.

Solar accounted for nearly half of additional renewable energy consumption in Italy between 2011 and 2012.

The use of biofuels in transport sector developed also fast during period 2005-2012 with 94.7% per annum in average (+1186 ktoe). Even than a decrease with 2.5% (-35 ktoe) took place between 2011 and 2012 the use of biofuels was found to exceed both NREAP plans: 19.6% (+229 ktoe) more in 2011 and 3.3% (+43 ktoe) more in 2012.

Biomass used in electricity and heating/cooling sectors had the highest additional energy consumption between 2005 and 2012, +3489.2 ktoe (+169.6%), over the baseline level of 2057 ktoe (86.1 PJ). Biomass exceedances from 2011 and 2012 NREAP plans were respectively 65% (+2133 ktoe) and 54.2% (+1949.7 ktoe).

Geothermal use for electricity and heat consumption decreased its absolute contribution with 8.4% (-56 ktoe) during period 2005-2012 reaching 614.8 ktoe (25.7 PJ). This downward trend putted this source under the NREAP plans in both 2011 and 2012: 13.9% (-100.7 ktoe) under in 2011 and 17.2% (-127.7 ktoe) under in 2012.

In 2020, biomass and geothermal are expected to keep almost the same shares as in 2012 respectively 33.9% and 4.1%. The share of hydropower is expected to reach 16.8%, heat pumps with 13.5%, biofuels with 11.8%, solar with 11.9% and wind with 8%.

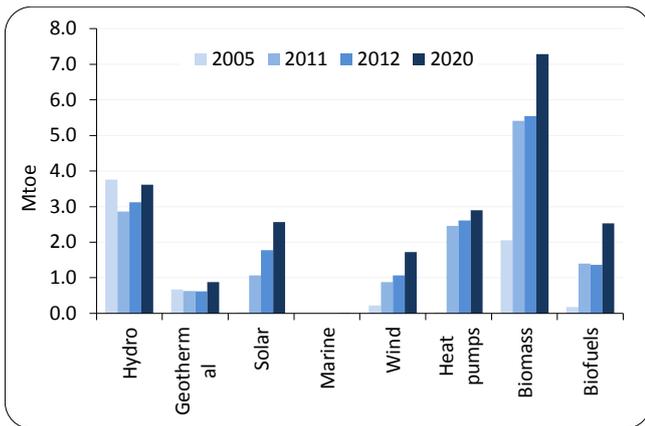


Figure 11-4. Contribution of renewable sources in Italy: projected growth and actual progress until 2020

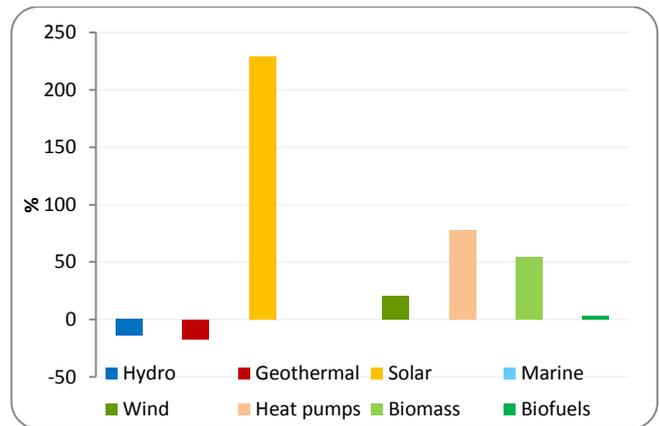


Figure 11-5. Deviation from NREAP in the contribution of renewable sources in Italy in 2012

11.3 Renewable energy share

The analysis of the Second Progress Report for Italy shows that the overall share of RES increased from 4.91% in 2005 to 12.27% in 2011 and 13.53% in 2012. The comparison with expected NREAP overall RES share showed that Italy was well over in both 2011 and 2012: 3.6% points over in 2011 and 4.3% points over in 2012. The 2002 overall RES share expected to be achieved in Italy is 17%.

.In 2012 the overall RES share in Italy exceeded both the 2012 NREAP target and the indicative minimum trajectories up to 2015/16. Based on reported overall RES shares in 2011 and 2012, Italy seems to be in a very good position for the achievement of 2020 RES share target.

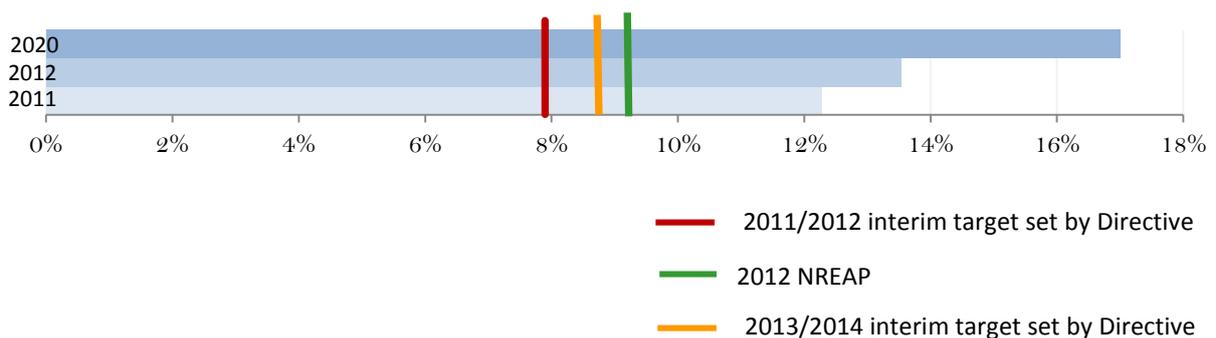


Figure 11-6. Overall RES share in Italy, 2011-12

The fastest development took place in renewable electricity share reaching 27.42% in 2012 which is 1.03% points over the 2020 planned share for this sector. The share of renewable electricity was over the NREAP planned shares by 4% points in 2011 and 7.22% points in 2012.

Renewable energy share in heating/cooling sector had the highest absolute increase between 2005 and 2012 with 10.01% points reaching 12.81%. Comparing with NREAP

shares for 2011 and 2012 this sector was found over respectively with 5.4% points and 5.1% points.

The share of renewable energy in transport sector reached 7.2% in 2012 being over the NREAP planned shares in both 2011 and 2012: 0.8% points over in 2011 and 2.4% points over in 2012.

Major increase from year 2012 expected to be achieved until 2020, will be in heating/cooling sector with 4.28% points followed by transport with 3% points.

11.4 Renewable electricity

11.4.1 Installed capacity

Renewable energy installed capacity in Italy increased from 18.8 GW in 2005 to 37.2 GW in 2011 and 43.1 GW in 2012. The exceedances from NREAP planned capacities were 26.2% (+7.7 GW) more in 2011 and 39.3% (+12.2 GW) more in 2012. In 2020 renewable energy installed capacity in Italy is expected to reach 43.8 GW.

In 2012 solar photovoltaic covered 38.1% of total renewable energy capacity followed by hydroppwer with 33.2%, wind with 18.8%, biomass with 8.2% and geothermal with 1.7%.

Solar photovoltaic had the fastest development between 2005 and 2012 increasing with 6885% per annum in average (+16.4 GW) over the baseline year level of 34 MW. The exceedances from NREAP planned capacities for 2011 and 2012 were respectively 263.8% (+9.3 GW) and 309% (+12.4 GW).

PV installed capacity in Italy in 2012 was 2 times higher than the 2020 planned capacity of 8.6 GW.

Wind power developed with an average growth rate of 56% during period 2005-2012 over the level of 1639 MW in the baseline year. Comparing with NREAP planned capacities the current development was faster surpassing both 2011 and 2012 levels: 7.8% (+498 MW) more in 2011 and 15.1% (+1062 MW) more in 2012.

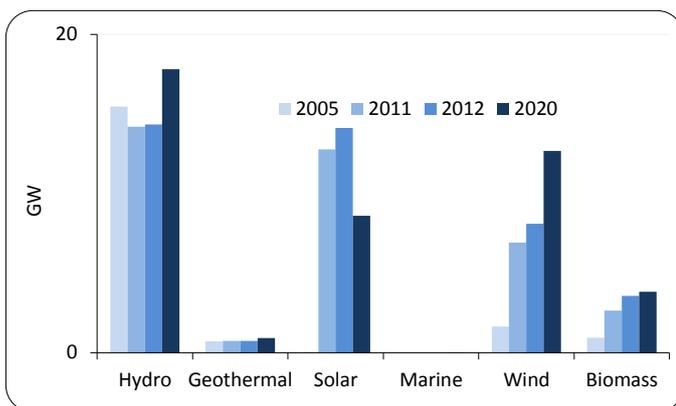


Figure 11-7. RES capacity deployment and progress until 2020 in Italy.

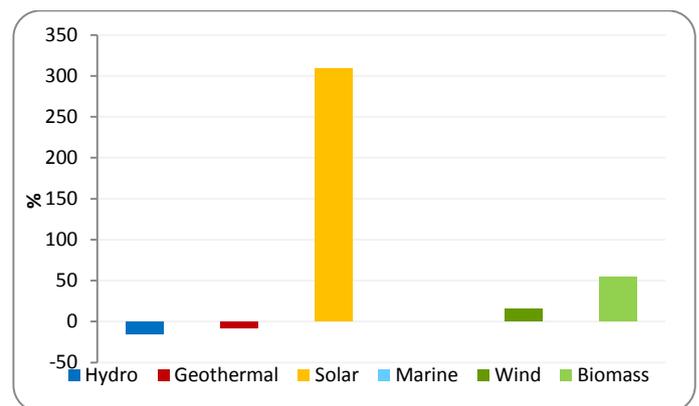


Figure 11-8. Deviation from NREAP in the RES installed capacity in Italy in 2012.

Biomass installed capacity increased from baseline year level of 937 MW with 40% per annum in average (+2618 MW) in 2012. This development was enough to surpass the

NREAP planned capacities in both 2011 and 2012: 24.8% (+523 MW) more in 2011 and 54.7% (+1257 MW) more in 2012.

Hydropower capacity decreased between 2005 and 2012 with nearly 1% per annum in average (-1140 MW). Due to this downward trend this source was found to be under the respective NREAP capacities in both 2011 and 2012: 15% (-2510 MW) under in 2011 and 14.8% (-2498 MW) under in 2012.

Geothermal capacity increased with only 2.4% (+2.4 MW) between 2005 and 2012 missing nevertheless both 2011 and 2012 NREAP planned capacities: 5.5% (-42 MW) under in 2011 and 7.5% (-59 MW) under in 2012.

In 2020 hydropower capacity is expected to increase its share up to 40.6% followed by wind with 28.9%, solar with 19.6%, biomass with 8.7% and geothermal with 2.1%.

11.4.2 Consumption

Renewable electricity developed with an average growth rate of 7.4% (+29.1 TWh) between 2005 and 2012 over the baseline level of 56.4 TWh (203 PJ). This development was fast enough to exceed the expected NREAP levels in both 2011 and 2012: 0.9% (+53.2 ktoe) more in 2011 and 17.1% (+1074.6 ktoe) more in 2012.

In 2012 hydropower provided 42.5% of total renewable electricity consumption in Italy and the rest was solar with 22.1%, wind with 14.5%, biomass with 14.4% and geothermal with 6.5%.

Solar photovoltaic experienced the fastest development during period 2005-2012 with an average growth rate of 8678% (+18.8 TWh) over the level of 31 GWh (0.1 PJ) in the baseline year. Renewable electricity from this source exceeded in 2012 the 2020 plan with 66.2% (+7512 GWh). The exceedances for 2011 and 2012 NREAP plans were: 224.5% (+7.5 TWh) more in 2011 and 365.8% (+14.9 TWh) more in 2012.

6% of gross final electricity consumption in Italy in year 2012 was covered by solar photovoltaic

Renewable electricity from wind increased with an average growth rate of 55% (+9.8 TWh) in 2012 over the baseline level of 2.6 TWh (9.2 PJ). Comparing with expected NREAP plans the current development of this source was found over in both 2011 and 2012: 9.7% (+908 GWh) over in 2011 and 20.2% (+2084 GWh) over in 2012.

Hydropower renewable electricity decreased with 2% per annum in average (-7.5 TWh) in 2012 compared with 43.8 TWh (157.6 PJ) in 2005 being 21% (-8.8 TWh) under in 2011 and 13.8% (-5809 GWh) under in 2012.

The increase of renewable electricity from biomass during period 2005-2012 took place with an average growth rate of 23% (+7.7 TWh) over the level of 4675 GWh (16.8 PJ). Comparing with NREAP plans this source exceeded both 2011 and 2012 plans respectively with 12.2% (+1.2 TWh) and 15.7% (+1.7 TWh).

Electricity from geothermal rose with only 5% (+267 GWh) between 2005 and 2012 reaching 5.6 TWh (20.1 PJ). The current development was found slower than the NREAP projected one in both 2011 and 2012: 1.6% (-90 GWh) less in 2011 and 4.5% (-264 GWh) less in 2012.

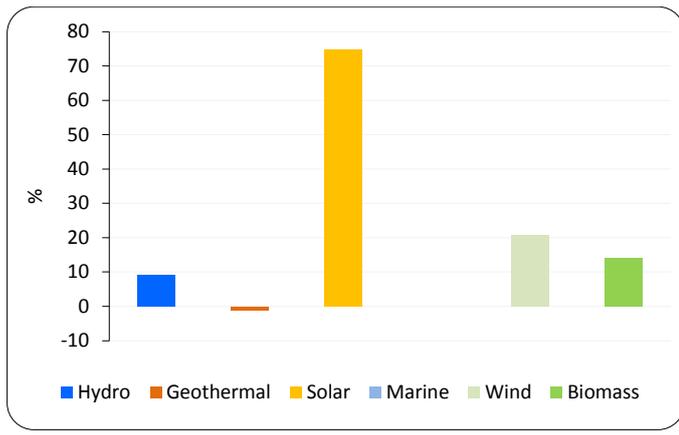


Figure 11-9. Relative increase/decrease of RES electricity sources in Italy, 2011-12

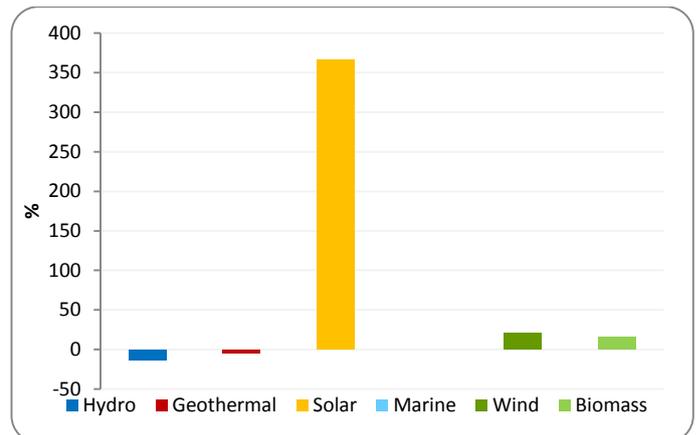


Figure 11-10. Deviation from NREAP in the RES electricity consumption in Italy in 2012.

The fast development of solar photovoltaic might change the picture of contribution of renewable energy sources in 2020. According to actual NREAP in 2020 the share of hydropower is expected to remain still 42.5% followed by wind with 20.2%, biomass with 19%, solar with 11.5% and geothermal with 6.8%.

11.5 Renewable energy in heating & cooling

Renewable energy in heating and cooling increased in Italy reaching 7217 ktoe (302.2 PJ) in 2011 and 7387 ktoe (309.3 PJ) in 2012 being respectively 72% (+3020 ktoe) and 61.2% (+2805 ktoe) over the NREAP projected values of 4197 ktoe (175.7 PJ) and 4582 ktoe (191.9 PJ).

In 2012 biomass share in total renewable heat consumption reached 60.7% and the rest was heat pumps (35.4%), solar (2.1%) and geothermal (1.8%).

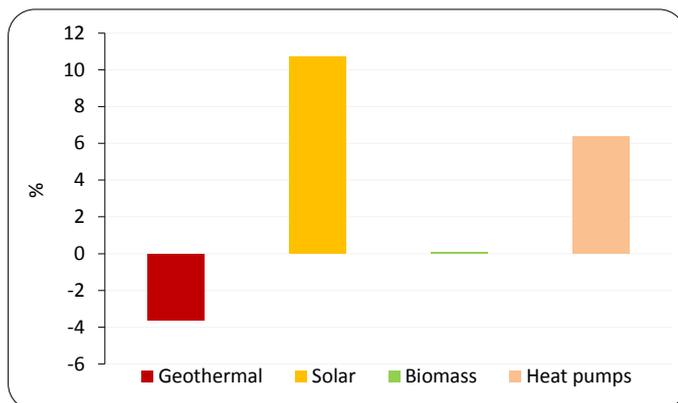


Figure 11-11. Relative increase/decrease of RES heating/cooling sources in Italy, 2011-12.

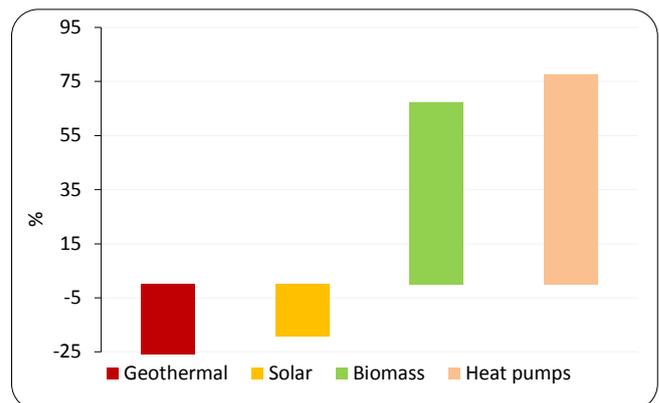


Figure 11-12. Deviation from NREAP in the RES heat consumption in Italy in 2012.

Heat pumps had the fastest increase with 1682% (+2591 ktoe) over the baseline level of 22 ktoe (0.9%). It exceeded both 2011 and 2012 NREAP planned consumptions respectively with 79.6% (+1089 ktoe) and 77.5% (+1141 ktoe).

Solar thermal almost 6 folded (+128 ktoe) in 2012 the baseline level of 27 ktoe (1.1 PJ) missing nevertheless the NREAP plans in both 2011 and 2012: 5.4% (-8 ktoe) less in 2011 and 19.3% (-37 ktoe) less in 2012.

Biomass heat consumption developed with an average growth rate of 24% (+2830 ktoe) between 2005 and 2012 over the baseline level of 1655 ktoe (69.3 PJ). This development surpassed the NREAP planned levels in both 2011 and 2012 respectively with 83% (+2032 ktoe) and 67.4% (+1806 ktoe).

14% of thw whole gross final heat consumption in 2012 in Italy was provided by biomass

Geothermal was the only source that decrease its heat consumption between 2005 and 2012 with 5% per annum in average (-79 ktoe) from the level of 213 ktoe (8.9 PJ) in 2005. Due to this negative trend this source was found under the 2011 and 2012 NREAP plane respectively with 40.1% (-93 ktoe) and 43.9% (-105 ktoe).

In 2020 biomass share is expected to decrease to 54.2% followed by heat pumps with 27.7%, solar thermal with 15.2% and geothermal with 2.9%.

11.6 Renewable energy in transport

Renewable energy in transport sector almost fivefold its use in 2012 from the level of 318 ktoe (13.3 PJ) in 2005. It exceeded both 2011 and 2012 NREAP plans respectively with 15.3% (+209 ktoe) and 1.3% (+20 ktoe).

In 2012 biodiesel covered 81.4% of total renewable energy consumed in this sector and the rest was coming from renewable electricity with 12% and bioethanol/bio-ETBE with 6.6%.

Biodiesel increased fast from 179 ktoe (7.5 PJ) in 2005 with 86% per annum in average (+1083 ktoe) in 2012. Comparing with NREAP plans this source was found over both 2011 and 2012 uses respectively with 32.7% (+317 ktoe) and 17.9% (+192 ktoe).

The use of bioethanol/bio-ETBE grew to 114 ktoe (4.8 PJ) in 2011 decreasing then with 9.6% (-11 ktoe) in 2012. This development was not fast enough to meet the NREAP plans in both 2011 and 2012: 40.9% (-79 ktoe) under in 2011 and 56.7% (-135 ktoe) under in 2012.

The of other biofuels (biogas and vegetable oils) have seen no use in transport sector during year 2011 and 2012 contrary with the planned contribution of 9 ktoe (0.4 PJ) in 2011 and 14 ktoe (0.6 PJ) in 2012.

The use of biofuels from wastes, residues, ligno-cellulosic material grew fast with 217.7% per annum in average during period 2005-2012 over the baseline level of 21 ktoe (0.9 PJ). This development was not enough to meet the 2011 NREAP plan missing it with 49.2% (-62 ktoe) but it was enough to exceed the 2012 plan with 117.2% (+184 ktoe).

The use of biofuels from import increased with 29.5% (+240 ktoe) between 2011 and 2012 reaching 1054 ktoe (44.1 PJ) in 2012 being over the NREAP plans in both 2011 and 2012:

349.7% (+633 ktoe) over in 2011 and 286.1% (+781 ktoe) over in 2012. The increase between 2011 and 2012 was so fast that it exceeded the 2020 plan for this category of biofuels with 5.4% (+54 ktoe).

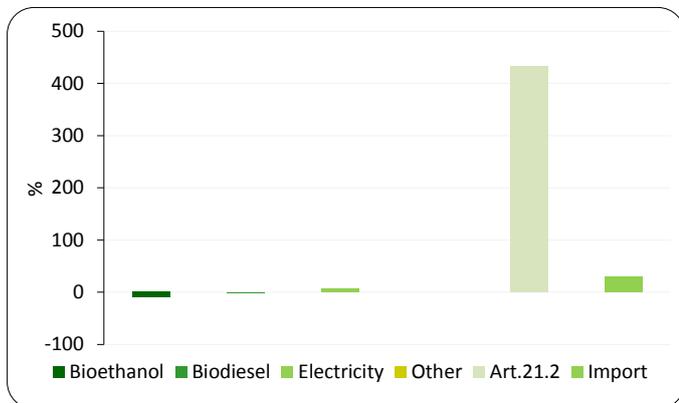


Figure 11-13. Relative increase/decrease of RES transport sources in France, 2011-12.

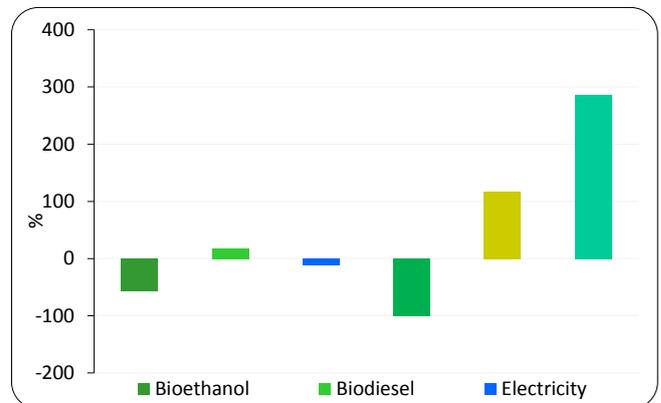


Figure 11-14. Deviation from NREAP in the RES use in transport in Italy in 2012.

The use of renewable electricity developed with an average growth rate of 4.8% (+47 ktoe) in 2012 over the level of 139 ktoe (5.8 PJ) in 2005. This development was found slower than the NREAP projected one missing both 2011 and 2012 levels: 10.3% (-20 ktoe) less in 2011 and 11% (-23 ktoe) less in 2012.

12. Renewable energy in Cyprus

12.1 Deployment of renewable energy

Renewable energy consumed in Cyprus increased from 45 ktoe (1.9 PJ) in 2005 to 114.8 ktoe (4.8 PJ) in 2011 and 120.6 ktoe (5.0 PJ) in 2012. Renewable energy consumption in Cyprus is expected to further increase to 263 ktoe (11 PJ) until 2020 (Figure 12-1).

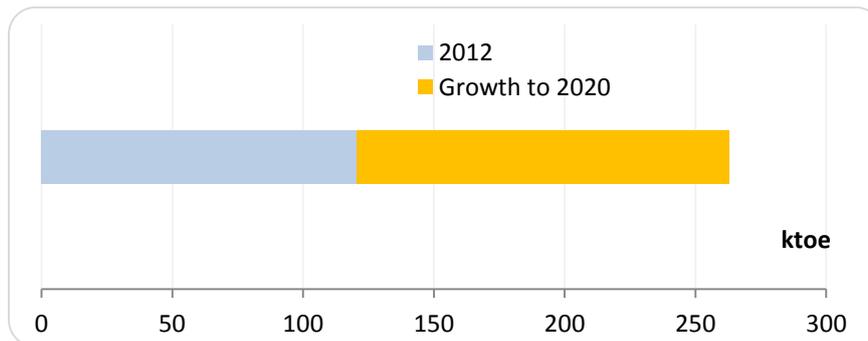


Figure 12-1. RES total in Cyprus in 2012 and the expected growth to 2020 target

Renewable energy consumed in heating/cooling sector was the only one to have been developed faster than planned during period 2005-2011 in Cyprus. It reached in 2011 the amount of 83.6 ktoe (3.5 PJ) being 2.8% (+2.3 ktoe) over the expected NREAP level for this year. Nevertheless a decrease by 2.5% (-2.1 ktoe) happened between 2011 and 2012 in renewable heat consumption reaching 81.5 ktoe (3.4 PJ) which was 5.0% (-4.3 ktoe) under the expected NREAP level of 85.8 ktoe.

Renewable electricity reached in 2011 only 15.2 ktoe or 70% of NREAP planned level for this year. An increase by 44.6% (+6.8 ktoe) happened in renewable electricity consumption between 2011 and 2012 and Cyprus already met the NREAP level for 2012: 0.7% (-0.1 ktoe) under the 2012 plan.

Renewable energy consumption in Cyprus was lower than the expected in both 2011 and 2012 respectively by 4.1% (- 4.9 ktoe) and 4.1% (-5.2 ktoe).

Renewable energy in transport sector reached in 2011 16.0 ktoe (0.7 PJ) but the additional use between 2011 and 2012 was only 1.0 ktoe. This development was not enough to meet the NREAP levels in both years: 5% (-0.8 ktoe) under in 2011 and 6.6% (-1.2 ktoe) under in 2012.

Renewable energy consumption in electricity sector is expected to have the fastest deployment up to 2020 with an average growth rate of nearly 45% (+919 GWh / +79 ktoe). The additional renewable heat expected to be consumed in 2020 present almost one-third of 2020 plan of 123.6 ktoe (5.2 PJ) for this sector. The development of renewable energy use in transport sector is expected to take place with an average growth rate of 15.7% (+21.4 ktoe).

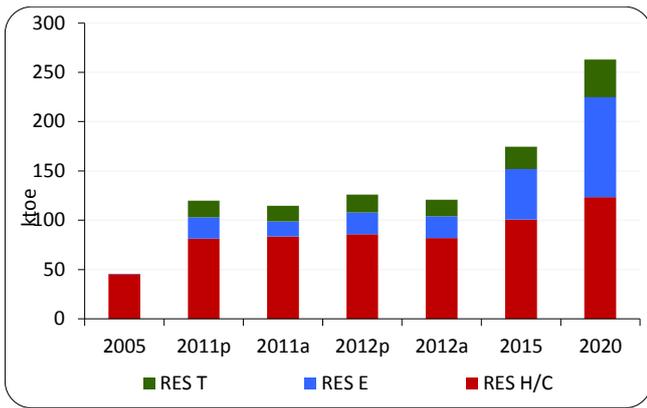


Figure 12-2. RES deployment in Cyprus: projected growth and actual progress until 2020.

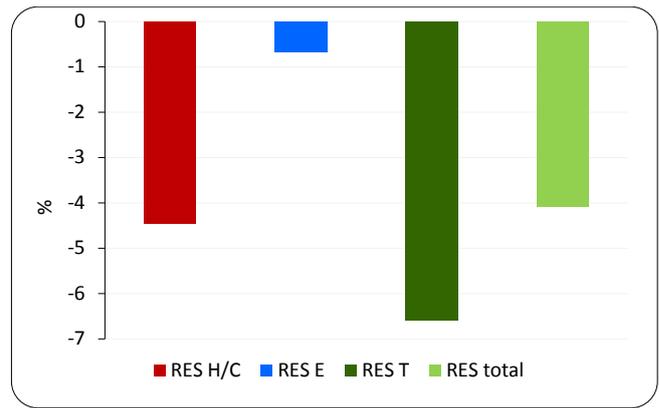


Figure 12-3. Deviation from NREAP in the RES consumption in Cyprus in 2012.

12.2 Sources of renewable energy

Solar technology was the main renewable energy source in Cyprus with a contribution of 55% in renewable energy consumed in 2012, followed by biomass with 16.9%, biofuels with 14.1%, wind with 13.2% and heat pumps with 0.9%.

Biomass experienced the fastest development between 2005 and 2012 with an average growth rate of 54.8% (+16.1 ktoe). Nevertheless due to the downward trend that took place during 2011-12 this source surpassed the expected NREAP plan in 2011 with 1.9% (+0.4 ktoe) but missed it in 2012 with 17.6% (-4.3 ktoe).

The development of solar during period 2005-2012 took place with an average growth rate of 8.7% (+25 ktoe) reaching 66.3 ktoe (2.8 PJ). This development was enough to surpass the expected NREAP plans in both years: 2.2% (+1.4 ktoe) over in 2011 and 0.2% (+0.1 ktoe) over in 2012.

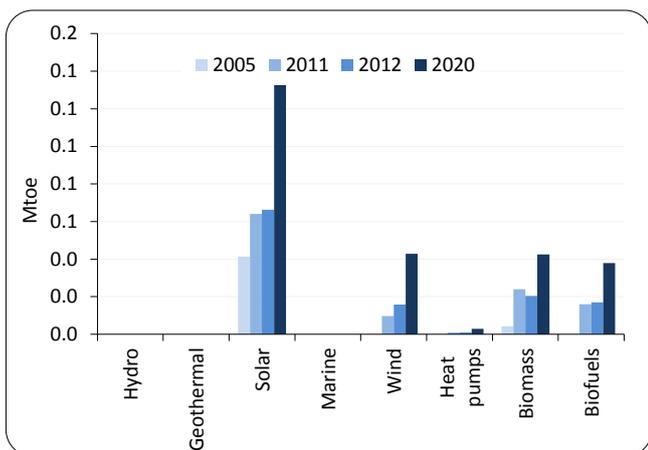


Figure 12-4. Contribution of renewable energy sources in Cyprus: actual and projected in 2020

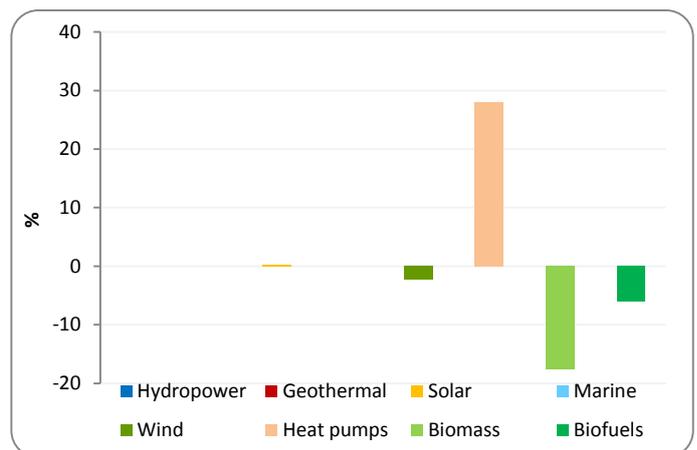


Figure 12-5. Deviation from NREAP in the contribution of renewable sources in Cyprus in 2012

Biofuels in transport sector reached 17 (0.7 PJ) ktoe in 2012 missing nevertheless the expected NREAP plans in both 2011 and 2012: 4.7% (-0.8 ktoe) less in 2011 and 6.1% (-1.1 ktoe) less in 2012.

In 2020, the share of solar in renewable energy mix in Cyprus is expected to decrease slightly to 52%, followed by wind and biomass with 16% each, biofuels 15% and heat pumps with only 1%.

12.3 Renewable energy share

The overall renewable energy contribution in Gross Final Energy Consumption in Cyprus reached 6.5% in 2011 and 7.7% in 2012. Comparing with the expected shares for 2011 and 2012 the overall share of RES was under by 0.3% points in year 2011 and 0.6% points over in 2012. The 2020 target that Cyprus has to reach for the overall RES share is 13%.

The overall RES share in Cyprus exceeded the indicative trajectories for both 2011/2012 and 2013/2014. As far as NREAP targets are concerned, Cyprus missed the 2011 NREAP share, while the 2012 NREAP target was achieved. Also considering that the overall target RES share is set in the NREAP well above the indicative trajectory defined in RED Directive, Cyprus seems to be in a good position for the achievement of 2020 RES share target

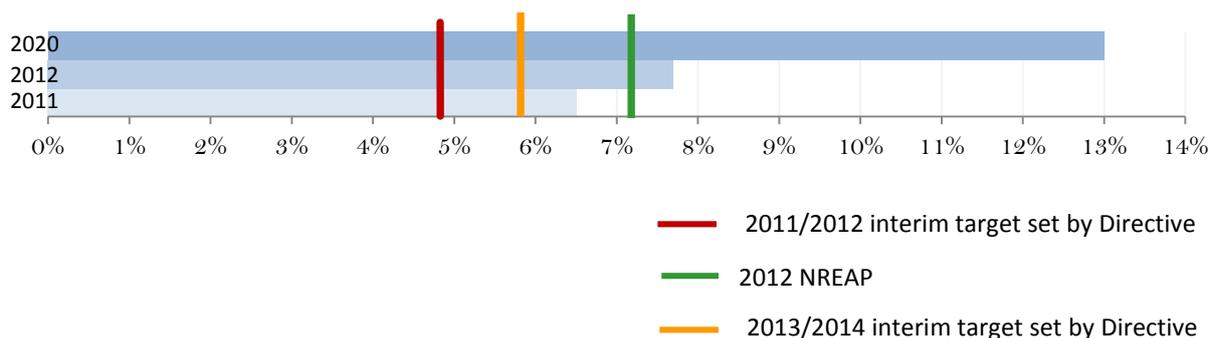


Figure 12-6. Overall RES share in Cyprus, 2011-12

The development of renewable energy share in heating/cooling sector in Cyprus was significant increasing by 12.4% points between 2005 and 2012. Comparing with expected NREAP shares Cyprus was over them in both years: 2.0% points (+11.8%) over in 2011 and 3.7% points (+20.8%) over in 2012.

Renewable energy share in electricity sector didn't develop very fast enough between 2005 and 2011 to meet the expected NREAP share for 2011, missing it by 0.5% points (-11.4%). Cyprus has planned not to change the renewable energy share in this sector during period 2011-12. Nevertheless the renewable electricity share increased to 5.9% exceeding by 1.5% points the planned NREAP share for this year.

The increase of renewable energy share in transport sector between 2005 and 2011 happened with 2.1% points increasing further in 2012 with only 0.3% points. Nevertheless the share of renewable energy in this sector remained lower than the expected shares in both years: 0.3% points (-11.9%) under in 2011 and 0.2% points (-7.3%) under in 2012.

Major increase from year 2012 is expected to be achieved until 2020, according to the NREAP, in heating/cooling (from 17.2% to 33%), followed by electricity sector (from 16.7% to 27%) and transport (from 7.4% to 10.2%).

12.4 Renewable electricity

12.4.1 Installed capacity

The renewable energy installed capacity in Cyprus reached 152.8 MW in 2011 increasing further to 173.9 MW in 2012 over 0.2 MW in 2005. The development of renewable energy installed capacity in Cyprus was faster than what was planned in the NREAP in both years: 19.4% (+24.8 MW) over in 2011 and 31.7% (+41.9 MW) over in 2012. In 2020 Cyprus expect to reach a capacity of 584 MW in renewable energy.

Wind technology was dominating the renewable energy capacity in Cyprus in year 2012 with 84% (146.7 MW). The second source of renewable energy capacity in Cyprus was solar with 10% (17.7 MW) of contribution. Biomass contribution in this year reached 6% with 9.5 MW.

In 2005 Cyprus report on 0.2 MW installed capacity on renewable energy which was totally solar photovoltaic. This technology had between 2005 and 2012 the fastest progress by a factor of 111 over the 2005 level. Comparing with expected NREAP levels in solar technology capacity Cyprus exceeded them in both years: 32.5% (+2.6 MW) over in 2011 and 47.5% (+5.7 MW) in 2012.

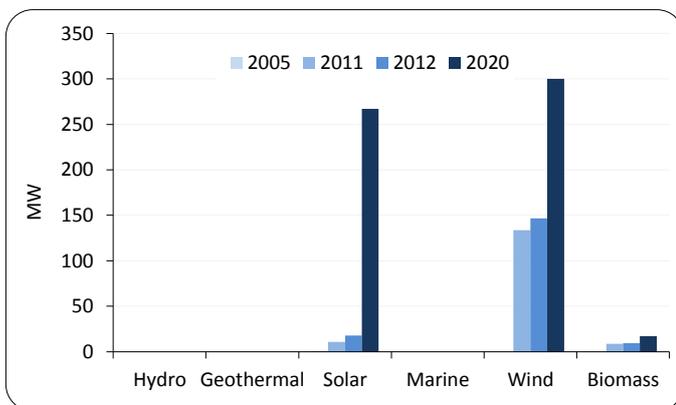


Figure 12-7. RES capacity deployment and progress until 2020 in Cyprus.

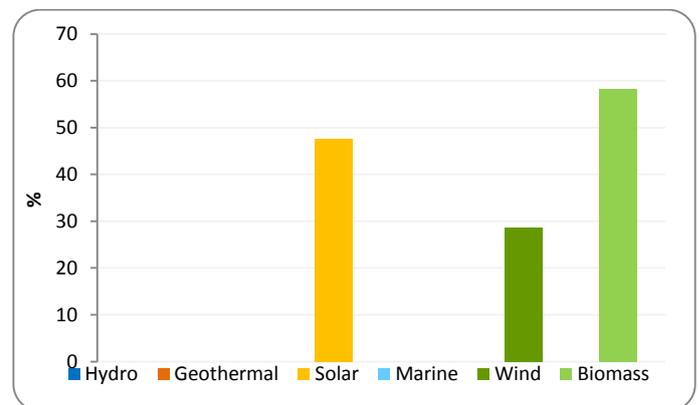


Figure 12-8. Deviation from NREAP in the RES installed capacity in Cyprus in 2012.

Wind capacity reached in 2011 133.5 MW increasing further by 9.9% (13.2 MW) in 2012. Comparing with the expected wind capacities Cyprus was over in both years: 17.1% (+19.5 MW) over in 2011 and 28.7% (+32.7 MW) in 2012.

Biomass installed capacity in Cyprus reached in 2012 the amount of 9.5 MW increasing by 9.2% (+0.8 MW) between 2011 and 2012. Both 2011 and 2012 biomass capacities were found to be over the expected capacities of NREAP: 45% (+2.7 MW) in 2011 and 58.3% (+3.5 MW) in 2012.

In 2012 the contribution of solar photovoltaic in total renewable energy capacity in Cyprus is expected to be increased significantly covering almost 46% of total renewable energy

capacity planned for this year. This technology is expected to have the highest absolute increase between 2012 and 2020 with 249.3 MW. Wind and biomass contributions are expected to be decreased respectively up to 51% and 3%.

12.4.2 Consumption

Renewable electricity consumption in Cyprus amounted to 177.3 GWh (0.6 PJ) in 2011 and 256.3 GWh (0.9 PJ) in 2012 from 0.07 GWh (0.25 GJ) in 2005. Nevertheless the renewable electricity consumption in Cyprus didn't reach the NREAP planned values missing the respective values by 29.7% (-74.7 GWh) in 2011 and 0.7% (-1.7 GWh) in 2012. In 2020 the renewable electricity consumption in Cyprus is expected to amount to 1175 GWh (4.2 PJ).

Wind technology was producing more than 72% of renewable electricity in Cyprus in year 2012 reaching the amount of 184.6 GWh (0.66 PJ). Nevertheless this development was not enough to meet the expected NREAP levels in both years: 39.8% (-75.2 GWh) under in 2011 and 2.3% (-4.4 GWh) under in 2012.

Wind power covered 4.2% of gross final electricity consumption in Cyprus in 2012.

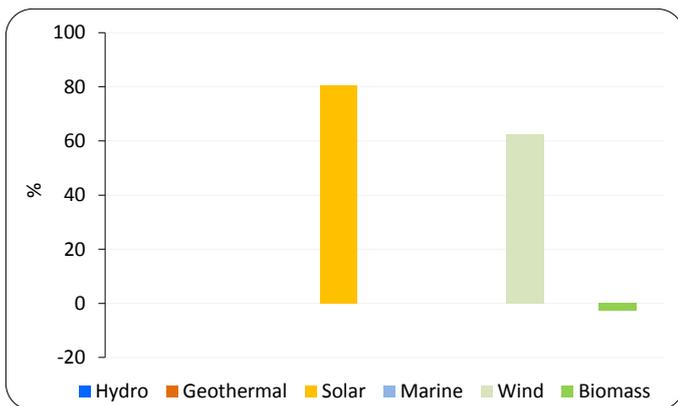


Figure 12-9. Relative increase/decrease of RES electricity sources in Cyprus, 2011-12

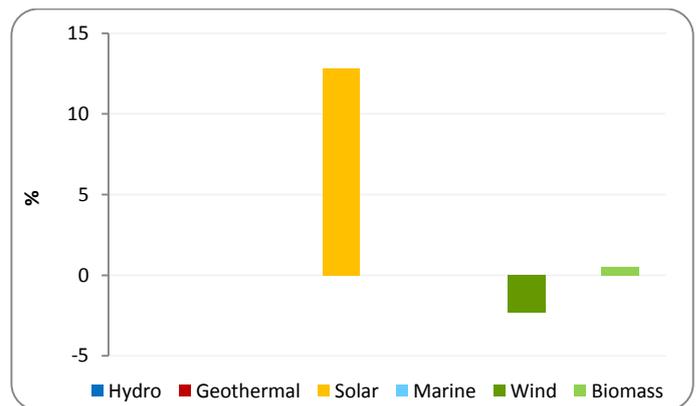


Figure 12-10. Deviation from NREAP in the RES electricity consumption in Cyprus in 2012.

Biomass use for electricity was the only source that developed faster than planned in the NREAP in both years: 3.2% (+1.6 ktoe) over in 2011 and 0.5% (+0.2 ktoe) over in 2012. Nevertheless a decrease by 2.7% (-1.4 ktoe) happened between 2011 and 2012 in the use of this source in electricity sector.

The development of solar technology between 2005 and 2011 resulted with a factor of 119 over the 0.1 GWh level of 2005. Nevertheless this technology was found to be under the expected NREAP level for this year with 8.5% (-1.1 ktoe). The increase by 80.3% (+9.6 GWh) between 2011 and 2012 was enough to exceed the expected NREAP for this year by 12.8% (+2.4 GWh).

In 2020 Cyprus is expected to get 45.4% of renewable electricity from solar technology and the rest 42.5% from wind and 12.2% from biomass.

12.5 Renewable energy in heating & cooling

The use of renewable energy in heating and cooling in Cyprus reached 83.6 ktoe (3.5 PJ) in 2011 and 81.5 ktoe (3.4 PJ) in 2012 over the 45.5 ktoe (1.9 PJ) in 2005. The development of renewable heat consumption was faster than expected between 2005 and 2011 exceeding the NREAP plan by 2.8% (+2.3 ktoe). Nevertheless a decrease by 2.5% (-2.1 ktoe) happened between 2011 and 2012 making Cyprus to miss the expected NREAP level for this year: 4.9% (-4.2 ktoe) under the plan. The renewable heat consumption in Cyprus is expected to reach 123.6 ktoe (5.2 PJ) in 2020.

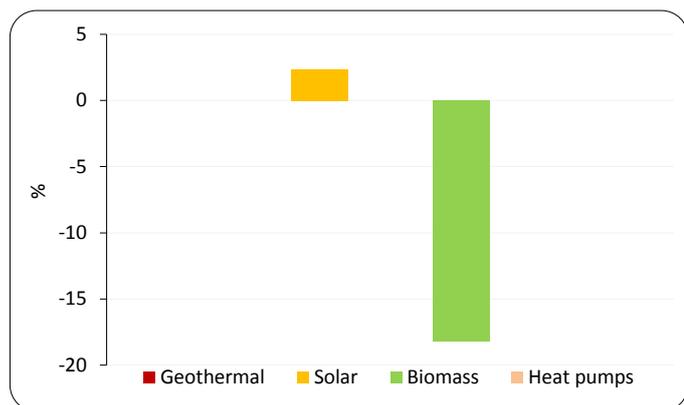


Figure 13-11. Relative increase/decrease of RES heating/cooling sources in Cyprus, 2011-12.

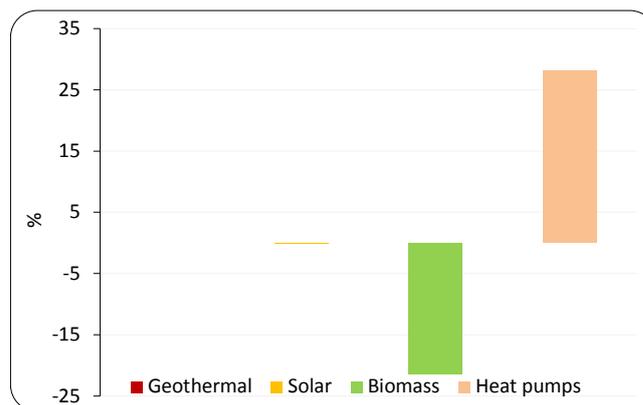


Figure 13-12. Deviation from NREAP in the RES heat consumption in Cyprus in 2012.

The main contributor in renewable heat in Cyprus in year 2011 was solar thermal with 79.1%. The contribution of biomass for heat was at the level of 19.3% while heat pumps counted for only 1.3%.

Heat pump was the only source in this sector that developed faster than expected over 2005 level. It reached in 2011 the amount of 1.1 ktoe (0.04 PJ) which doesn't change between 2011 and 2012. Comparing with NREAP expected plans Cyprus was over in both years: 81.0% (+0.5 ktoe) over in 2011 and 28.0% (+0.2 ktoe) over in 2012.

The main progress from 2005 happened in biomass use for renewable heat which increased by +15.4 ktoe (+365.5%) in 2011. Comparing with expected biomass use in this sector Cyprus was over in this year with 1.6% (+0.3 ktoe). Between 2011 and 2012 the biomass use for renewable heat decreased by 18.2% (-3.6 ktoe) reaching in 2012 the amount of 16 ktoe (0.7 PJ). Due to this decrease biomass use missed in 2012 the expected level of 20.4 ktoe by 21.4% (-4.4 ktoe).

Renewable heat from solar thermal increased by 2.3% (+1.5 ktoe) between years 2011 and 2012. The use of solar thermal was over the expected NREAP plan in year 2011 by 2.4% (+1.5 ktoe) but missing then it by 0.1% (-0.1 ktoe) in year 2012.

In 2020 the main progress is expected in solar thermal technology (+26.0 ktoe) which is expected to produce 73.2% of total renewable heat in Cyprus. The contributions of biomass and heat pumps are expected to be increased respectively to 24.4% and 2.4%.

12.6 Renewable energy in transport

The use of renewable energy in transport reached 16.0 ktoe (0.7 PJ) in 2011 increasing further by only 1.0 ktoe in 2012. Comparing with expected NREAP renewable energy in this sector Cyprus was under in both 2011 and 2012: 5.0% (-0.8 ktoe) under in 2011 and 6.6% (-1.2 ktoe) under in 2012. The use of renewable energy in transport sector in 2020 is expected to reach 38.5 ktoe (1.6 PJ).

No use of renewable energy in this sector was reported from Cyprus in year 2005.

Biodiesel was the only type of renewable energy that was used in the transport sector in Cyprus between 2011 and 2012. Comparing with expected biodiesel NREAP plan Cyprus was under in both years: 4.7% (-0.8 ktoe) under in 2011 and 6.1% (-1.1 ktoe) under in 2012.

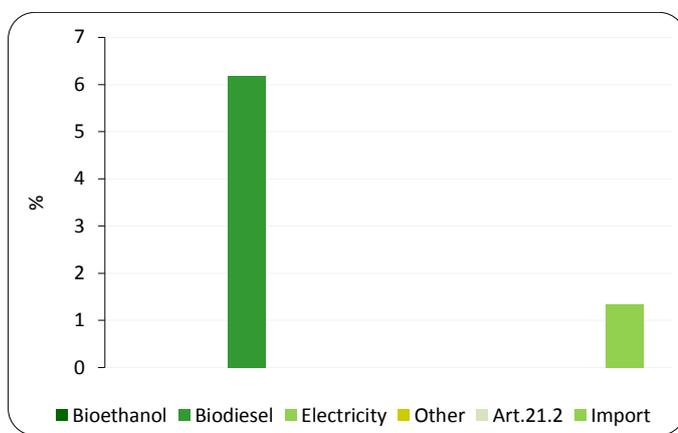


Figure 12-13. Relative increase/decrease of RES transport uses in Cyprus, 2011-12.

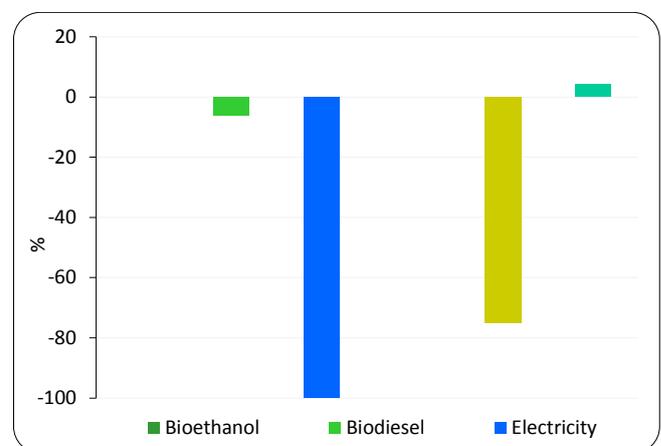


Figure 12-14. Deviation from NREAP in the RES use in transport in Cyprus in 2012.

The use of biofuels from wastes, residues, ligno-cellulosic material, reached only 0.1 ktoe in 2011 remaining at this level even in 2012. This use was lower than the expected NREAP use in both years: 66.7% (-0.2 ktoe) under in 2011 and 75.0% (-0.3 ktoe) under in 2012.

Between 2011 and 2012 Cyprus imported more biofuels than what it planned in its NREAP: 10.4% (+1.0 ktoe) more in 2011 and 4.2% (+0.4 ktoe) more in 2012.

Even that planned no other biofuels (biogas and vegetable oils) and renewable electricity was used in transport sector in Cyprus in 2011 and 2012.

For 2020 Cyprus is expected to have a contribution from bioethanol/bio-ETBE of 38.2% while the contribution of biodiesel is expected to decrease up to 60.3%. Renewable electricity contribution in this sector is expected to reach only 1.5%.

13. Renewable energy in Latvia

13.1 Deployment of renewable energy

Renewable energy consumed in Latvia decreased from 1381.6 ktoe (57.8 PJ) in 2005 to 1370.8 ktoe (57.4 PJ) in 2011 increasing then in 2012 to 1517.4 ktoe (63.5 PJ). Renewable energy consumption in Latvia is expected to further increase to 1925.4 ktoe (80.6 PJ) until 2020 (Figure 13-1).

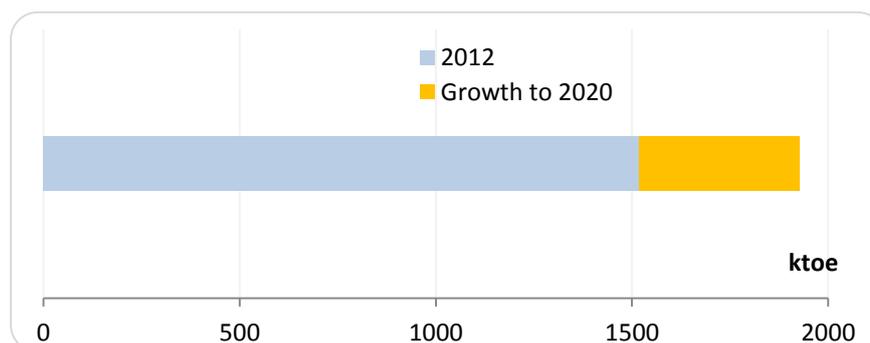


Figure 13-1 RES total in Latvia in 2012 and the expected growth to 2020 target

Renewable energy consumed in transport sector made the fastest progress in relative terms between 2005 and 2011 increasing with 52.6% per annum in average to reach 29.1 ktoe (1.2 PJ). Nevertheless renewable energy in this sector decreased during period 2011-12 with 10% (-2.9 ktoe). Despite the fastest development till 2011 renewable energy in this sector missed the expected NREAP levels in both 2011 and 2012: 33.9% (-14.9 ktoe) less in 2011 and 43% (-19.8 ktoe) less in 2012.

Renewable energy consumption in Latvia missed the expected NREAP level for 2011 by 1.2% (-16.4 ktoe) but exceeded it in 2012 by 4.3% (+62.3 ktoe).

Renewable energy in heating/cooling sector had the highest contribution in total renewable energy in Latvia, 77.3%. Renewable energy in this sector experienced a decrease between 2005 and 2011 with 4.9% (-54.8 ktoe) increasing then further in 2012 with 12.1% (+5.7 ktoe). Due to the decrease that took place till 2011 renewable energy in this sector missed the respective NREAP level for 2011 with 0.7% (-7.8 ktoe) being nevertheless over in 2012 with 5.7% (+64.5 ktoe).

In 2011 renewable electricity consumption in Latvia reached 282.5 ktoe (11.8 PJ) increasing further in 2012 to 303.7 ktoe (12.7 PJ) over 260.6 ktoe (10.9 PJ) in 2005. This development was fast enough to exceed the expected NREAP consumptions in both 2011 and 2012: 2.3% (+6.3 ktoe) over in 2011 and 6.1% (+17.6 ktoe) over in 2012.

The fastest progress of renewable energy consumed in Latvia until 2020 is expected to happen in transport sector (+216.8%) followed by electricity sector (47%) and heating/cooling sector (17.6%).

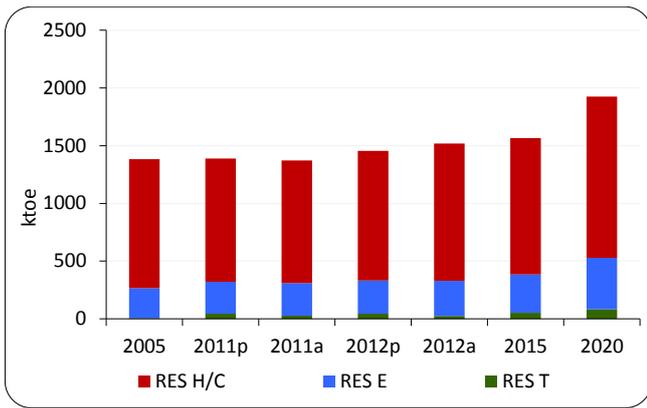


Figure 13-2. RES deployment in Latvia: projected growth and actual progress until 2020.

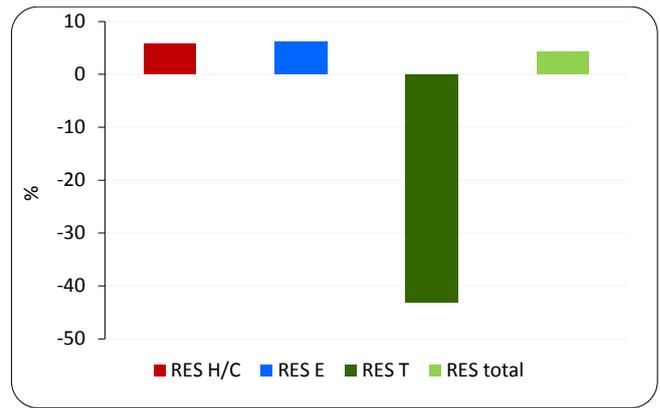


Figure 13-3. Deviation from NREAP in the RES consumption in Latvia in 2012.

13.2 Sources of renewable energy

In 2012 biomass contribution in the total renewable energy mix in Latvia reached 86.1% and the rest was coming from hydropower (17.9%), biofuels (1.4%) and wind (0.6%).

A decrease by 4.3% (-48.1 ktoe) took place in biomass use for electricity and heat in Latvia between 2005 and 2011 which resulted higher than what was planned for this period putting this source 1.0% (-10.8 ktoe) under the respective NREAP level for 2011. Nevertheless an increase by 13.4% (+142.9 ktoe) was registered between 2011 and 2012 in Latvia making possible the exceedance of expected NREAP level for 2012 with 6.1% (+69.1 ktoe).

Even that planned no introduction of solar technology took place in Latvia during period 2011-12.

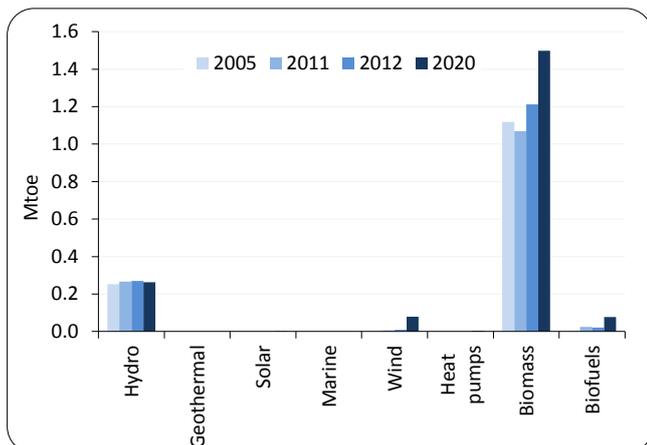


Figure 13-4. Contribution of renewable energy sources in Latvia: actual and projected in 2020

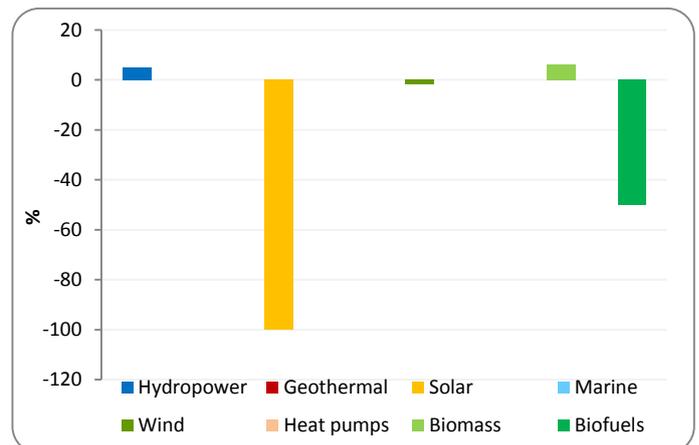


Figure 13-5. Deviation from NREAP in the contribution of renewable sources in Latvia in 2012

Biofuels use in transport sector in Latvia increased with 88.1% per annum in average (+18.5 ktoe) between 2005 and 2012 reaching 21.5 ktoe (0.9 PJ) meanwhile that a decrease by 12.6% (-3.1 ktoe) happened between 2011 and 2012. In comparison with NREAP development biofuels use in this sector were under the respective levels in both 2011 and 2012: 40% (-16.4 ktoe) under in 2011 and 50% (-21.5 ktoe) under in 2012.

In 2020 the contributions of biomass and hydropower in total renewable energy mix is expected to decrease slightly respectively to 77.9% and 13.7%. The contribution of wind, biofuels, heat pumps and solar are expected to be 4.1%, 4.0%, 0.2% and 0.1%.

13.3 Renewable energy share

The overall renewable energy contribution in Gross Final Energy Consumption in Latvia reached 33.6% in 2011 and 35.8% in 2012 increasing over 32.6% in 2005. Comparing with the expected shares for 2011 and 2012 the overall share of RES was under by 0.3% points in year 2011 and over with 1.5% points in 2012. The 2020 target that Latvia has to reach for the overall RES share is 40%.

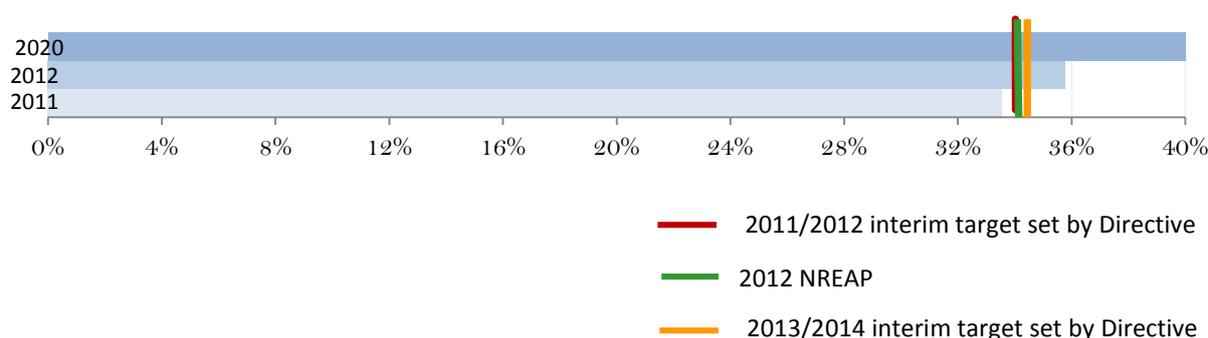


Figure 13-6. Overall RES share in Latvia, 2011-12

Latvia reached already in 2009 an overall RES share higher than the planned NREAP share for years 2010 and 2011. Nevertheless in 2010 the overall RES share in Latvia decreased just under the planned share for that year and again in 2011 the NREAP value was missed. On the contrary, in 2012 the overall RES share in Latvia was found 1.5% point above the planned RES share for this year and exceeded both the 2011/12 and 2013/14 indicative minimum targets. Latvia seems now in a good position for the achievement of 2020 RES share target.

Renewable energy share in heating/cooling sector increased with 2.13% points between 2005 and 2011 increasing further in 2012 with 2.56% points. Despite of this increase the share of renewable energy in this sector was found to be under the expected NREAP shares in both 2011 and 2012: 1.9% points under in 2011 and 0.2% points under in 2012.

The share of renewable energy in electricity sector decreased with 0.2% points between 2005 and 2011 reaching 44.7%, increasing then with the same value in 2012. This development nevertheless was slower than what was planned in the NREAP missing the respective planned RES shares in both 2011 and 2012: 1.6% points under in 2011 and 2.1% points under in 2012.

The share of renewable energy in transport sector increased by +2.7% points in 2011 compared with 2005 but in 2012 this share decreased by 0.1% points compared with 2011. The share of RES in this sector in Latvia was found to be under the expected shares in both years: -0.5% points in 2011 and -0.7% points in 2012.

According to the NREAP major increase from year 2012 until 2020 in Latvia is expected in electricity sector (+14.9% points) followed by transport sector (+6.5% points) and heating/cooling (+6.0% points).

13.4 Renewable electricity 13.4.1 Installed capacity

The renewable energy installed capacity in Latvia amounted to 1642 MW in 2011 and 1701 MW in 2012 increasing from 1572 MW in the baseline year. This development was fast enough to exceed the expected NREAP capacities in both years: 2.8% (+44 MW) above in 2011 and 4.7% (+76 MW) over in 2012. In 2020 the expected renewable energy in Latvia will be 2168 MW.

In 2012 hydropower covered 92.6% of total renewable energy installed capacity in Latvia and the rest was biomass (3.9%) and wind (3.5%).

According to Latvia's NREAP no changes in hydropower installed capacity was planned for period 2005-2012. In fact an increase took place during this period in the capacity of this technology reaching 1576 MW in 2011 remaining such even in 2012. This capacity was 2.6% (+40 MW) over the planned capacities in each year exceeding also by 1.7% (+26 MW) the 2020 plan for this technology.

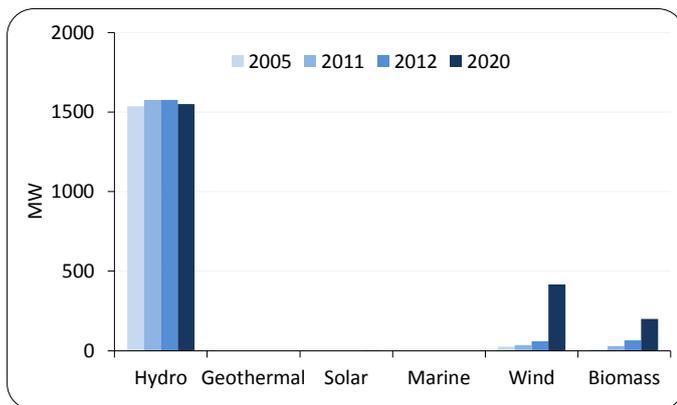


Figure 13-7. RES capacity deployment and progress until 2020 in Latvia.

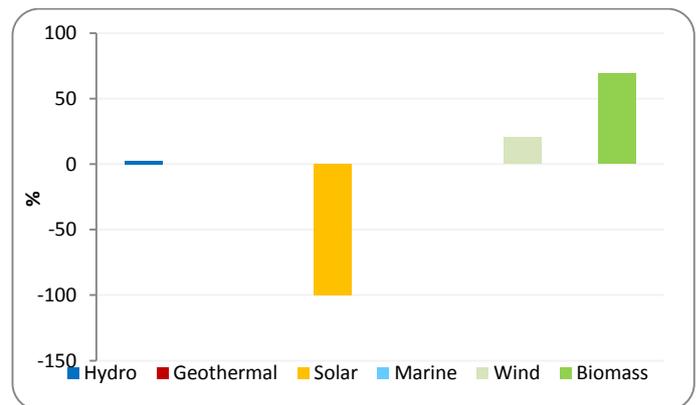


Figure 13-8. Deviation from NREAP in the RES installed capacity in Latvia in 2012.

Biomass installed capacity increased with 200% between 2005 and 2011 reaching 30 MW and furthermore with 120% (+36 MW) in 2012. This development was fast enough to exceed the expected NREAP capacities in both 2011 and 2012: 20% (+5 MW) over in 2011 and 69.2% (+27 MW) over in 2012.

39% of additional installed electricity capacity in Latvia during 2011-2012 was provided by wind power

The additional wind power capacity between 2005 and 2012 was +10 MW (+38.5%) increasing then further in 2012 with +23 MW (+64%) over 26MW installed in 2005. The development of the wind capacity was slower between 2005 and 2011 missing the respective capacity by 2.7% (-1.0 MW). Nevertheless the installed capacity of this technology was found to be 20.4% (+10 MW) over the expected NREAP capacity for year 2012.

No solar photovoltaic capacity was registered in Latvia between 2011 and 2012 even that an installed capacity equal to 1 MW was planned for this period.

In 2020 hydropower contribution in total renewable energy installed capacity in Latvia is expected to decrease to 71.5% while wind and biomass are expected to increase their contribution respectively to 19.2% and 9.2%.

13.4.2 Consumption

Renewable electricity consumption in Latvia increased with 8.4% during period 2005-2011 reaching 3284.8 GWh (11.8 PJ) over 3030 GWh (10.9 PJ) in 2005. The consumption of renewable electricity in Latvia increased further between 2011 and 2012 with 7.5% (+246.3 GWh). Comparing with NREAP these values were found to be over the expected consumptions in both years: 2.3% (+72.8 GWh) over in 2011 and 6.1% (+204.1 GWh) over in 2012. In 2020 the renewable electricity consumption in Latvia is expected to amount to 5191 GWh (18.7 PJ).

In 2012 almost 89% of renewable electricity in Latvia was produced by hydropower and the rest was from biomass (8.2%) and wind (2.8%).

Hydropower technology increased the electricity consumption during period 2005-2011 more than planned reaching 3101 GWh (11.2 PJ) in 2011 increasing further in 2012 with 1.4% (+43.3 GWh). These consumptions were exceeding not only the respective NREAP consumptions for 2011 and 2012 (+3.9% or +115.8 GWh over in 2011 and +5.1% or +151.1 GWh over in 2012) but even the 2020 planned consumption of 3051 GWh (11 PJ).

Renewable electricity consumption originated from biomass increased very fast between 2005 and 2011 with 191.2% (+78.4 GWh) and furthermore with 141.7% (+169.2 GWh) in 2012. Nevertheless comparing with expected developments according to NREAP biomass use for electricity consumption was found to be under the respective 2011 value by 22.5% (-34.6 GWh) but over the 2012 value with 22.8% (+53.6 GWh).

3.7% of gross final electricity consumption in Latvia in year 2012 was covered by bioelectricity

Wind power renewable electricity didn't increased as fast as planned during period 2005-2012 reaching only 64.6 GWh in 2011 over 47.0 GWh in 2005. An increase between 2011 and 2012 by 52.3% (+33.8 GWh) took place in renewable energy from wind technology. Despite of this developments the renewable energy consumption from this technology was found to be under the expected NREAP consumptions in both 2011 and 2012: 11.5% (-8.4 GWh) under in 2011 and 1.6% (-1.6 GWh) under in 2012.

No renewable electricity consumption originated from solar photovoltaic was registered in Latvia during period 2011-12.

In 2020 the contribution of hydropower is expected to decrease up to 58.8% followed by biomass with 23.6%, wind with 17.5% and solar with 0.1%.

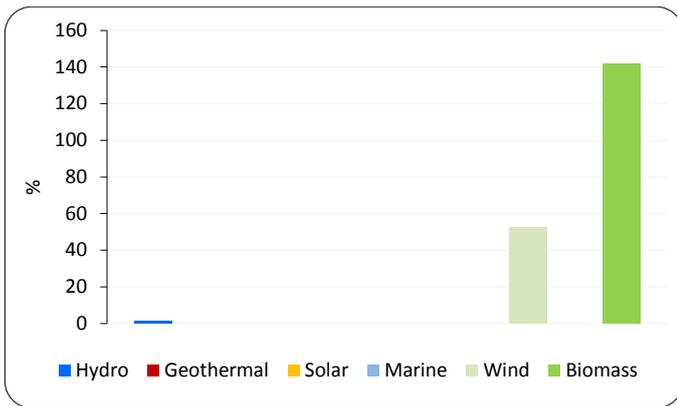


Figure 13-9. Relative increase/decrease of RES electricity sources in Latvia, 2011-12

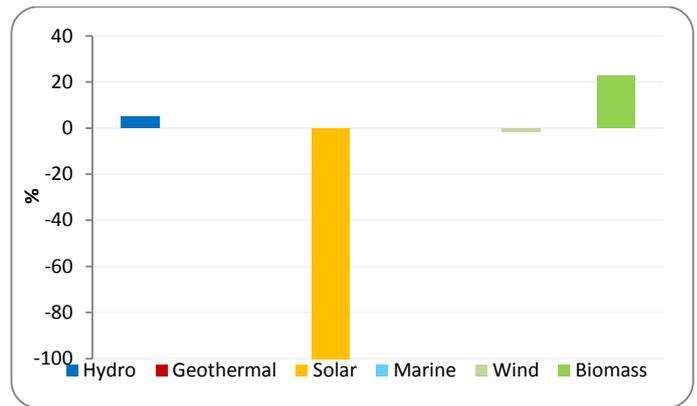


Figure 13-10. Deviation from NREAP in the RES electricity consumption in Latvia in 2012.

13.5 Renewable energy in heating/cooling

Renewable energy consumed in heating/cooling sector in Latvia reached 1059.2 ktoe (44.3 PJ) in 2011 increasing then further to 1187.5 ktoe (49.7 PJ) over 1114 ktoe (46.6 PJ) in baseline year. This development was slower than planned for period 2005-2011 missing the respective NREAP heat consumption by 0.7% (-7.8 ktoe) exceeding then in 2012 the expected heat by 5.7% (+64.5 ktoe). In 2020 the renewable heat consumption in Latvia is expected to reach 1398 ktoe (58.5 PJ).

In 2012 biomass was the only renewable energy source used for heat consumption in Latvia.

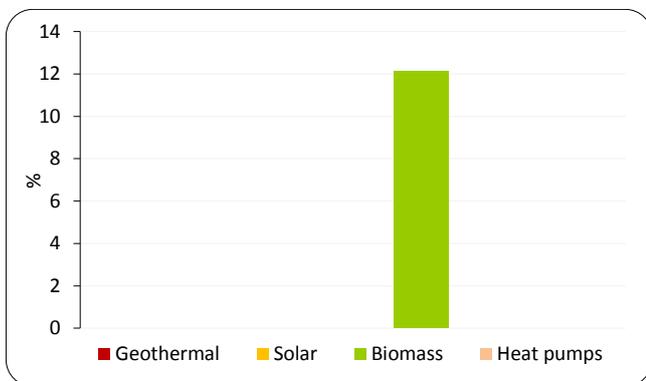


Figure 13-11. Relative increase/decrease of RES heating/cooling sources in Latvia, 2011-12.

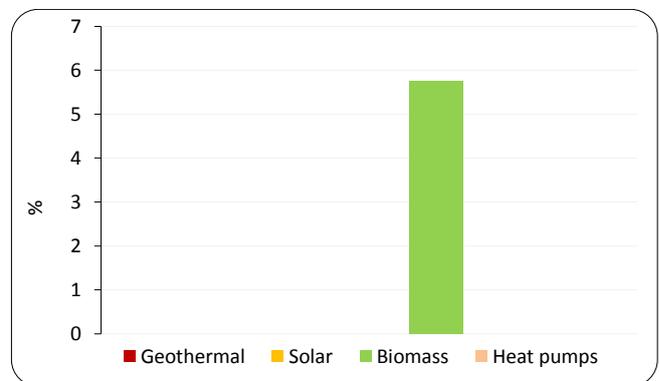


Figure 13-12. Deviation from NREAP in the RES heat consumption in Latvia in 2012.

In 2020 the contribution of biomass is expected to change slightly to 99.6% and the rest is expected to be heat pumps (0.3%) and solar thermal (0.1%).

13.6 Renewable energy in transport

The use of renewable energy in transport reached 29.1 ktoe (1.2 PJ) in 2011 and 26.2 ktoe (1.1 PJ) in 2012 over 7 ktoe (0.3 PJ) in 2005. Nevertheless these uses were 33.9% (-14.9 ktoe) and 43% (-19.8 ktoe) under the respective NREAP projected values of 44 ktoe (1.8 PJ) and 46 ktoe (1.9 PJ). The use of renewable energy in transport sector in 2020 is expected to be 83 ktoe (3.5 PJ).

In 2012 biodiesel contribution reached 57.6% followed by bioethanol/bio-ETBE with 24.4% and renewable electricity with 17.9%.

Biodiesel made the main progress in transport sector during 2005-2011 increasing with +66.2% per annum in averages or +13.9 ktoe over 3.0 ktoe (0.1 PJ) in baseline year. Nevertheless a decrease with 10.7% (-1.8 ktoe) took place between 2011 and 2012. The biodiesel use development was slower than what was planned according the NREAP missing the respective 2011 and 2012 levels by 32.4% (-8.1 ktoe) and 39.6% (-9.9 ktoe).

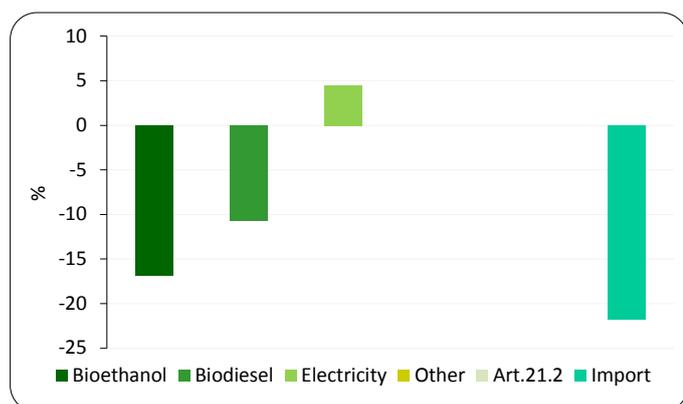


Figure 13-13. Relative increase/decrease of RES transport uses in Latvia, 2011-12.

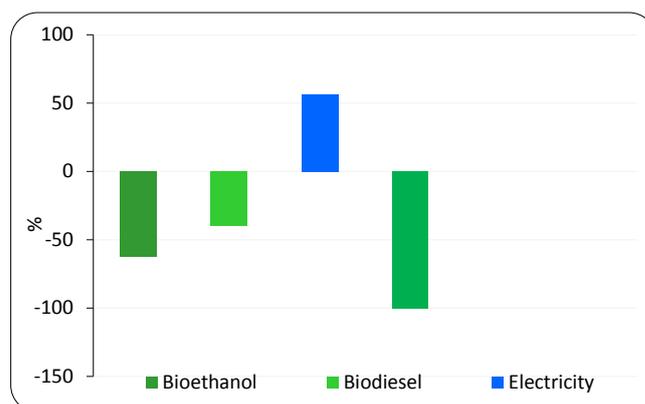


Figure 13-14. Deviation from NREAP in the RES use in transport in Latvia in 2012.

Bioethanol/bio-ETBE reached 7.7 ktoe (0.32 PJ) in 2011 decreasing further to 6.4 ktoe (0.27 PJ) in 2012. In comparison with NREAP plans these uses were found to be under the respective expected levels in both years: 51.9% (-8.3 ktoe) under in 2011 and 62.4% (-10.6 ktoe) under in 2012.

No other biofuels (biogas and vegetable oils) were used in Latvia in 2011 and 2012 even than an amount of 1 ktoe was planned for year 2012.

While no contribution was expected in both years for the use of imported biofuels their use grew to 20.2 ktoe (0.8 PJ) in 2011 but decreased by 21.8% in 2011-12 time span reaching 15.8 ktoe (0.7 PJ).

The use of renewable electricity in transport was higher than what was planned in the NREAP reaching 4.5 ktoe (0.19 PJ) in 2011 and 4.7 ktoe (0.20 PJ) in 2012 which are respectively 50% (+1.5 ktoe) and 56.7% (+1.7 ktoe) over the NREAP plans for these years.

In 2020 the picture of the contributions of different renewable energy sources in this sector is expected to change. Other biofuels are expected to dominate with a contribution of 37.3% followed by biodiesel with 33.7%, bioethanol/bio-ETBE with 21.7% and renewable electricity with 7.2%.

14. Renewable energy in Lithuania

14.1 Deployment of renewable energy

In 2011 renewable energy consumed in Lithuania reached 1002.8 ktoe (42 PJ) increasing then further with 9.9% (+18.1 ktoe) in 2012. In 2020 the use of renewable energy in Lithuania is expected to reach 1474.9 ktoe (61.8 PJ) (Figure 15-1).

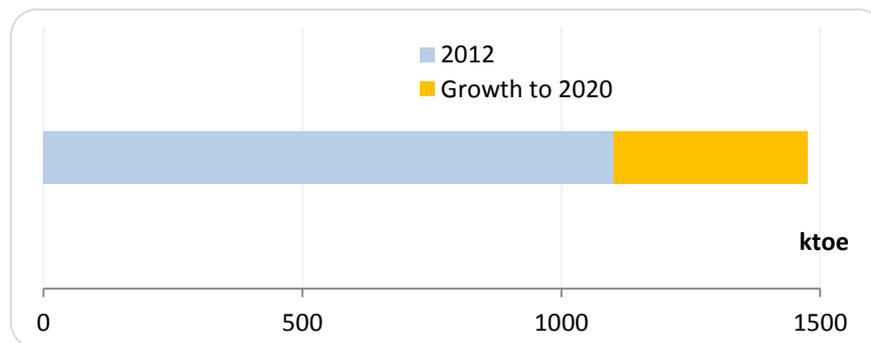


Figure 14-1. RES total in Lithuania in 2012 and the expected growth to 2020 target

Renewable energy consumed in transport sector had the fastest development in relative terms between 2005 and 2011 increasing with 191.7% per annum in average over the 3.6 ktoe (0.15 PJ) in the baseline year. It had also the fastest development during period 2011-12 with 35.6% (+16 ktoe). Nevertheless this development was not enough to meet the expected NREAP levels being under in both years: 22.1% (-12.8) ktoe under in 2011 and 19.5% (-14.8 ktoe) under in 2012.

Renewable energy consumption in Lithuania has exceeded the expected NREAP levels in both 2011 and 2012 respectively by 15.6% (+135.6 ktoe) and by 18.1% (+169 ktoe)..

The additional renewable energy consumed in heating/cooling sector between 2005 and 2011 was +185.5 ktoe (+27%) reaching 873 ktoe (36.6 PJ) in 2011 increasing further in 2012 with 7.3% (+64 ktoe). Comparing with expected NREAP levels the renewable energy in this sector was found to be over the respective levels in both years: 22.3% (+159.0 ktoe) over in 2011 and 25.3% (+189.0 ktoe) over in 2012.

Electricity sector experienced a use of renewable energy equal to 84.8 ktoe (3.6 PJ) in 2011 and 103.8 ktoe (4.3 PJ) in 2012. Nevertheless the renewable electricity consumption in Lithuania between 2011 and 2012 was found to be under the expected NREAP levels: 11.1% (-10.6 ktoe) under in 2011 and 25.3% (-5.2 ktoe) under in 2012.

In 2020 the fastest progress is expected to take place in the use of renewable energy in transport sector (+177.9%) followed by electricity sector (+145.1%) and heating/cooling sector (+12.2%).

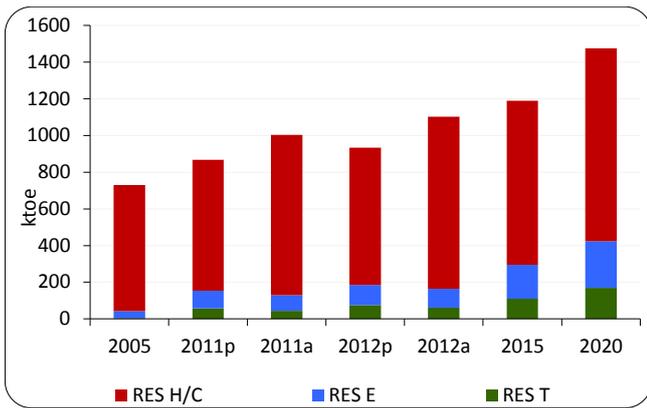


Figure 14-2. RES deployment in Lithuania: projected growth and actual progress until 2020.

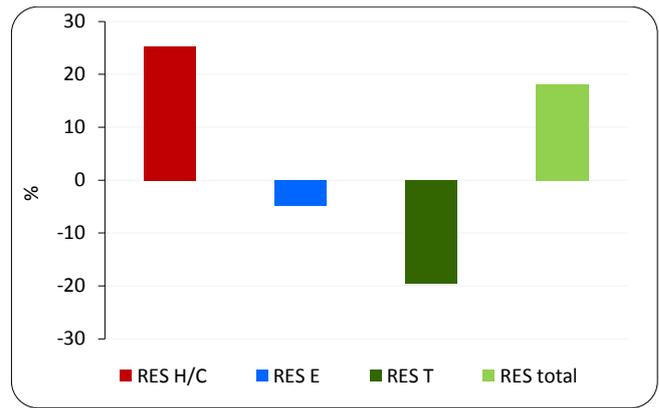


Figure 14-3. Deviation from NREAP in the RES consumption in Lithuania in 2012.

14.2 Sources of renewable energy

In 2012 almost 80% of renewable energy mix in Lithuania was biomass and the rest hydropower (17.9%), biofuels (1.4%) and wind (0.6%).

Biomass had the highest additional development between 2005 and 2011 with 198 ktoe (+28.8%) reaching 884.6 ktoe in 2011 increasing further in 2012 with 7.8% (+69.2 ktoe). This development was faster than the NREAP planned one exceeding the respective expected levels in both years: 22.1% (+160.2 ktoe) over in 2011 and 25.1% (+191.6 ktoe) over in 2012. Solar technology was introduced in Lithuania only in 2012 with an amount of only 0.17 ktoe (0.01 PJ). Despite of this technology was behind the projected NREAP development even for 2012 missing the respective expected level by 92.4% (-2.1 ktoe).

Geothermal absolute contribution in Lithuania reached only 2 ktoe in 2011 remaining in this level even in 2012. This contribution was under the expected NREAP respective contributions in both 2011 and 2012 with 33.3% (-1.0 ktoe).

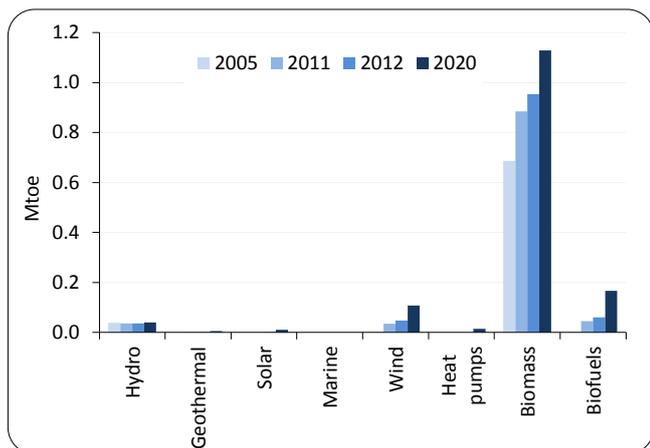


Figure 14-4. Contribution of renewable energy sources in Lithuania: actual and projected in 2020

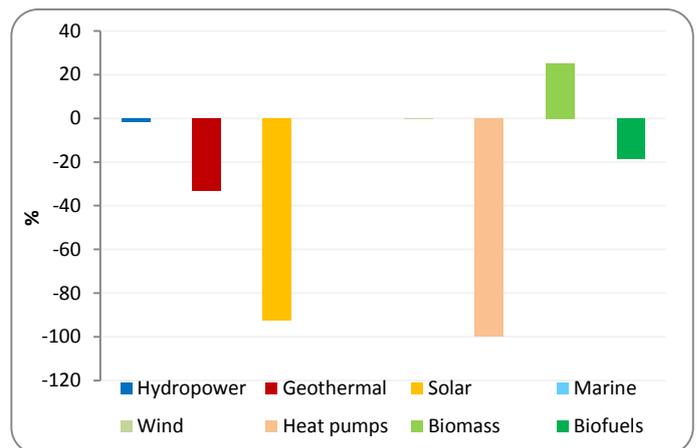


Figure 14-5. Deviation from NREAP in the contribution of renewable sources in Lithuania in 2012

Biofuels use in transport sector in Lithuania reached 45 ktoe (1.88 PJ) in 2011 increasing with 227.8% per annum in average. An increase by 35.6% (+16.0 ktoe) took place furthermore between 2011 and 2012. Nevertheless the uses of biofuels in transport sector

were under the expected NREAP ones in both 2011 and 2012: 21.1% (-12.0 ktoe) less in 2011 and 18.7% (-14.0 ktoe) less in 2012.

In 2020 biomass share is expected to decrease up to 76.6% followed by biofuels with 11.3%, wind 7.3%, hydropower 2.8%, heat pumps 1%, solar 0.7% and geothermal 0.3%.

14.3 Renewable energy share

The overall renewable energy share in Gross Final Energy Consumption in Lithuania reached 20.2% in 2011 and 21.7% in 2012. Comparing with the expected shares for 2011 and 2012 the overall share of RES was over by 3.2% points in year 2011 and 3.7% points in 2012. The 2020 target that Lithuania has to reach for the overall RES share is 24%.

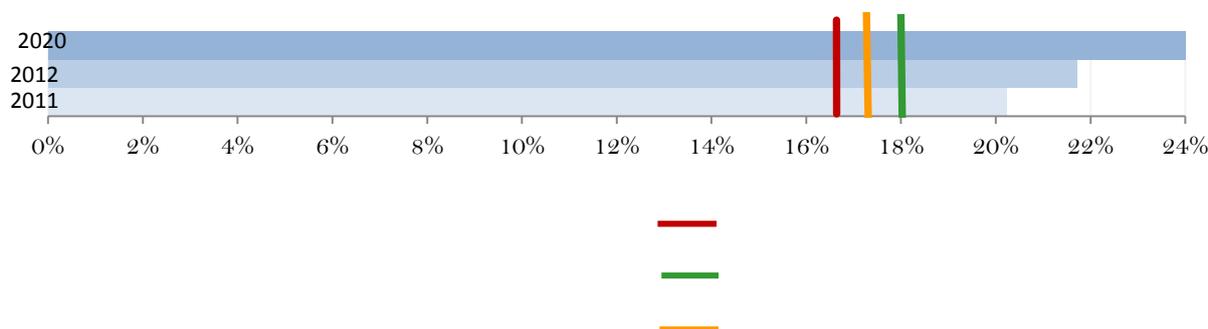


Figure 14-6. Overall RES share in Lithuania, 2011-12

The overall RES share in Lithuania in 2011-12 was well over the respective NREAP planned values and indicative trajectory for both 2011/12 and 2013/14. In 2012 Lithuania exceeded already its overall expected RES share for year 2015 being in a very good position for the achievement of 2020 RES share target.

The share of renewable energy in transport sector made the main progress among energy sectors in Lithuania during period 2005-2012. It increased by +6.9% points in 2011 compared with 2005 and furthermore by +2.2 in 2012. In comparison with NREAP the expected shares of RES in this sector were found to be under the achieved shares in both years: +3.0% points in 2011 and +4.1% points in 2012.

Renewable energy share in heating/cooling sector developed also fast during period 2005-2012 increasing with +6.7% points in 2011 and with +1.7% points in 2012. This development was faster than the expected NREAP one exceeding the respective share in both years: 4.7% points over in 2011 and 5.4% points over in 2012.

In electricity sector the share of renewable energy increased with +5.0% points in 2011 but only with +1.9% points more in 2012. Renewable energy share in this sector was found to be under the NREAP planned shares in both 2011 and 2012: -1.0% points under in 2011 and -0.1% points under in 2012.

Major increase from year 2012 until 2020, is expected to be achieved in electricity sector (+10.1% points) followed by heating/cooling (+3.6% points) and transport sector (+0.4% points).

14.4 Renewable electricity
15.4.1 Installed capacity

Renewable energy installed capacity in Lithuania reached 351 MW in 2011 and 451 MW in 2012 increasing over baseline capacity of 133.8 MW. The development of renewable capacity in Lithuania was slower than what was planned during period 2005-2011 missing the respective expected capacity by 5.1% (-18.8 MW). The increase that took place between 2011 and 2012 was enough to put the installed capacity of renewable energy in Lithuania over by 2.5% (+11.2 MW) the expected value for year 2012. In year 2020 Lithuania has planned to reach an installed capacity equal to 874.8 MW for renewable energy.

In 2012 wind installed capacity in Lithuania covered 61% of total renewable energy installed capacity. The rest was hydropower with 25.7%, biomass with 11.8% and solar photovoltaic with 1.6%.

Wind provided 73% of the additional renewable electricity capacity installed in Lithuania during 2011-

The main progress from year 2005 was made in wind technology with an increase in capacity by 3350% per annum in average (+201 MW) in 2011 and furthermore with 36.1% (+73 MW) in 2012 over 1 MW installed in 2005.. Comparing with expected NREAP capacities this technology was found to be over the respective capacities in both 2011 and 2012: 1.0% (+2.0 MW) over in 2011 and 10% (+25 MW) over in 2012.

Biomass installed capacity in Lithuania reached 33 MW in 2011 and 53 MW in 2012 increasing over 5 MW in the baseline year. Nevertheless this development was not faster than what was projected in the NREAP missing the respective expected capacities in both years: 19.5% (-8.0 MW) less in 2011 and 10.2% (-6.0 MW) less in 2012.

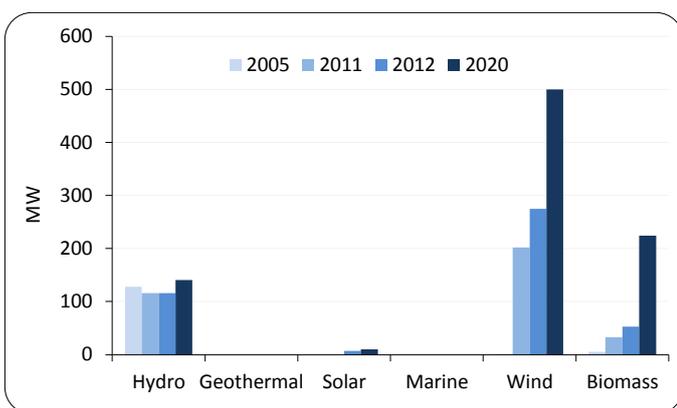


Figure 14-7. RES capacity deployment and progress until 2020 in Lithuania.

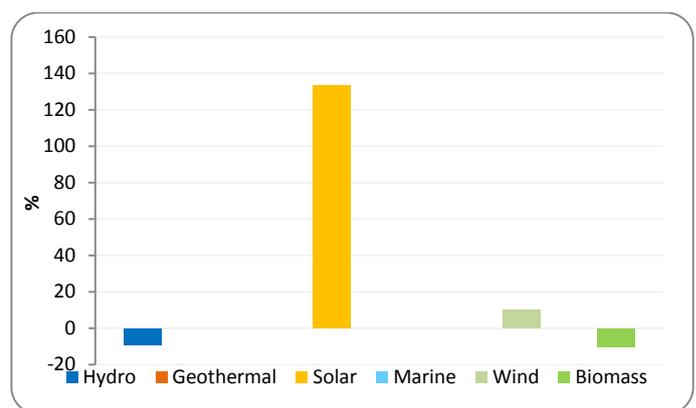


Figure 14-8. Deviation from NREAP in the RES installed capacity in Lithuania in 2012.

Even that a capacity of 2.0 MW of solar photovoltaic technology was planned for year 2011 the introduction of this technology took place only in 2012 with a capacity of 7.0 MW. In this

year this capacity was found 133.3% (+4.0 MW) over the expected NREAP capacity for this year.

A decrease by 9.2% (-11.8 MW) took place in hydropower installed capacity in Lithuania during period 2005-2012 from 127.8 MW installed in the baseline year. Due to this decrease this technology was found to be under the respective expected capacities in both 2011 and 2012: 8.5% (-10.8 MW) under in 2011 and 9.2% (-11.8 MW) under in 2012.

In 2020 wind power will still remain the main contributor in total renewable capacity planned for this year with 57.2% followed by biofuels with 25.6%, hydropower with 16.1% and solar with 1.1%.

14.4.2 Consumption

Renewable electricity consumption in Lithuania amounted to 966 GWh (3.5 PJ) in 2011 and 1207 GWh (4.3 PJ) in 2012 from 460 GWh (1.7 PJ) in 2005. Nevertheless the renewable electricity consumption in Lithuania didn't reach the NREAP planned values missing the respective values by 11.1% (-123 GWh) in 2011 and 4.8% (-61 GWh) in 2012. In 2020 the renewable electricity consumption in Lithuania is expected to amount to 2958 GWh (10.6 PJ).

In 2012 wind technology covered 46.6% of renewable electricity consumption in Lithuania followed by hydropower with 35.2%, biomass with 18.1% and solar photovoltaic with 0.2%.

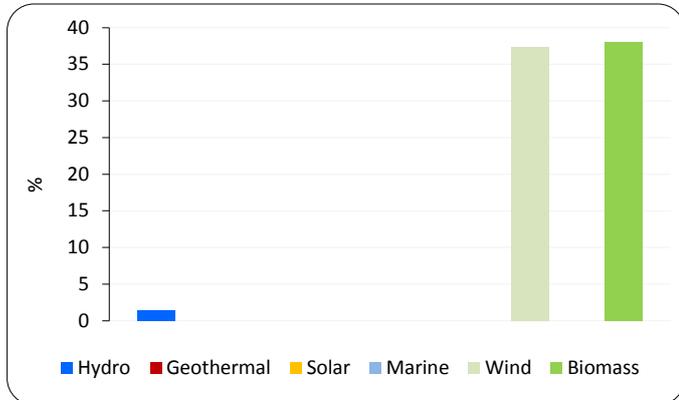


Figure 14-9. Relative increase/decrease of RES electricity sources in Lithuania, 2011-12

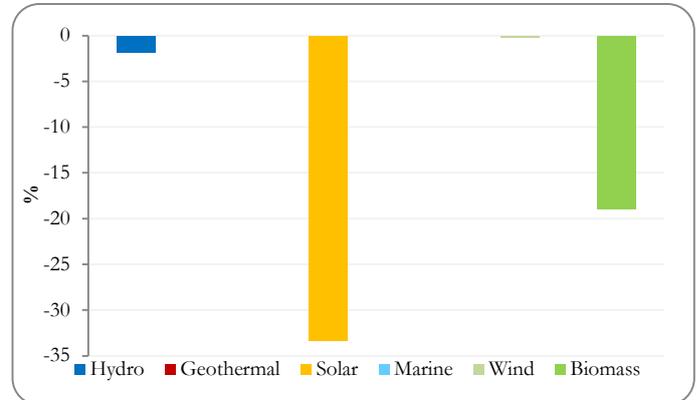


Figure 14-10. Deviation from NREAP in the RES electricity consumption in Lithuania in 2012.

Renewable electricity consumption originated from wind technology reached 409 GWh (1.5 PJ) in 2011 over 2.0 GWh (0.01 PJ) in the baseline year increasing then further with 37.4% (+153 GWh) in 2012. Nevertheless the achieved levels for 2011 and 2012 were found to be under the projected NREAP consumptions in both years: 13.5% (-64 GWh) less in 2011 and 0.2% (-1.0 GWh) less in 2012.

Hydropower renewable electricity consumption decreased to 419 GWh (1.5 PJ) in 2011 compared with the baseline level of 451 GWh (1.6 PJ). Even that an increase with 1.4% (+ 6 GWh) happened between 201 and 2012 this technology was found to be under the projected NREAP levels in both 2011 and 2012: 3.0% (-13 GWh) under in 2011 and 1.8% (-8 GWh) under in 2012.

Biomass use for electricity consumption increased with 359.3% per annum in average between 2005 and 2011 over 7.0 GWh in the baseline year. This use increase further in 2012 with almost 38% (+60 GWh) comparing with 2011 level. Nevertheless the renewable electricity consumption from biomass missed in both 2011 and 2012 the expected NREAP consumptions respectively by 21.8% (-44 GWh) and 19% (-51 GWh).

Solar photovoltaic renewable electricity consumption was registered only in 2012 even that a contribution of 2.0 GWh was planned for year 2011. Comparing with projected NREAP levels this technology was found to be under even in year 2012 missing the respective level by 33.3% (-1.0 GWh).

In 2020 biomass contribution is expected to have a significant increase reaching 41.3% approaching to the 42.3% of wind power contribution. The rest is expected to be covered by hydropower with 15.9% and solar photovoltaic with 0.5%.

14.5 Renewable energy in heating & cooling

Heat consumption originated from renewable energy in Lithuania reached 873 ktoe (36.6 PJ) in 2011 increasing then further with 7.3% (+ 64 ktoe) in 2012 over 687.5 ktoe (28.8 PJ) in 2005. The development of renewable energy consumed in this sector was faster than what was projected in the NREAP exceeding the respective expected uses in both 2011 and 2012: 22.3% (+159 ktoe) over in 2011 and 25.3% (+189 ktoe) over in 2012. The heat consumption coming from renewable energy sources is expected to reach 1051 ktoe (44 PJ) in 2020.

In 2012 almost total renewable energy consumed in heating/cooling sector in Lithuania was biomass (99.8%) with a very marginal contribution of geothermal technology (0.2%).

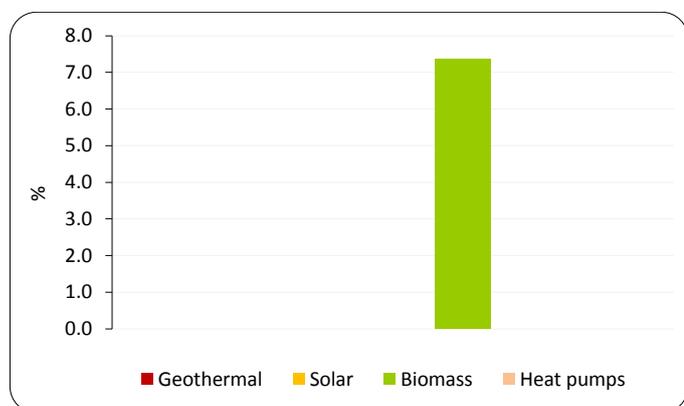


Figure 14-11. Relative increase/decrease of RES heating/cooling sources in Lithuania, 2011-12.

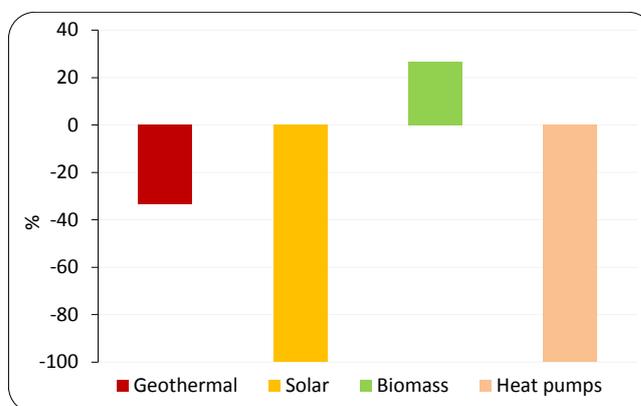


Figure 14-12. Deviation from NREAP in the RES heat consumption in Lithuania in 2012.

Biomass use for heat consumption in Lithuania increase with 27% between 2005 and 2011 reaching 871 ktoe (36.5 PJ) increasing then further with 7.3% (+64 ktoe) in 2012. Comparing with expected biomass uses for 2011 and 2012 the achieved level was found to be higher in both years: 23.2% (+164 ktoe) more in 2011 and 26.5% (+196 ktoe) more in 2012.

35.3% of gross final heat consumption in Lithuania in year 2012 was covered by biomass-thermal

Geothermal technology use for heat consumption reached only 2 ktoe (0.08 PJ) in 2011 over 1.5 ktoe (0.06 PJ) in the baseline year remaining then unchanged till 2012. This development was found to be under the expected NREAP development in both 2011 and 2012 by 33.3% (-1.0 ktoe).

In 2020 the contribution of biomass is expected to decrease slightly to 97.3% while the other technologies, heat pumps, solar and geothermal, are expected to increase respectively to 1.3%, 0.9% and 0.5%.

14.6 Renewable energy in transport

The use of renewable energy in transport reached 45 ktoe (1.88 PJ) in 2011 and 61 ktoe (2.55 PJ) in 2012 over 3.6 ktoe (0.15 PJ) in the baseline year. Nevertheless these uses were found to be under the expected NREAP ones in both 2011 and 2012: 22.1% (-12.8 ktoe) under in 2011 and 19.5% (-14.8 ktoe) under in 2012. The 2020 use of renewable energy in Lithuania in transport sector is expected to reach 169.5 ktoe (7.1 PJ).

In 2012 the contribution of biodiesel in total renewable energy consumed in this sector reached 85.2% and the rest of 14.8% was bioethanol/bio-ETBE.

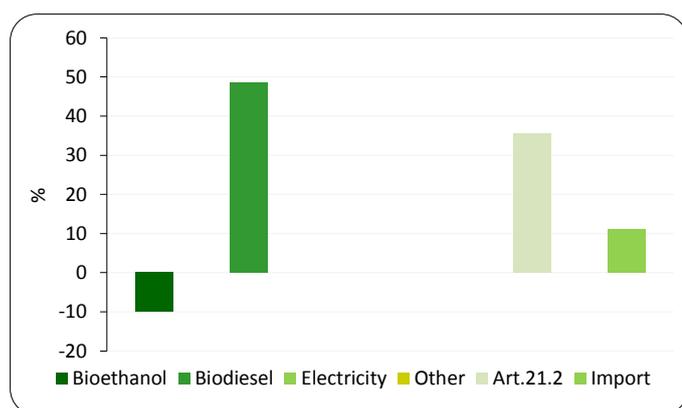


Figure 14-13. Relative increase/decrease of RES transport uses in Lithuania, 2011-12.

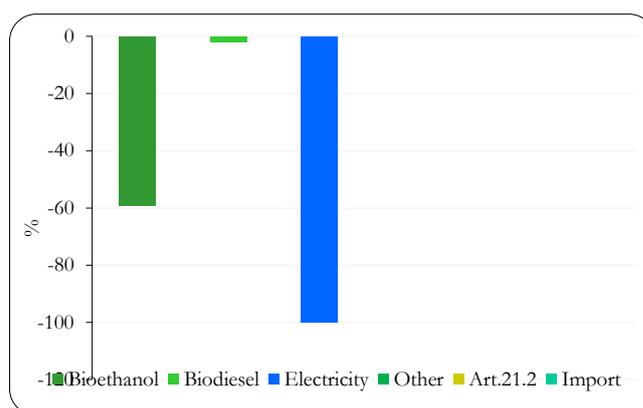


Figure 14-14. Deviation from NREAP in the RES use in transport in Lithuania in 2012.

Biodiesel made the main progress in transport sector during 2005-2011 increasing with 191.6% per annum in average (+32.2 ktoe) over 2.8 ktoe (0.12 PJ) in the baseline year. Between 2011 and 2012 the use of biodiesel in this sector increase further with 48.6% (+17 ktoe). Despite of this development the uses of biodiesel in Lithuania was found to be under the expected NREAP uses in both 2011 and 2012: 18.6% (- 8 ktoe) under in 2011 and 1.9% 8-1.0 ktoe) under in 2012.

Bioethanol/bio-ETBE use increased with the same average growth rate as biodiesel use between 2005 and 2011 reaching 10 ktoe. Nevertheless a decrease by 10% (-1.0 ktoe) took place in the use of this biofuel during period 2011-12. Comparing with expected NREAP uses this type of biofuel was found to be under the respective expected levels in both 2011 and 2012: 28.6% (-4 ktoe) under in 2011 and 59.1% (-13 ktoe) under in 2012.

Even that planned no use of renewable electricity in transport sector took place in Lithuania during period 2011-12.

No other biofuels (biogas and vegetable oils) were used in Lithuania in 2011 and 2012.

While no contribution up to 2020 is planned in Lithuanian NREAP for the use of imported biofuels their use was present in transport sector since in 2009 with 31 ktoe (1.3 PJ) reaching then 45 ktoe (1.9 PJ) in 2011 and furthermore 61 ktoe (2.6 PJ) in 2012.

In 2020 the contribution of bioethanol/bio-ETBE is expected to increase its contribution to 21.2% while the contribution of biodiesel will decrease to 77.3%. The contribution of renewable electricity will be marginal in the total renewable energy that is expected to be used in Lithuania in 2020 with 1.5%.

15. Renewable energy in Luxembourg

15.1 Deployment of renewable energy

The renewable energy consumed in Luxembourg increased from 40.1 ktoe (1.68 PJ) in 2005 to 126.9 ktoe (5.3 PJ) in 2011 and 132.7 ktoe (5.56 PJ) in 2012. The renewable energy consumed in Luxembourg is expected to further increase to 401.1 ktoe (16.8 PJ) until 2020 (Figure 15-1).

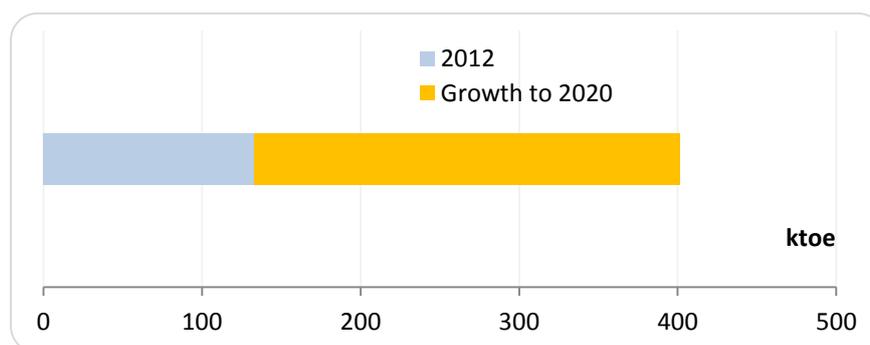


Figure 15-1. RES total in Luxembourg in 2012 and the expected growth to 2020 target

Renewable energy consumed in transport sector made the most significant progress from

Renewable energy consumption in Luxembourg increased faster than planned exceeding the NREPA targets by 61.8% (+48.5 ktoe) in 2011 and by 30.9% (+31.4 ktoe) in 2012.

year 2005. It experienced a very fast increase up to 2011 with 364.3% per annum in average (+24.3 ktoe) but the additional renewable energy in 2012 was only 1 ktoe (+2.1%). This increase was fast enough to surpass the

expected NREAP levels for both 2011 and 2012: 81.8% (+21.6 ktoe) over in 2011 and 28.6% (+10.9 ktoe) over in 2012.

Heating/cooling sector in Luxembourg experienced an increase by 29.2% per annum in average between 2005 and 2011 reaching 53.9 ktoe (2.26 PJ) increasing further with 6.5% (+3.5 ktoe) in 2012. This development was fast enough to exceed the expected NREAP levels in both 2011 and 2012: 93.9% (+26.1 ktoe) over in 2011 and 70.8% (+23.8 ktoe) over in 2012.

Electricity sector experienced a use of renewable energy in 2011 equal to 25 ktoe which increased further in 2012 with 5.2% (+1.3 ktoe). Nevertheless this development was enough to exceed only the expected NREAP level for year 2011 (+3.2% or +0.77 ktoe) but missing it in 2012 with 1.3% (-3.35 ktoe).

The main progress from 2012 to 2020 is expected in the use of renewable energy in transport sector (45.2% per annum in average) followed by electricity sector (19.4% per annum in average) and heating/cooling sector (11% per annum in average).

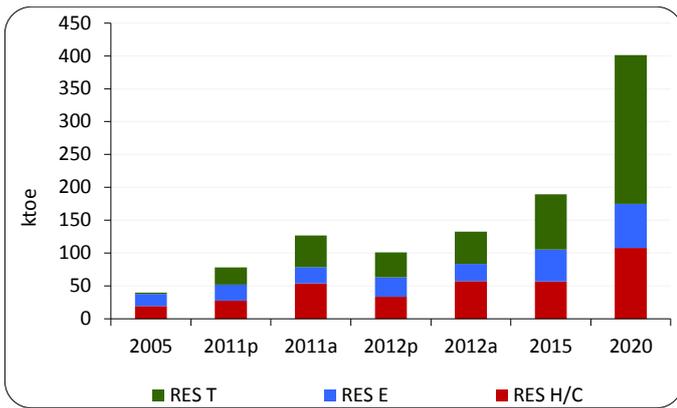


Figure 15-2. RES deployment in Luxembourg: projected growth and actual progress until 2020.

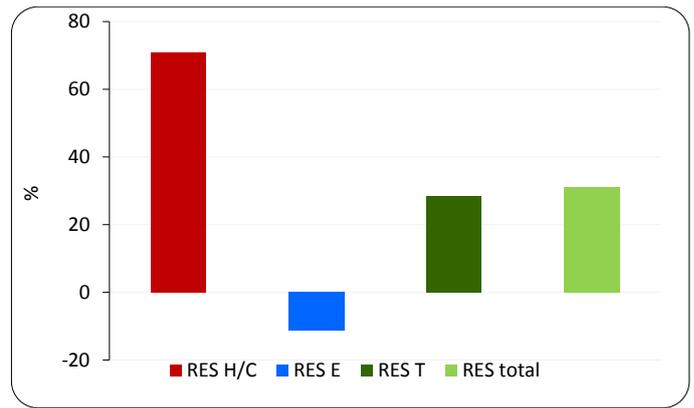


Figure 15-3. Deviation from NREAP in the RES consumption in Luxembourg in 2012.

15.2 Sources of renewable energy

Biomass was the main renewable energy source in Luxembourg with a 47.7% contribution in renewable energy mix in 2012, followed by biofuels with 36%, hydropower with 6.8%, wind with 4.9%, solar with 3.8% and heat pumps with 0.9%.

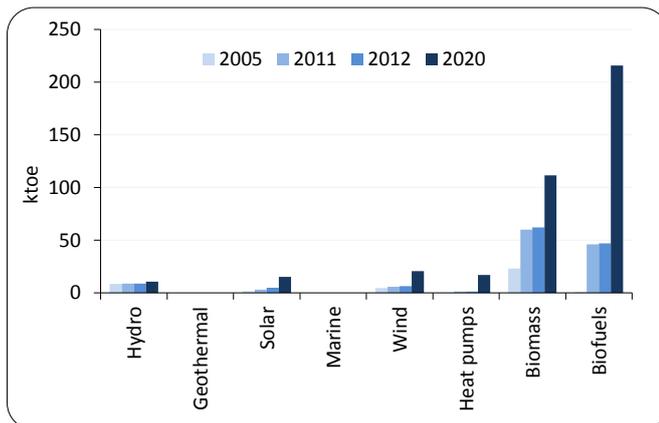


Figure 15-4. Contribution of renewable energy sources in Luxembourg: actual and projected in 2020

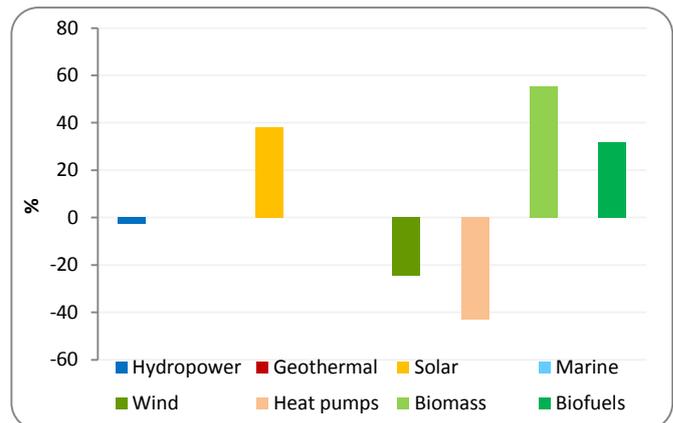


Figure 15-5. Deviation from NREAP in the contribution of renewable sources in Luxembourg in 2012

Biofuels use in transport sector in Luxembourg made the fastest progress between 2005 and 2012 with 657% per annum in average reaching 47 ktoe (2.0 PJ) in 2012. This development was faster than what was planned in the NREAP exceeding the respective expected uses in both years: 90.1% (+21.8 ktoe) more in 2011 and 31.7% (+11.3ktoe) more in 2012.

More than half of 2011-2012 additional renewable energy in Luxembourg came from biofuels

Biomass use for electricity and heat consumption in Luxembourg increased in 2011 with +36.8 ktoe (26.5% per annum in average) from 23.2 ktoe (0.97 PJ) in 2005. It increased further between 2011 and 2012 with 3.95% (+2.37 ktoe). This development was enough to surpass the expected NREAP uses in both 2011 and 2012: 84.4% (+27.4 ktoe) more in 2011 and 55.3% (+22.2 ktoe) more in 2012.

The development of solar technology was faster than what was expected according to the NREAP in both 2011 and 2012. It reached in 2011 the amount of 3.24 ktoe (0.14 PJ)

increasing then further with 53.5% (+1.73 ktoe) in 2012 over 1.72 ktoe (0.07 PJ) in the baseline year. These values are over the expected levels respectively by 23.5% (+0.62 ktoe) and 38.2% (+1.37 ktoe).

In 2020, the contribution of biofuels is expected to cover 55.2% of total renewable energy mix planned for this year while the contribution of biomass is expected to decrease to 28.6%. The contribution of other renewable energy sources will be as following: wind 5.3%, heat pumps 4.3%, solar 3.9% and hydropower 2.7%.

15.3 Renewable energy share

The overall renewable energy contribution in Gross Final Energy Consumption in Luxembourg reached 2.87% in 2011 and 3.13% in 2012. Comparing with the expected shares for 2011 and 2012 the overall share of RES was under by 0.03% points in year 2011 and over by 0.23% points in 2012. The 2020 target that Luxembourg has to reach for the overall RES share is 11.0%.

In 2009 Luxembourg already exceeded the 2010 NREAP planned overall RES share meeting also the overall expected shares for 2011 and 2012 and the indicative RES trajectory for 2011/2012.

In 2011 the overall RES share in Luxembourg slightly decreased missing the planned share for that year. Nevertheless in 2012 Luxembourg again exceeded the NREAP overall RES share for this year by 0.2% points. Although RES share remains above both the minimum trajectory and the NREAP targets, based on data reported in 2011 and 2012 Luxembourg still has to achieve a significant increase in overall RES share in its Gross Final Energy Consumption in order to reach the 2020 targets

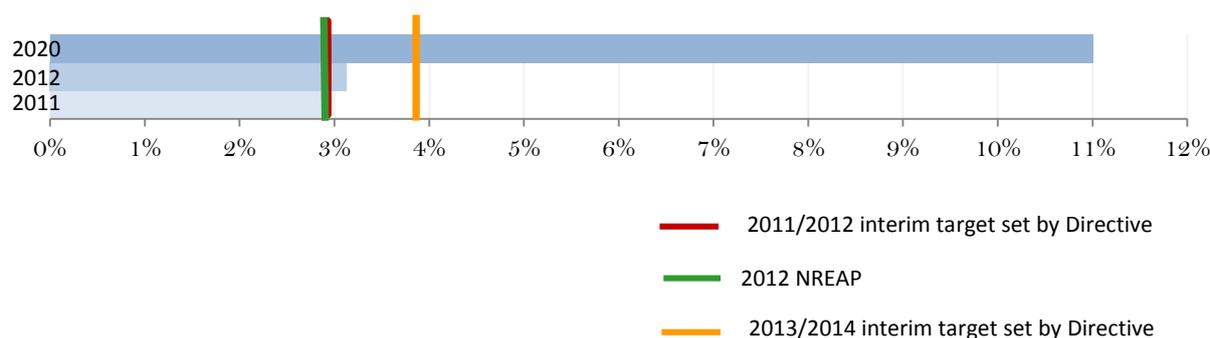


Figure 15-6. Overall RES share in Luxembourg, 2011-12

Renewable energy share in heating/cooling sector made the main progress between 2005 and 2012 increasing with 3.29% points from 1.7% in baseline year. This development was faster than what was expected according to the NREAP exceeding the expected shares in both years: 2.5% points over in 2011 and 2.29% points over in 2012.

The share of renewable energy in transport sector reached 2.06% in 2011 increasing then with 0.57% points in 2012. Comparing with expected NREAP shares the current

development of renewable energy in this sector was over by 0.8% points in 2011 and 0.41% points over in 2012.

In electricity sector the share of renewable energy increased with +1.9% points in 2011 but only with +0.6% points more in 2012. This development was slower than what was expected missing the expected shares by 0.33% points in 2011 and 0.76% points in 2012.

Major increase from year 2012 until 2020 is expected to happen in transport sector (+7.81% points) followed by electricity sector (+7.16% points) and heating/cooling sector (+3.51% points).

15.4 Renewable electricity

15.4.1 Installed capacity

The renewable energy installed capacity in Luxembourg increased with 6.2% per annum in average between 2005 and 2011 reaching 140 MW and further more in 2012 with 33.6% (+47 MW). The development of renewable energy installed capacity in Luxembourg was faster than what was planned in the NREAP being over the respective expected capacities in both 2011 and 2012: 16.7% (+20 MW) over in 2011 and 33.6% (+36 MW) over in 2012.

In 2012 solar technology covered 40.1% of total renewable energy installed capacity in Luxembourg followed by windpower with 31%, hydropower with 18.2% and biomass with 10.7%.

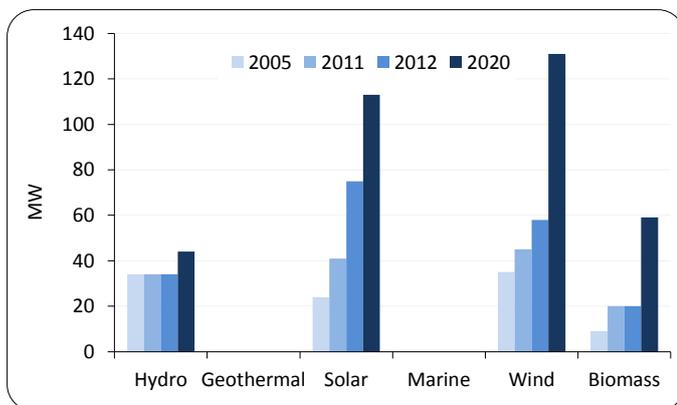


Figure 15-7. RES capacity deployment and progress until 2020 in Luxembourg.

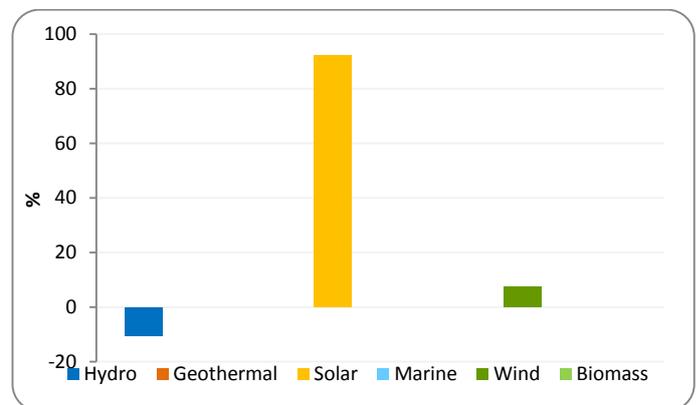


Figure 15-8. Deviation from NREAP in the RES installed capacity in Luxembourg in 2012.

Solar photovoltaic increased its capacity between 2005 and 2011 with 70.8% (+17 MW) reaching 41 MW. It had then the fastest development during period 2011-12 with 82.9% (+34 MW). This development was faster than what was projected in the NREAP exceeding the expected capacities in both 2011 and 2012: 51.9% (+14 MW) over in 2011 and 92.3% (+36 MW) over in 2012.

72.3% of additional renewable electricity installed capacity in Luxembourg between 2011 and 2012 was provided by photovoltaic

Wind capacity also increased fast during 2011-12 time span with 28.9% (+13 MW) from 45 MW reached in 2011. Comparing with NREAP capacities for 2011 and 2012 this technology

developed faster than planned being over the respective expected capacities with 12.5% (+5 MW) and 7.4% (+4 MW).

Biomass capacity reached in 2011 the amount of 20 MW remaining then in this level even in 2012. Nevertheless this capacity was found to be higher than the expected capacity for year 2011 with 33.3% (+ 5MW) and to meet the expected capacity for year 2012.

Even than an increase was planned in hydropower capacity during period 2005-2011 this technology didn't change from the baseline level of 34 MW remaining unchanged even in year 2012. The deviation from the expected capacities was equal in both years with 10.5% (- 4 MW).

In 2020 wind power is expected to have the main contribution in renewable installed capacities in Luxembourg with 38% followed by solar photovoltaic with 32%, biomass with 17% and hydropower with 13%.

15.4.2 Consumption

Renewable electricity consumption in Luxembourg amounted to 291 GWh (1 PJ) in 2011 and 306 GWh (1.1 PJ) in 2012 from 214.3 GWh (0.8 PJ) in 2005. Nevertheless the renewable electricity consumption in Luxembourg was over the NREAP planned value only in year 2011 exceeding it with 3.2% (+9 GWh) missing then the 2012 expected consumption by 11.3% (- 39 GWh). In 2020 the renewable electricity consumption in Luxembourg is expected to amount to 781 GWh (2.8 PJ).

In 2012 hydropower provided 33.7% of total renewable electricity consumption in Luxembourg followed by biomass with 29.7%, wind power with 24.2% and solar photovoltaic with 12.4%.

The development of renewable energy from hydropower experienced an increase by 0.7% per annum in average (+4.9 GWh) between 2005 and 2012 reaching 103 GWh (0.37 PJ). A very slightly increase (+0.98% or 1 GWh) took place during 2011-12 period. This development was slower that what was planned according to the NREAP missing the expected levels in both 2011 and 2012: 3.77% (-4 GWh) under in 2011 and 2.8% (-3 GWh) under in 2012.

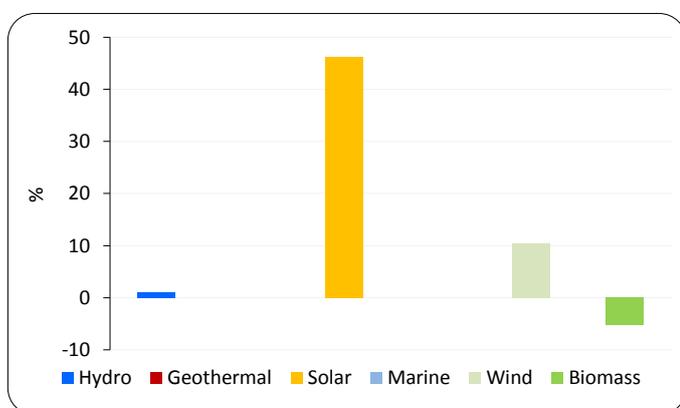


Figure 15-9. Relative increase/decrease of RES electricity sources in Luxembourg, 2011-12

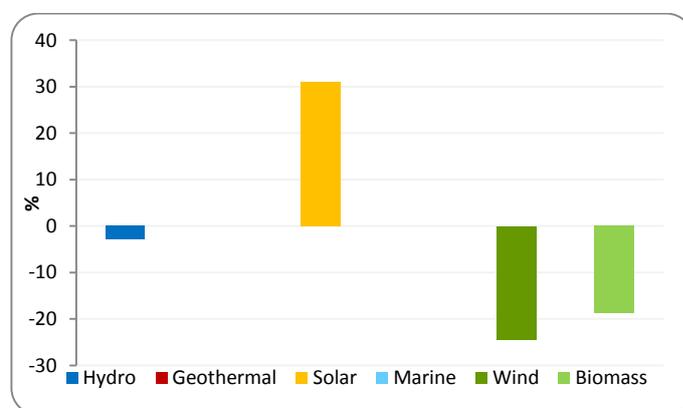


Figure 15-10. Deviation from NREAP in the RES electricity consumption in Luxembourg in 2012.

Biomass had the fastest increase with 108.2% (+49.9 GWh) between 2005 and 2011 reaching 96 GWh. This development was enough to exceed the expected renewable electricity consumption for year 2011 with 12.9% (+11 GWh). Nevertheless a decrease by 5.2% (-5 GWh) in renewable electricity consumption from this source took place between 2011 and 2012 putting this consumption 18.8% (-21 GWh) under the expected NREAP level for this year.

Almost 50% of additional renewable electricity consumption in Luxembourg between 2011 and 2012 came from biomass.

Renewable electricity from wind power increased by 14.6% between 2005 and 2011 reaching 67 GWh (0.2 PJ) and further more in 2012 with 10.45% (+7 GWh). Nevertheless this development was not faster than the expected NREAP development for both 2011 and 2012: 5.6% (-4 GWh) under in 2011 and 24.5% (-24 GWh) under in 2012.

Solar photovoltaic increased with 20.3% during period 2005-2012 over 17.7 GWh in the baseline year. Renewable electricity consumption from this technology increased further in 2012 with 46.15% (+12 GWh). These increases were higher than what was planned in the NREAP for both 2011 and 2012: 30% (+6 GWh) higher in 2011 and 31% (+9 GWh) higher in 2012.

15.5 Renewable energy in heating & cooling

The use of renewable energy in heating and cooling in Luxembourg increased by +34.3 ktoe (+175%) during 2005-2011 and furthermore with +3.5 ktoe (+6.5%) in 2012. This increase was faster than the projected NREAP development being over by 93.9% (+26.1 ktoe) in 2011 and 70.3% (+23.7 ktoe) in 2012. The heat consumption from renewable energy sources is expected to reach 107.9 ktoe (4.5 PJ) in 2020.

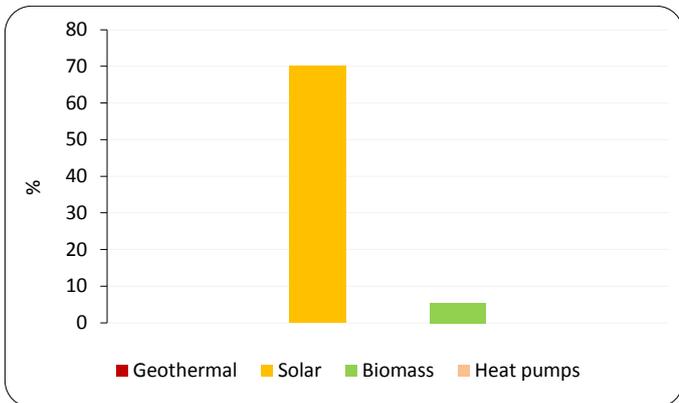


Figure 15-11. Relative increase/decrease of RES heating/cooling sources in Luxembourg, 2011-12.

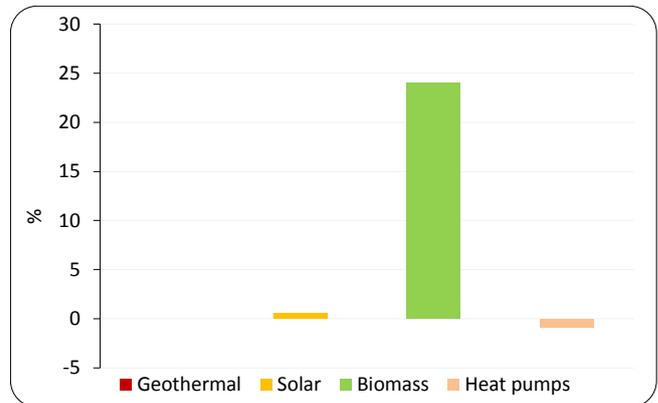


Figure 15-12. Deviation from NREAP in the RES heat consumption in Luxembourg in 2012.

In 2012 biomass contributed with almost 95% in the total heat consumption in Luxembourg and the rest was solar thermal (3.0%) and heat pumps (2.1%).

Heat pumps technology had the fastest increase in relative terms (+500%) between 2005 and 2011, in absolute terms only +1.0 ktoe, remaining then unchanged till 2012. Nevertheless this development was not as fast as planned in the NREAP being under the

respective expected heat consumptions in both 2011 and 2012: 29.4% (-0.5 ktoe) under in 2011 and 42.9% (-0.9 ktoe) under in 2012.

Solar thermal developed also fast between 2005 and 2011 with +400% (+0.8 ktoe) and furthermore in 2012 with +70% (+0.7 ktoe). This development was faster than what was planned in the NREAP exceeding the respective heat consumptions in both years: 11.1% (+0.1 ktoe) over in 2011 and 54.5% (+0.6 ktoe) over in 2012.

Biomass use for heat consumption in Luxembourg increased with 28.2% per annum in average (+32.5 ktoe) between 2005 and 2011 and furthermore in 2012 with 5.4% (+2.8 ktoe). Comparing with NREAP development the use of biomass for heat was higher than the respective expected uses in both years: 105.2% (+26.5 ktoe) higher in 2011 and 78.7% (+24 ktoe) higher in 2012.

In 2020 the contributions of heat pumps and solar thermal are expected to be increased respectively to 15.7% and 7.5% while the contribution of biomass will decrease up to 76.8%.

15.6 Renewable energy in transport

Renewable energy consumed in transport sector in Luxembourg increased to 48 ktoe (2.0 PJ) in 2011 and 49 ktoe (2.1 PJ) in 2012 from 2.1 ktoe (0.1 PJ) in baseline year. This development was faster than what was planned in the NREAP for period 2011 and 2012 exceeding the respective expected uses by 81.8% (+21.6 ktoe) and 28.3% (+10.6 ktoe). In 2020 the use of renewable energy in this sector is expected to reach 226.2 ktoe (9.5 PJ).

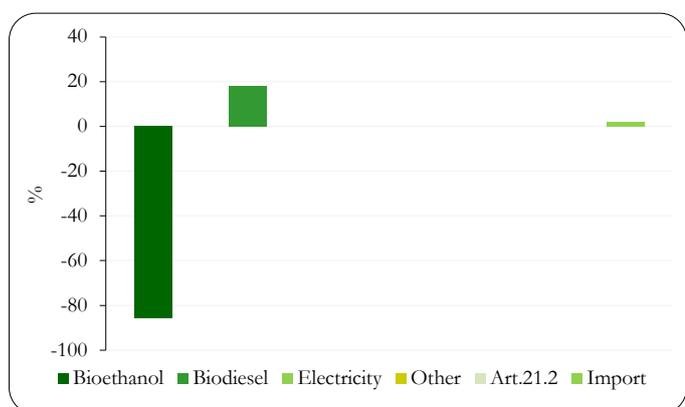


Figure 15-13. Relative increase/decrease of RES transport uses in Luxembourg, 2011-12.

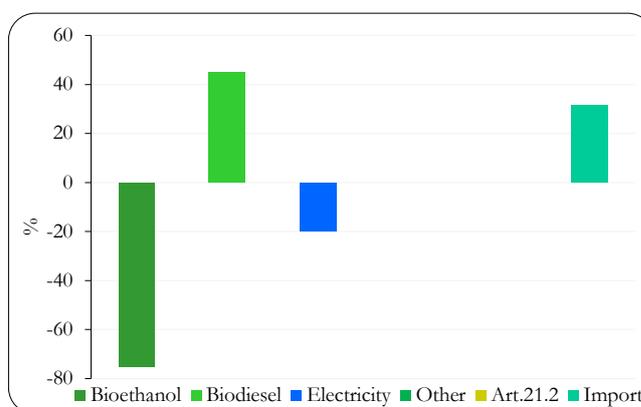


Figure 15-14. Deviation from NREAP in the RES use in transport in Luxembourg in 2012.

Biodiesel made the main progress in transport sector during 2005-2011 increasing with 633% per annum in average (+38 ktoe) but only with 17.9% (+7 ktoe) in 2011-12 time span. This development was fast enough to surpass the expected NREAP biodiesel uses in both 2011 and 2012: 81.4% (+17.5 ktoe) more in 2011 and 45.1% (+14.3 ktoe) more in 2012.

Bioethanol/bio-ETBE reached 7.0 ktoe (0.3 PJ) in 2011 but decreased significantly during 2011-12 period with 85.7% (-6.0 ktoe). In 2011 the use of bioethanol/bio-ETBE was over the expected NREAP use with 159.3% (+4.3 ktoe) but in 2012 due to the decrease that took place the use of this type of biofuel missed the planned use with 75% (-3.0 ktoe).

No other biofuels or biofuels from wastes, residues and ligno-cellulosic material were used in Luxembourg in 2011 and 2012.

Between 2005 and 2011 imported biofuels use increased more than what was planned with 750% per annum in average reaching 46 ktoe (1.9 PJ) in 2011 and furthermore with only +1.0 ktoe (+2.2%) in 2012. This development was well over the expected NREAP development in both years: 90.1% (+21.8 ktoe) over in 2011 and 31.7% (+11.3 ktoe) over in 2012.

The use of renewable electricity in transport reached 2.0 ktoe (0.3 PJ) in 2011 increasing with 81.8% over the level in 2005 remaining then unanged between 2011 and 2012. Despite of this increase the use of renewable electricity in transport sector didn't met the expected NREAP uses in both 2011 and 2012: 9.1% (-0.2 ktoe) under in 2011 and 20% (-0.5 ktoe) under in 2012.

16. Renewable energy in Croatia

16.1 Deployment of renewable energy¹⁹

The renewable energy consumed in Croatia increased from 925 ktoe (38.7 PJ) in 2005 to 940.5 ktoe (39.4 PJ) in 2011 and 982.9 ktoe (41.2 PJ) in 2012. The renewable energy consumed in Croatia is expected to further increase to 1488.4 ktoe (62.3 PJ) until 2020 (Figure 16-1).

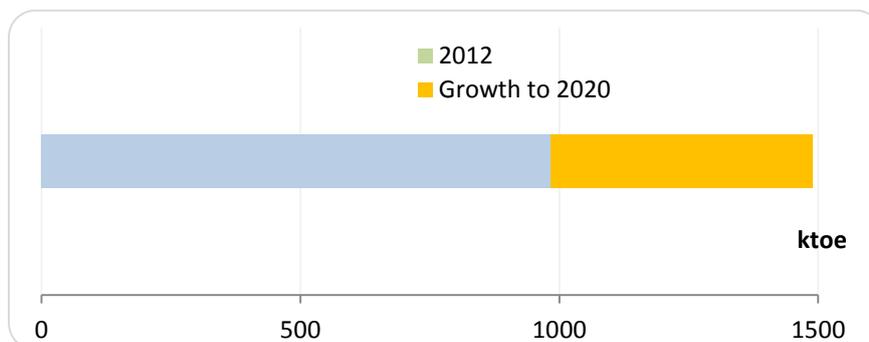


Figure 16-1. RES total in Croatia in 2012 and the expected growth to 2020 target

Renewable energy consumed in transport sector made the fastest progress from year 2005 with 36.7% per annum in average reaching 26.9 ktoe (1.1 PJ). It also increased faster between 2011 and 2012 with 56.5% (+15.2 ktoe).

The development of renewable energy in heating/cooling sector between 2005 and 2011 took place with 0.9% per annum in average reaching 371.6 ktoe (15.6 PJ) in 2011. The increase that happen during period 2011-12 had a growth rate of 5.7% (+21.3 ktoe).

Electricity sector experienced a decrease with 0.7% per annum in average (-22.8 ktoe) in the renewable electricity consumption during period 2005-2011. Nevertheless an increase with 1.1% (+5.9 ktoe) took place between 2011 and 2012 in the renewable electricity consumption in Croatia.

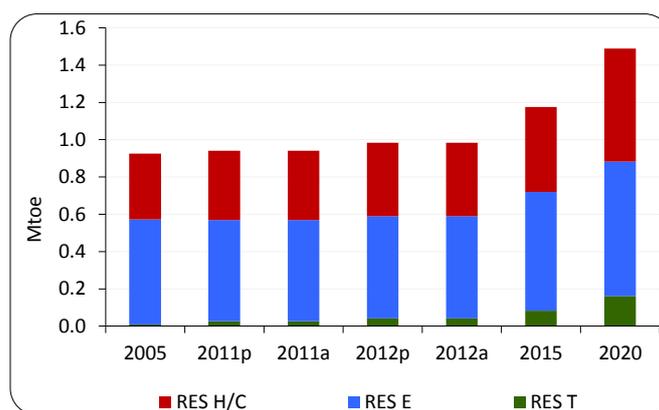


Figure 16 - 2. RES deployment in Croatia, projected growth and actual progress until 2020

Up to 2012 the fastest development is projected to take place in transport sector (+283.8%) followed by heating/cooling sector (+54.1%) and electricity sector (+31.7%).

¹⁹ Croatia's progress report for 2011-12 contains the same data as the NREAP for the same period. Therefore, the snapshot for Croatia does not include a comparison with its NREAP.

16.2 Sources of renewable energy

In 2012 more than half of renewable energy consumption in Croatia was coming from hydropower (52.7%). The rest was covered by biomass (36.4%), biofuels (3.3%), wind (3.1%), heat pumps (2.7%), solar (1.1%) and geothermal (0.8%).

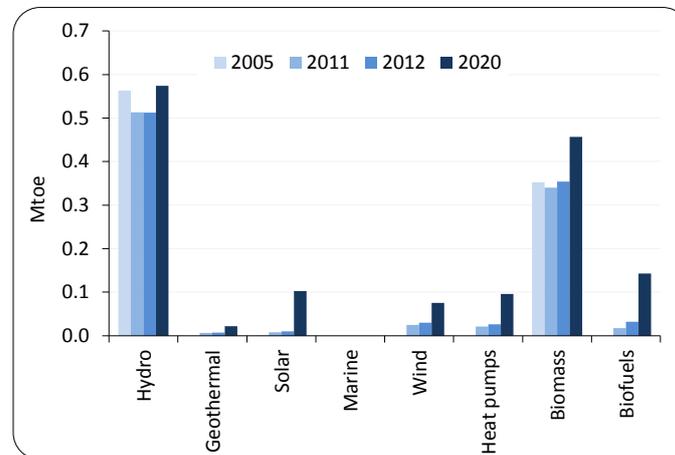


Figure 16-3. Contribution of renewable energy sources in Croatia: actual and projected in 2020

The main progress between 2005 and 2011 among renewable energy sources happened in solar technology which increased with 16978% per annum in average from a very low level in the baseline year (0.01 ktoe). Solar photovoltaic technology contribution increased further more in 2012 with 32.1% (+2.5 ktoe).

Wind technology also developed fast from the baseline year increasing with 508.4% per annum in average reaching 287.3 GWh (1.0 PJ) in 2011. The renewable energy consumption from this source increased further in 2012 with 21% (+60.3 GWh).

Biomass use electricity and heating/cooling sectors in Croatia decreased with 3.6% (-12.6 ktoe) between 2005 and 2011 reaching 340 ktoe (14.2 PJ). In 2012 the biomass use in these sectors increased by 4.1% (+13.9 ktoe) reaching 354 ktoe (14.8 PJ).

Biofuels use in transport sector in Croatia between 2011 and 2012 increased with 84.5% (+14.7 ktoe) reaching 32.1 ktoe (1.3 PJ). Between 2005 and 2011 the additional biofuels use in this sector took place with +17.4 ktoe (0.7 PJ).

Geothermal technology reached in 2011 the level of 6.2 ktoe (0.3 PJ) increasing then by 19.4% (+1.2 ktoe) in 2012.

More than 55% of additional renewable energy consumed in Croatia between 2011 and 2012 was covered by biofuels

Heat pumps use in heating/cooling sector in Croatia reached 21.4 ktoe (0.9 PJ) which increased further in 2012 with 23.4% (+ 13.9 ktoe).

Hydropower was the only technology that decreases its energy consumption between 2005 and 2012. It reached 5969.7 GWh (21.5 PJ) in 2011 from 6547 GWh (23.6 PJ) decreasing then further in 2012 with 0.1% (-6.9 GWh).

The fastest progress from 2012 until 2020 is expected in solar technology (+902%), followed by biofuels (+345.5%), heat pumps (+262%), geothermal (+195.8%), wind (+153%), biomass (+29%) and hydropower (+12%).

16.3 Renewable energy share

The overall renewable energy contribution in Gross Final Energy Consumption in Croatia reached 14.2% in 2011 and 15.1% in 2012. The 2020 target that Croatia has to reach for the overall RES share is 20.1%.

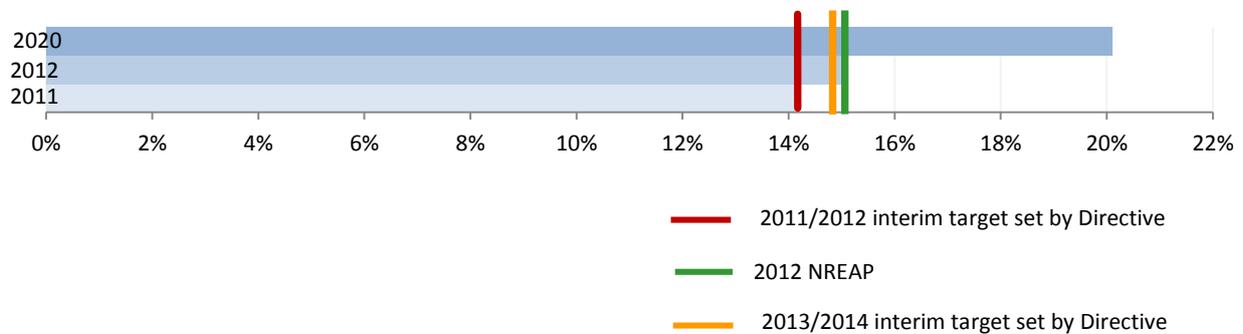


Figure 16-4. Overall RES share in Croatia, 2011-12

The overall RES share in Croatia in 2011-2012 has closely met the targets defined in the NREAP, exceeding the indicative minimum trajectory for 2011/2012. Also considering that the overall target RES share is set in the NREAP above the indicative trajectory defined in RED Directive, based on data reported in 2011 and 2012, Croatia seems in a good position for the achievement of 2020 RES share target

The share of renewable energy in electricity sector increased by +1.2% points in 2011 compared with 2005 increasing then with +1.1% points in 2012.

The increase of RES share in heating/cooling sector from 2005 was with +1.8% points in 2011 and it increased further with +0.7% points in 2012.

The share of renewable energy in transport sector increased from 0.5% in the baseline year to 1.4% in 2011 increasing further more with +0.9% points in 2012.

Major increase from year 2012 expected to be achieved until 2020, will be in transport (from 2.2% to 12.5%), followed by heating/cooling sector (from 13.5% to 19.6%) and electricity sector (from 35.6% to 39%).

16.4 Renewable electricity

16.4.1 Installed capacity

The renewable energy installed capacity in Croatia reached 2275 MW in 2011 and 2315.4 MW in 2012 from 2091 MW in 2005. In 2020 Croatia has planned to reach 3043 MW of installed renewable energy capacity.

In 2012 more than 92% of renewable installed capacity in Croatia was hydropower and the rest wind (6.8%), biomass (0.5%) and solar (0.3%).

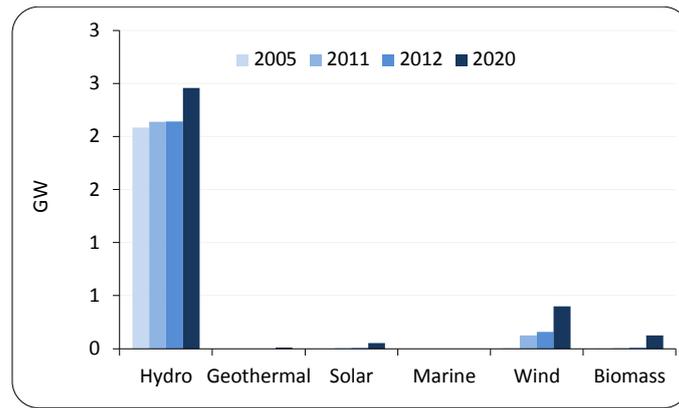


Figure 16-5. RES installed capacity in Croatia, projected growth and actual progress until 2020

The fastest progress between 2005 and 2011 took place in wind power which increased with +330% per annum in averages reaching 125 MW in 2011 and further more with 26.5% (+33 MW) in 2012.

Biomass installed capacity also increased fast during period 2005-2011 with 25% per annum in average but only with +3 MW in absolute terms. This capacity increased also fast between 2011 and 2012 with 116% (+5.8 MW) in 2012 reaching 10.8 MW.

Hydropower installed capacity increased by 2.7% between 2005 and 2011 reaching 2139 MW increasing then slightly with 0.05 (+1.0 MW) in 2012.

Solar photovoltaic installed capacity reached 6.4 MW in year 2011 increasing further with 6.7% (+0.4 MW) in 2012.

In 2020 the contribution of hydropower installed capacity is expected to decrease to 80.7% While the capacities of other technologies as wind, biomass, solar photovoltaic and geothermal are expected to increase their contribution respectively to 13.1%, 4.1%, 1.7% and 0.3%.

16.4.2 Consumption

Renewable electricity consumption in Croatia decreased during period 2005 – 2012 reaching 6302 GWh (22.7 PJ) in 2011 and 6370.6 GWh (22.9 PJ) in 2012 from 6567.4 GWh in 2005 (23.6 PJ). In 2020 the renewable electricity consumption in Croatia is expected to reach 8388.4 GWh (30.2 PJ).

In 2012 almost 94% of renewable electricity consumption in Croatia was coming from hydropower and the rest was wind with 5.5%, biomass with 0.8% and solar photovoltaic with 0.1%.

One-third of gross final electricity consumption in Croatia in 2012 was covered by hydropower

The fastest development in relative terms in Croatia took place in solar photovoltaic technology which increased its renewable electricity between 2005 and 2011 with 2000% per annum in average from the very low level in the baseline year (0.1 GWh). Nevertheless the renewable electricity from this technology decreased during period 2011-12 with 39.7% (-4.8 GWh) reaching 7.3 GWh (0.026 PJ) in 2012.

Renewable electricity from wind technology also increased fast between 2005 and 2011 increasing with 487.4% per annum in average over the 9.5 GWh (0.034 PJ) in the baseline year. The renewable electricity from this technology continues to increase until 2012 with 21% (+60.3 GWh).

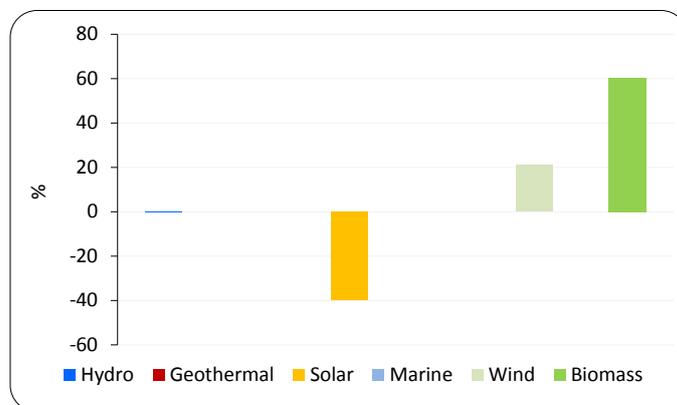


Figure 16 - 6. Relative increase/decrease of RES electricity sources in Croatia, 2011-12

Biomass use for electricity recorded an increase of 203% in 2011 from 22.1 GWh (0.039 PJ) in the baseline year. It increased further with 60.3% (+19.9 GWh) in 2012 reaching 347.6 GWh (1.25 PJ).

Hydropower renewable electricity experienced a decrease by 8.8% (-577.2 GWh) between 2005 and 2011 from 6546.9 GWh (23.6 PJ) in 2005. This type of renewable electricity decreased then further in 2012 reaching 5962.8 GWh (21.5 PJ).

16.5 Renewable energy in heating & cooling

The use of renewable energy in heating and cooling in Croatia increased by 5.6% (+19.8 ktoe) between 2005 and 2011 reaching 371.6 ktoe (15.6 PJ). The additional use of renewable energy in this sector amounted to +21.3 ktoe (+5.7 %) reaching 392.9 ktoe (16.4 PJ) in 2012. The heat production from renewable energy sources is expected to reach 605.4 ktoe (25.3 PJ) in 2020.

In 2012 89% of renewable energy consumed in heating/cooling sector in Croatia was biomass and the rest was shared between heat pumps (6.7%), solar thermal (2.4%) and geothermal (1.9%).

Solar photovoltaic developed fast in relative terms between 2011 and 2012 with 43.3% (+2.9 ktoe) reaching 9.6 ktoe (0.3 PJ) in 2012.

Heat pumps was the second technology increasing fast during period 2011-12 with 23.4% (+5.0 ktoe) reaching 26.4 ktoe (1.1 PJ) in 2012.

Almost two-third of additional renewable heat consumption between 2011 and 2012 in Croatia was covered by heat pumps

The development of geothermal thermal technology between 2011 and 2012 took place with 19.4% (+1.2 ktoe) reaching 7.4 ktoe (0.3 PJ) in 2012.

Biomass use in this sector decreased between 2005 and 2011 with 4.1% (-14.5 ktoe) from 351.8 ktoe (14.7 PJ) increasing then further with 3.6% (+12.2 ktoe) between 2011 and 2012.

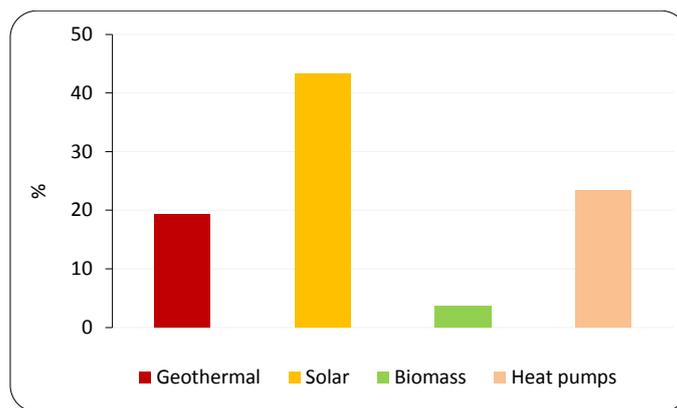


Figure 16-7. Relative increase/decrease of RES heating/cooling sources in Croatia, 2011-12

In 2020 almost two-third (65.5%) of renewable energy consumed in heating/cooling sector in Croatia is expected to be supplied by biomass and the rest is expected to be solar thermal (16.1%), heat pumps (15.8%) and geothermal (2.6%).

16.6 Renewable energy in transport

The use of renewable energy in transport reached 26.9 ktoe (1.1 PJ) in 2011 and 42.1 ktoe (1.8 PJ) in 2012 from 8.4 ktoe (0.4 PJ) in 2005. The use of renewable energy in transport sector in 2020 is expected to reach 161.6 ktoe (6.8 PJ).

In 2012 the contribution of renewable energy in transport sector in Croatia was shared between biodiesel (76.2%) and renewable electricity (23.8%).

Biodiesel use in transport sector in Croatia reached 17.4 ktoe (0.7 PJ) in 2011 increasing then with 84.5% (+14.7 ktoe) between 2011 and 2012.

The use of renewable electricity in 2011 reached 9.5 ktoe (0.4 PJ) increasing with 13.1% (+1.1 ktoe) from the baseline year. Between 2011 and 2012 the use of renewable electricity in this sector developed with 5.3% (+0.5 ktoe), reaching 10.0 ktoe (0.42 PJ) in 2012.

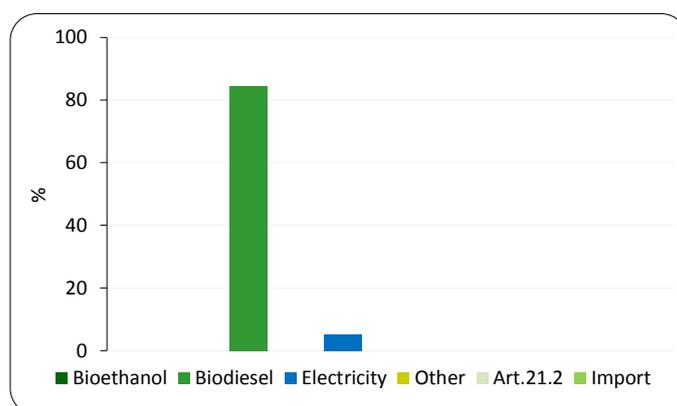


Figure 16-8. Relative increase/decrease of RES transport uses in Croatia, 2011-12

In 2020 the renewable energy consumed in transport sector in Croatia is expected to be shared between biodiesel (75.2%), renewable electricity (11.5%), bioethanol/bio-ETBE (10.1%) and other biofuels (3.2%).

17. Renewable energy in Hungary

17.1 Deployment of renewable energy

The renewable energy consumed in Hungary increased from 5.0 ktoe (0.2 PJ) in 2005 to 1545.8 ktoe (64.7 PJ) in 2011 decreasing then to 1491.2 ktoe (62.4 PJ) in 2012. Renewable energy consumption in Hungary is expected to further increase to 2879.3 ktoe (120.6 PJ) until 2020 (Figure 17-1).

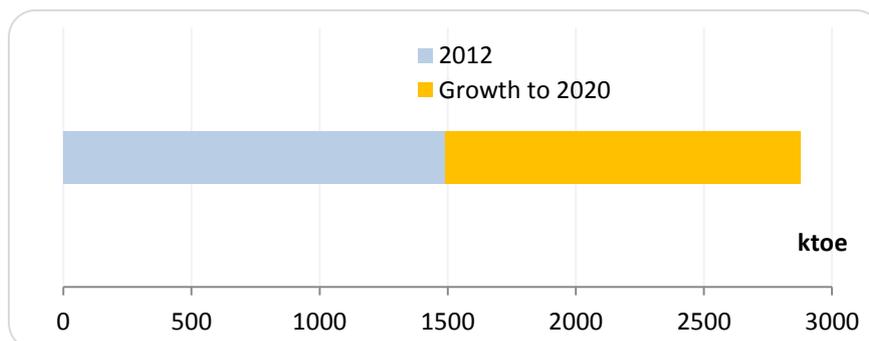


Figure 17-1 RES total in Hungary in 2012 and the expected growth to 2020 target

The development of renewable energy in heating/cooling sector noticed the main progress among sectors in Hungary between 2005 and 2011 reaching 1133 ktoe (47.4 PJ). During 2011-12 a decrease by 1.6% (-18.0 ktoe) took place in the renewable energy consumed in this sector. Despite of this downward trend between 2011 and 2012 renewable energy consumed in heating/cooling sector in Hungary was over the expected NREAP uses in both years: 20.4% (+192.0 ktoe) over in 2011 and 18.1% (+171.0 ktoe) in 2012.

Renewable energy consumption in Hungary exceeded the expected NREAP values in both years: by 11.45% (+158.8 ktoe) in 2011 and by 3.64% (+52.4 ktoe) in 2012.

Renewable electricity had the second highest absolute increase between 2011 amounting to 232.8 ktoe (9.7 PJ) in 2011. Between 2011 and 2012 renewable electricity followed a downward trend decreasing with 4.5% (-10.6 ktoe). The development of this type of renewable energy in Hungary was slower than what was planned in the NREAP for both years: 5.38% (-13.2 ktoe) behind in 2011 and 17.34% (-46.6 ktoe) behind in 2012.

Transport sector in Hungary experienced in 2011 a use of renewable energy of 180.0 ktoe (7.5 PJ) which decreased then in 2012 with 14.4% (-26.0 ktoe). Comparing with expected developments of renewable energy consumed in this sector Hungary was under in both 2011 and 2012: 10.0% (-20.0 ktoe) under in 2011 and 31.86% (-72.0 ktoe) under in 2012.

The fastest development between 2012 and 2020 is expected in transport sector (+247.4%) followed by electricity sector (+116.6%) and heating/cooling sector (+67.1%).

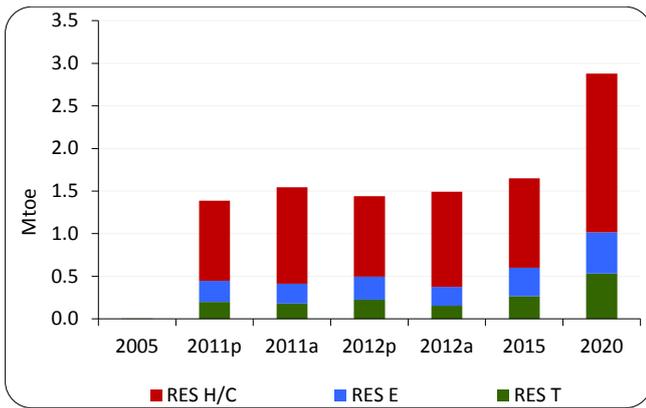


Figure 17-2. RES deployment in Hungary: projected growth and actual progress until 2020.



Figure 17-3. Deviation from NREAP in the RES production in Hungary in 2012.

17.2 Sources of renewable energy

In 2012 biomass use for electricity and heat production had a share of 77.6% in total renewable energy mix in Hungary. The rest includes the contributions of other renewable energy sources: biofuels with 9.3%, geothermal with 7.3%, wind with 4.1% and hydropower with 1.3%.

Biomass had the highest additional use between 2005 and 2011, +1181.6 ktoe which decreased in 2012 to +1144.4 ktoe. This development was enough to exceed the expected NREAP uses for this source in both years: 19.8% (+195.1 ktoe) more in 2011 and 17.5% (+170.9 ktoe) more in 2012.

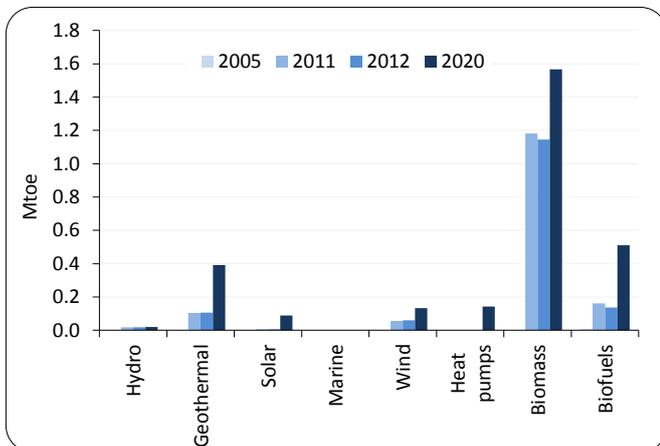


Figure 17-4. Contribution of renewable energy sources in Hungary: actual and projected in 2020

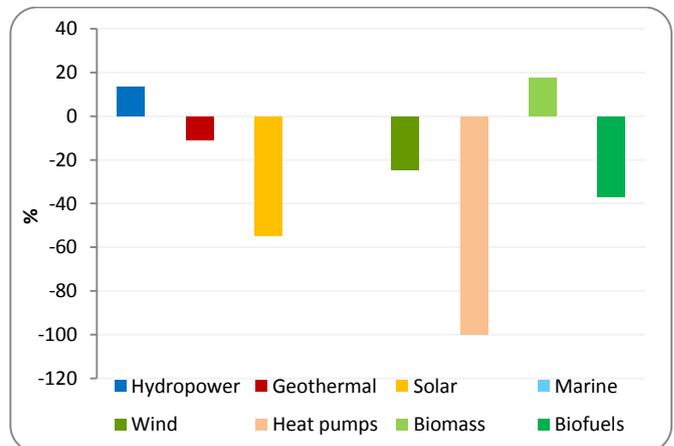


Figure 17-5. Deviation from NREAP in the contribution of renewable sources in Hungary in 2012

Biofuels use in transport sector in Hungary reached 162.0 ktoe (in 2011 and 137.0 ktoe in 2012) over 5.0 ktoe in 2005. Despite this decrease the development of this source between 2005 and 2012 was enough to exceed the respective expected NREAP uses in both 2011 and 2012: 19.8% (+195.1 ktoe) over in 2011 and 17.5% (+170.9 ktoe) over in 2012.

Biomass contributed for 5.4% to gross final energy consumption in Hungary in 2012.

Geothermal had the third additional increase between 2005 and 2011 with +104.0 ktoe increasing then with 2.9% (+3.0 ktoe) in 2012. Nevertheless this development was not enough to meet the NREAP planned levels in both 2011 and 2012: 3.7% (-4.0 ktoe) under in 2011 and 10.8% (-13.0 ktoe) under in 2012.

Solar technology use for electricity and heat production reached 6.2 ktoe in 2011 increasing then after with 8.4% (+0.5 ktoe) in 2012. Nevertheless these values were found to be under the expected NREAP values in both years: 34.5% (-3.3 ktoe) under in 2011 and 54.7% (-8.1 ktoe) under in 2012.

In 2020 biomass share is expected to decrease to 54.9% remaining still the main source of renewable energy in Hungary. The rest will be covered by biofuels with 17.9%, geothermal with 13.7%, heat pumps with 5%, wind with 4.7, solar with 3.1% and hydropower with 0.7%.

17.3 Renewable energy share

The overall renewable energy contribution in Gross Final Energy Consumption in Hungary reached 9.1% in 2011 and 9.6% in 2012. Comparing with the expected shares for 2011 and 2012 the overall share of renewable energy was over by 1.8% points in year 2011 and 2.2% points in 2012. The 2020 target that Hungary has to reach for the overall RES share is 14.7%.

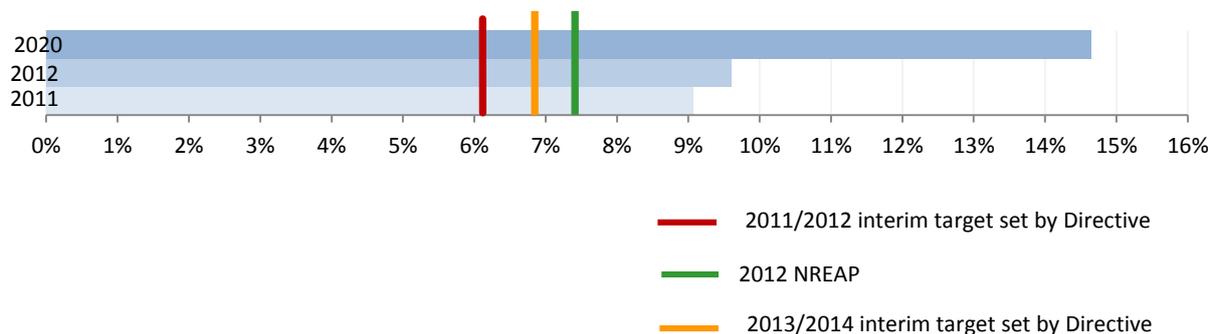


Figure 17-6. Overall RES share in Hungary, 2011-12

The overall RES share in Hungary in 2011-2012 was well above the NREAP planned values and exceeded both 2011/12 and 2013/14 minimum indicative trajectories. Based on data reported in 2011 and 2012 Hungary seems in a good position for the achievement of 2020 RES share target

Renewable energy share in heating/cooling sector made the main progress between 2005 and 2012 increasing with 8.1% points. This development was faster than what was planned for 2011 and 2012 being over respectively with 3.5% points and 4.9% points.

In 2011 transport sector had a share of renewable energy equal to 5.6% which then decreased in 2012 to 5.0%. Comparing to the expected NREAP renewable energy shares in this sector Hungary was over in 2011 with 0.6% points but under in 2012 with 0.4% points.

Renewable electricity share reached 6.4% in 2011 from 4.3% in 2005 decreasing then to 6.1% in 2012. The development of renewable electricity share was slower than what was expected from NREAP: 0.2% points under in 2011 and 0.8% points under in 2012.

Major increase from year 2012 until 2020 according to the NREAP is expected in transport sector (+5.6% points) followed by heating/cooling (+5.4% points) and electricity (+4.8% points).

17.4 Renewable electricity

17.4.1 Installed capacity

The renewable energy installed capacity in Hungary reached 773.8 MW in 2011 decreasing then with 4.36% (-33.7 MW) in 2012. This slow development set the achieved installed capacity in Hungary under the planned NREAP capacities for both 2011 and 2012: 5.98% (-49.2 MW) under in 2011 and 16.2% (-142.9 MW) under in 2012. In 2020 Hungary has planned to reach 1537.0 MW in renewable energy capacity.

In 2012 biomass installed capacity had a contribution of 47% in total renewable installed capacity in Hungary followed by wind with 43.9%, hydropower with 7.4% and solar with 1.6%.

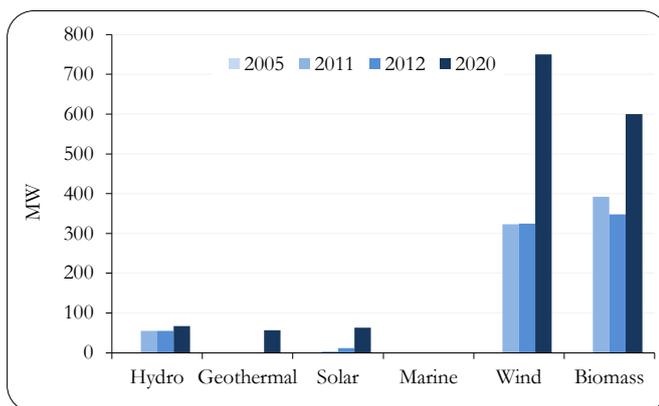


Figure 17-7. RES capacity deployment and progress until 2020 in Hungary.

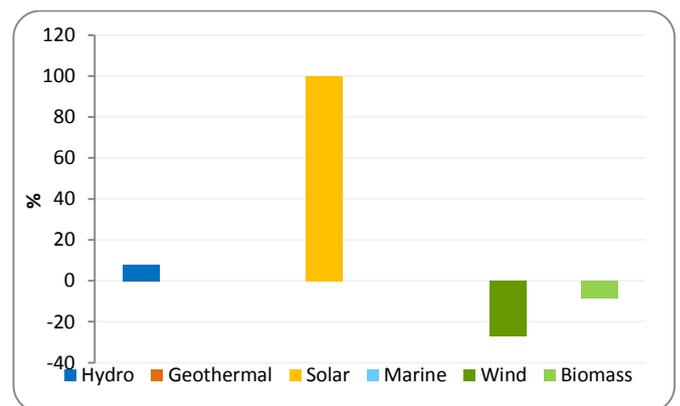


Figure 17-8. Deviation from NREAP in the RES installed capacity in Hungary in 2012.

Biomass installed capacity reached 392 MW in 2011 decreasing then with 11.2% (-44.0 MW) in 2012. The development between 2005 and 2011 was fast enough to exceed by 4.0% (+15.0 MW) the planned capacity for this year. Due to the decrease that took place between 2011 and 2012 the biomass installed capacity was under the expected NREAP value by 8.7% (-33.0 MW).

Wind was the second technology having the highest installed capacity in Hungary in 2011 with 323 MW increasing then further with 0.6% (+2.0 MW) in 2012. Nevertheless this development was slower than what was planned in the NREAP being under the respective expected capacities in both 2011 and 2012: 17.8% (70.0 MW) under in 2011 and 27% (-120 MW) under in 2012.

Hydropower installed capacity developed faster than what was planned for period 2005-2012 being over the planned capacities for 2011 (51 MW) and 2012 (51 MW) respectively by 7.5% (+3.8 MW) and 8.0% (+4.1 MW).

Solar photovoltaic tripled its capacity between 2011 and 2012, from 4.0 MW to 12.0 MW. It developed faster than the expected NREAP capacities in both years: 100% (+2.0 MW) over in 2011 and 100% (+6.0 MW) over in 2012.

In 2020 the contribution of wind power is expected to surpass by 10% points the contribution of biomass reaching 49%. The rest is expected to be divided equally with a contribution of 4% each to other technologies, hydropower, geothermal and solar.

17.4.2 Consumption

Renewable electricity consumption in Hungary amounted to 2707 GWh (9.7 PJ) in 2011 decreasing then to 2584 GWh (9.3 PJ) in 2012. This development was not fast as it was planned in the NREAP being under the respective expected consumptions in both years: 5.4% (-154 GWh) less in 2011 and 17.3% (-542 GWh) less in 2012. In 2020 the renewable electricity consumption in Hungary is expected to amount to 5597 GWh (20.1 PJ).

In year 2012 almost two-third (64.1%) of total renewable electricity consumption was coming from biomass. The rest was produced by wind (27.1%), hydropower (8.5%) and solar (0.3%).

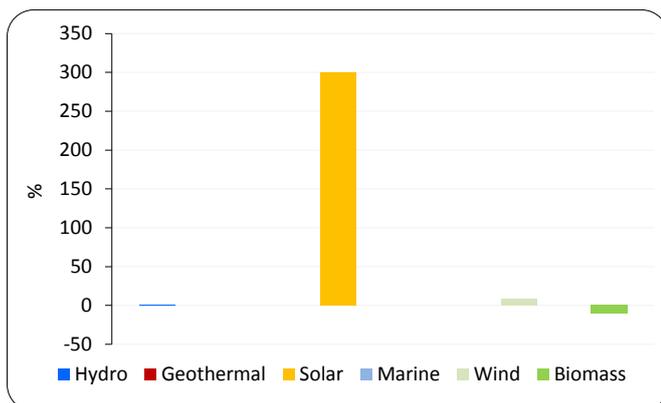


Figure 17-9. Relative increase/decrease of RES electricity sources in Hungary, 2011-12

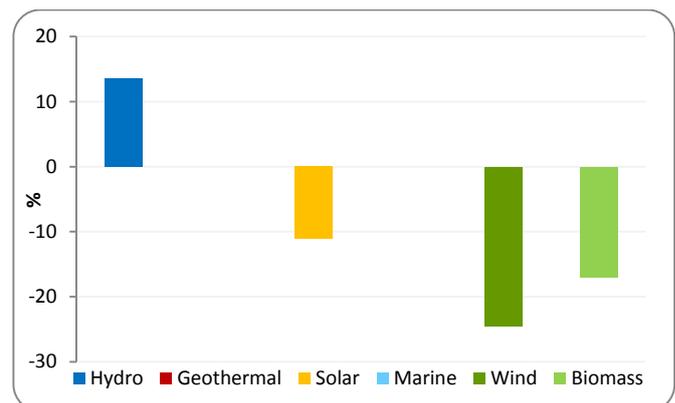


Figure 17-10. Deviation from NREAP in the RES electricity consumption in Hungary in 2012.

No changes were planned in the renewable electricity in Hungary coming from hydropower during period 2005-2012. In fact an increase in renewable electricity from this technology took place since in 2009 increasing further during period 2011-12. Due to this increase hydropower technology was producing more renewable electricity in Hungary than what was planned in the NREAP exceeding by 11.9% (+23 GWh) and 13.5% (+26 GWh) the respective expected productions for 2011 and 2012 (193 GWh).

Biomass had the highest additional electricity production between 2005 and 2011, +1844 GWh, decreasing then further by 10.2% (-188 GWh) in 2012. Comparing with expected developments for 2011 and 2012 renewable electricity production from this source was found to be under in both years: 6.4% (-127 GWh) under in 2011 and 17% (-339 GWh) under in 2012.

Two-third of additional renewable electricity consumption in Hungary between 2011 and 2012 was covered by biomass electricity

Wind power contribution increased in 2012 with 8.7% (+56 GWh) over 645 GWh (2.3 PJ) in 2011. Nevertheless the renewable electricity production from this technology was under the expected NREAP productions in both 2011 and 2012: 6.8% (-47 GWh) under in 2011 and 24.5% (-228 GWh) under in 2012.

Renewable electricity production from solar photovoltaic during period 2011-12 was lower than what was planned in the NREAP even an exceedance in installed capacities (see section over) and fast increase by 300% (+6GWh) took place. This technology missed by 60% (-3 GWh) in 2011 and 11.1% (-1 GWh) in 2012 the respective expected productions of 692 GWh and 929 GWh.

In 2020 it expected that the contribution of biomass will reach 59.4% and the rest will be wind (27.6%), geothermal (7.3%), hydropower (4.2%) and solar photovoltaic (1.4%).

17.5 Renewable energy in heating & cooling

Renewable energy consumed in heating/cooling sector in Hungary decreased between 2011 and 2012 with 1.6% (-18 ktoe) reaching 1115 ktoe (46.7 PJ). Nevertheless this use was over the expected NREAP uses in both 2011 and 2012: 20.5% (+193 ktoe) over in 2011 and 18.1% (+171 ktoe) over in 2012. In 2020 the use of renewable energy in heating/cooling sector in Hungary os planned to reach 1863 ktoe (78 PJ).

In 2012 the main contribution in renewable energy consumed in heating/cooling sector in Hungary was coming from biomass (89.9%) followed by geothermal (9.6%) and solar thermal (0.5%).

Biomass had the highest additional use between 2005 and 2011, +1023 ktoe, which then decreased to +1002 ktoe in 2012. This development was enough to exceed the expected NREAP uses in both 2011 and 2012: 25.2% (+206 ktoe) over in 2011 and 24.9% (+200 ktoe) over in 2012.

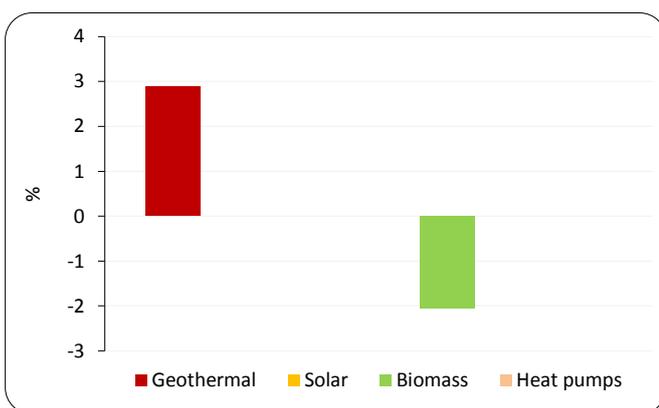


Figure 17-11. Relative increase/decrease of RES heating/cooling sources in Hungary, 2011-12.

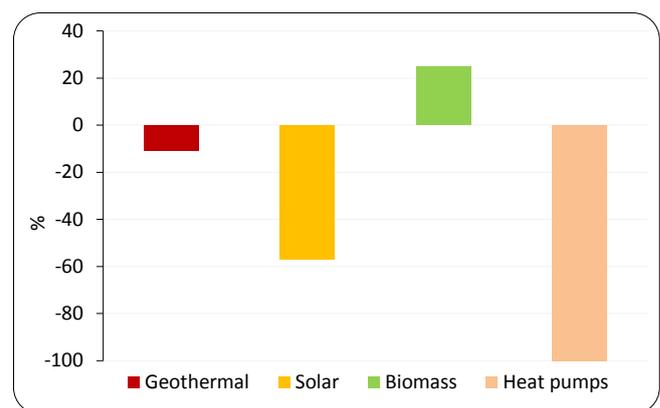


Figure 17-12. Deviation from NREAP in the RES heat consumption in Hungary in 2012.

Geothermal use for heat production had the second highest additional production between 2005 and 2011, +104 ktoe, which increased further to +107 ktoe. Nevertheless this development was not fast enough to meet the expected heat productions being under in both years: 3.7% 8-4.0 ktoe) less in 2011 and 10.8% (-13 ktoe) less in 2012.

Solar thermal development didn't follow the increasing projected trend for period 2005-2012. It reached only 6 ktoe in 2011 remaining then unchanged at this level. The deviations from expected heat productions were: 33.3% (-3 ktoe) less in 2011 and 57.1% (-8 ktoe) less in 2012.

Even that it was planned no heat production from heat pumps took place during period 2011-12.

In 2020 biomass contribution was expected to reach 68.8% of total expected renewable heat in Hungary followed by geothermal with 19.2%, heat pumps with 7.7% and solar thermal with 4.4%. The fastest progress between 2012 and 2020 is expected to happen in solar thermal technology with 158.3% per annum in average and geothermal with 29.2% per annum in average.

17.6 Renewable energy in transport

The additional use of renewable energy in transport sector in Hungary during period 2005-2011 was +175 ktoe which decreased to +149 ktoe in 2012. In comparison with expected NREAP uses renewable energy in this sector was found to be under the respective expected levels for both years: 10% (-20 ktoe) below in 2011 and 31.86% (-72 ktoe) under in 2012. The use of renewable energy in transport sector in 2020 is expected to be 535 ktoe (22.4 PJ).

In 2012 biodiesel use had the main contribution with 66.9% followed by bioethanol/bio-ETBE with 22.1% and renewable electricity with 11%.

Biodiesel made the main progress in transport sector during 2005-2011 increasing with +116 ktoe but decreasing then with 11.2% (-13 ktoe) in 2012. Despite this development the use of biodiesel in transport sector during period 2011-12 was under the expected NREAP uses for this period: 4.9% (-6 ktoe) under in 2011 and 23.7% (-32 ktoe) under in 2012.

Bioethanol/bio-ETBE increased with +49 ktoe in period 2005-2011 decreasing then with 26.1% (-12 ktoe) in 2012. These uses were found to be well under the expected NREAP uses for period 2011-12: 35.2% (-25 ktoe) under in 2011 and 58.5% (-48 ktoe) under in 2012.

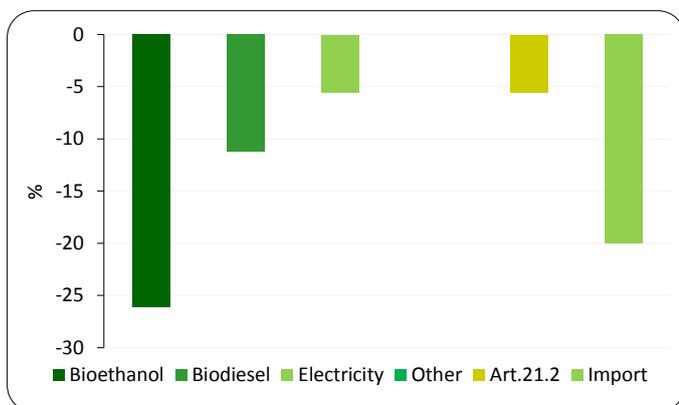


Figure 17-13. Relative increase/decrease of RES transport uses in Hungary, 2011-12.

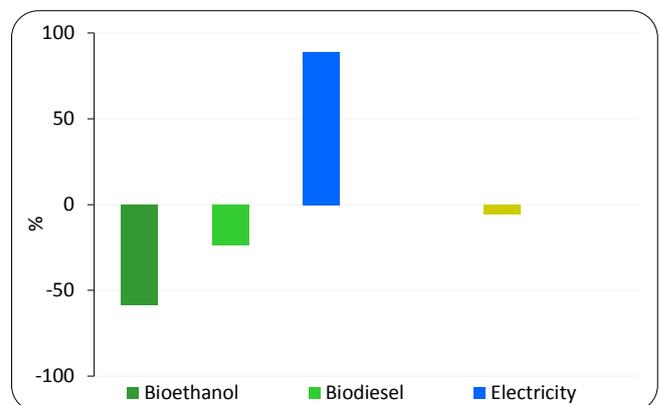


Figure 17-14. Deviation from NREAP in the RES use in transport in Hungary in 2012.

No other biofuels (biogas and vegetable oils) were used in Hungary in 2011 and 2012.

The biofuels from wastes, residues and ligno-cellulosic material met the NREAP level in year 2011 (18 ktoe) but missed it in 2012 by 5.6% (-1 ktoe).

While no contribution was expected in both years for the use of imported biofuels, their use grew to 65 ktoe (2.7 PJ) in 2011 but decreased by 20% (13 ktoe) in 2011-12 time span.

The use of renewable electricity in this sector was the only one to surpass the expected NREAP uses for 2011 and 2012 respectively by 157% (+11 ktoe) and 88.9% (+8 ktoe) the respective expected levels of 7 ktoe (0.3 PJ) and 9 ktoe (0.4 PJ).

In 2020 the picture of the contributions of different renewable energy sources in transport sector in Hungary is expected to change from the actual one due to the planned increase to 56.8% of bioethano/bio-ETBE use. The contributions of biodiesel and renewable electricity are expected to fall respectively to 37.8% and 4.5%. Other biofuels are expected to have a very marginal contribution in this year equal to 0.9%.

18. Renewable energy in Malta

18.1 Deployment of renewable energy

The renewable energy consumed in Malta reached 6.4 ktoe in 2011 increasing with 75.5% (+4.8 ktoe) in 2012. The renewable energy use in Malta is expected to further increase to 60 ktoe (2.51 PJ) until 2020 (Figure 18-1).

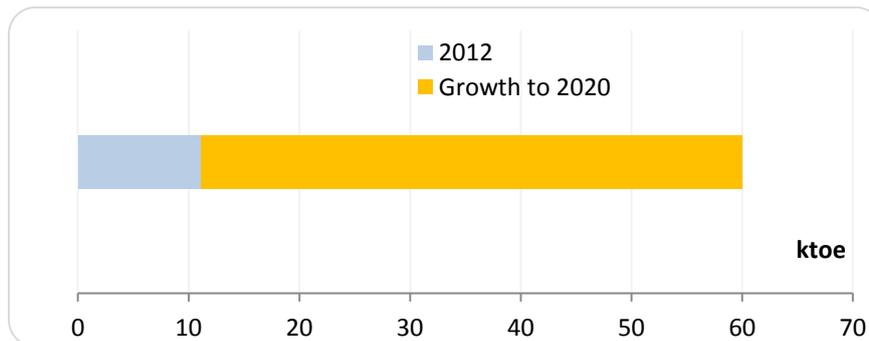


Figure 18-1. RES total in Malta in 2012 and the expected growth to 2020 target

Renewable energy in heating/cooling sector in Malta according to its NREAP is planned to follow an increasing trajectory between 2005 and 2017 (from 0 ktoe to 7.17 ktoe)

Renewable energy consumption in Malta missed the expected NREAP targets in both 2011 and 2012: by 40.75% (-4.37 ktoe) and by 11.1% (-1.4 ktoe) respectively.

decreasing then to 6.2 ktoe in 2020. In fact an increase of renewable energy consumed in this sector took place reaching in 2012 the amount of 6.7 ktoe which surpass by 8.1% (+0.5 ktoe) the 2020 planned use. Nevertheless the use of renewable energy in this sector was

under the expected NREAP planned uses in both years: 41.28% (-2.7 ktoe) under in 2011 and 6.2% (-0.44 ktoe) under in 2012.

The development of renewable energy in electricity sector was faster than planned between 2005 and 2011 exceeding the expected NREAP use for this year (0.8 ktoe) by 49.27% (+0.40 ktoe). The increase by 19.3% (+0.23 ktoe) that took place between 2011 and 2012 was not enough to surpass the expected use of renewable energy in this sector being under by 11.0% (-0.2 ktoe).

Renewable energy consumed in transport sector reached 1.32 ktoe in year 2011 increasing then further with 129.6% (+1.7 ktoe) in 2012. Nevertheless comparing with expected NREAP uses renewable energy in this sector was under in both 2011 and 2012: 61.06% (-2.07 ktoe) under in 2011 and 20.5% (-0.78 ktoe) under in 2012.

In 2020 the main progress is expected in heating/cooling sector with an average growth rate of 52.3% (+39.1 ktoe). In the transport sector the progress of renewable energy consumed is expected to happened with an average growth rate of 5.4% (+10.5 ktoe) while a decrease by 0.9% (-0.5 ktoe) is expected for the heating/cooling sector.

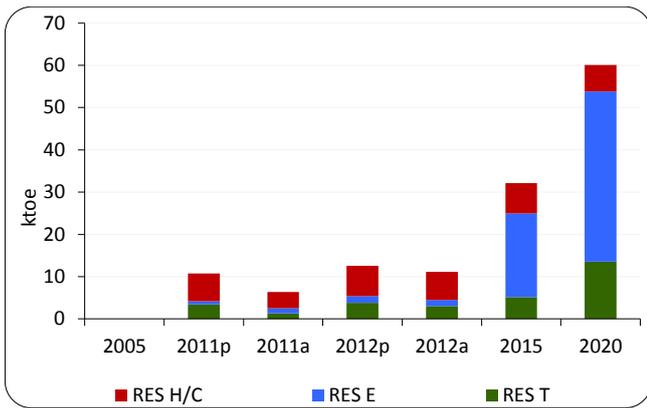


Figure 18-2. RES deployment in Malta: projected growth and actual progress until 2020.

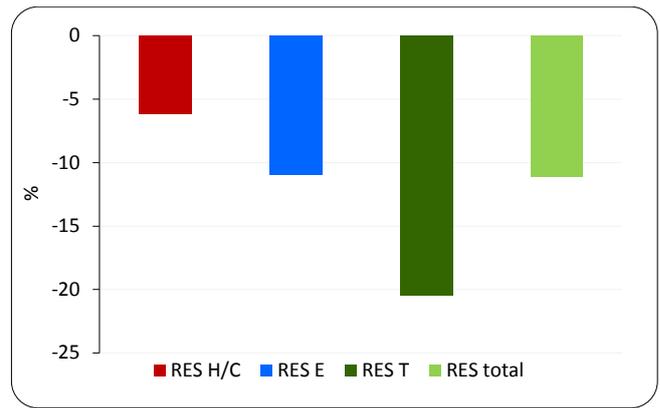


Figure 18-3. Deviation from NREAP in the RES production in Malta in 2012.

18.2 Sources of renewable energy

Renewable energy mix in Malta is dominated by solar technology which reached in 2012 a contribution of 45.2%. Biofuels followed with a contribution of 27.2% together with heat pumps with 15.8% and biomass with 11.8%.

The main progress between 2005 and 2011 was made by solar technology even that in absolute terms this increase was only 3.9 ktoe. This technology increased also fast between 2011 and 2012 with 28% (+1.1 ktoe). This development was enough to exceed the expected NREAP levels in both years: 22.39% (+0.7 ktoe) over in 2011 and 22.41% (+0.9 ktoe) over in 2012.

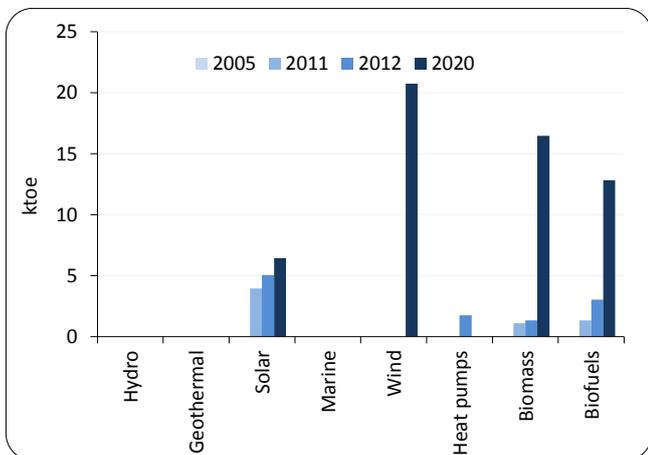


Figure 18-4. Contribution of renewable energy sources in Malta: actual and projected in 2020

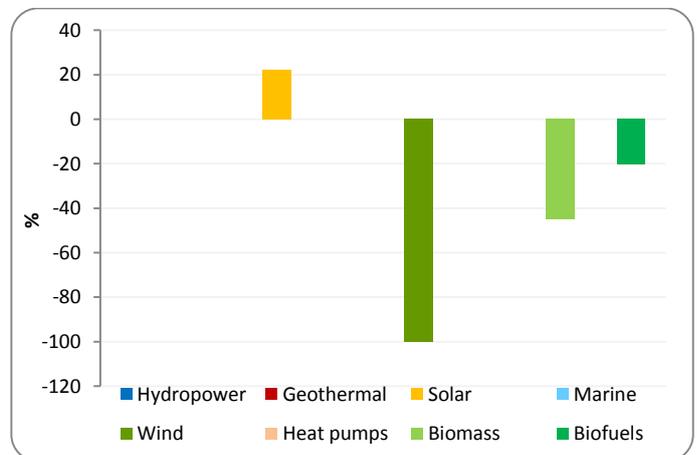


Figure 18-5. Deviation from NREAP in the contribution of renewable sources in Malta in 2012

Biofuels use in Malta increase very fast between 2011 and 2012, with 129.5% (+1.7 ktoe) reaching 3.0 ktoe in 2012. Nevertheless in comparison with expected NREAP uses this source was well behind the respective uses in both years: 61.1% (-2.1 ktoe) less in 2011 and 20.3% (-0.8 ktoe) less in 2012.

Biomass use in Malta for electricity and heat production reached only 1.09 ktoe in year 2011 decreasing slightly (-3.0% or 0.03 ktoe) in 2012. In comparison with NREAP plans biomass in Malta was found to be under the respective expected uses in both years: 49.3% (-1.1 ktoe) under in 2011 and 45.1% (-1.1%) under in 2012.

In 2020 wind is expected to have the main contribution in renewable energy mix in Malta with 38% followed by biomass with 28.6%, biofuels with 22.3% and solar with 11.2%.

18.3 Renewable energy share

The overall renewable energy contribution in Gross Final Energy Consumption in Malta reached 1.3% in 2011 and 2.7% in 2012. Comparing with the expected shares for 2011 and 2012 the overall share of RES was under by 1.0% points in year 2011 and over with 0.1% points in 2012. The 2020 target that Malta has to reach for the overall RES share is 10.2%.

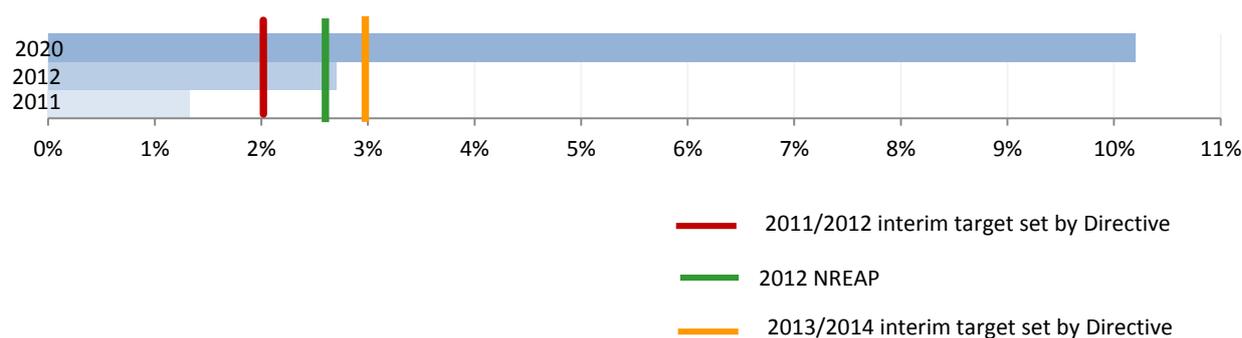


Figure 18-6. Overall RES share in Malta, 2011-12

Malta missed its planned overall RES shares in both 2010 and 2011 but in 2012 both its NREAP target and the minimum indicative 2011/12 trajectory were reached and exceeded. Although RES share remains above both the minimum trajectory and the NREAP targets, based on data reported in 2011 and 2012 Malta still has to achieve a significant increase in overall RES share in its Gross Final Energy Consumption in order to reach the 2020 targets.

Renewable energy share in heating/cooling sector increased with 5.8% points in 2011 over baseline share remaining nevertheless under the expected share for this year. The development of renewable energy share in this sector had a very significant development between 2011 and 2012 exceeding by 6.3% points the expected 2020 share. In comparison with expected share for year 2012 renewable energy in this sector surpassed it by 3.7% points.

The share of renewable energy in transport sector increased with 5.6% points in 2012 over 2.1% of year 2011. Nevertheless this share was found to be under the expected NREAP share for year 2011 (0.9% points under) but is surpassed the respective expected share in year 2012 (4.4% points over).

In electricity sector the share of renewable energy increased with only 0.6% points in 2011 and furthermore with +0.4% points in 2012. This development was very slow compared with expected NREAP development being under in each year with 0.5% points.

Major increase from year 2012 expected to be achieved until 2020, according to the NREAP, in electricity sector (+12.8% points), followed by electricity sector (from 16.7% to 27%) and transport (from 7.4% to 10.2%).

18.4 Renewable electricity

18.4.1 Installed capacity

The renewable energy installed capacity in Malta increased to 6.65 MW in 2011 and 18.72 MW in 2012. Comparing with expected developments these capacities are 38.25% (+1.84 MW) and 71.6% (+7.81 MW) over the respective NREAP planned capacities for years 2011 and 2012.

The installed capacity in Malta in year 2012 was totally solar photovoltaic which exceeded NREAP planned capacities in both years: 44.88% (+2.06 MW) over in 2011 and 75.28% (+8.04 MW) over in 2012.

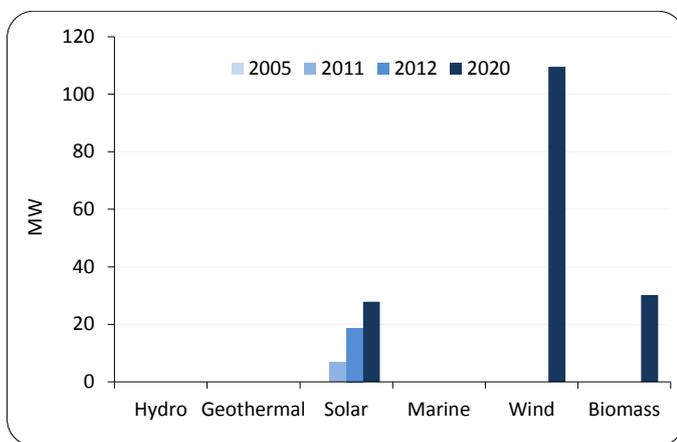


Figure 18-7. RES capacity deployment and progress until 2020 in Malta.

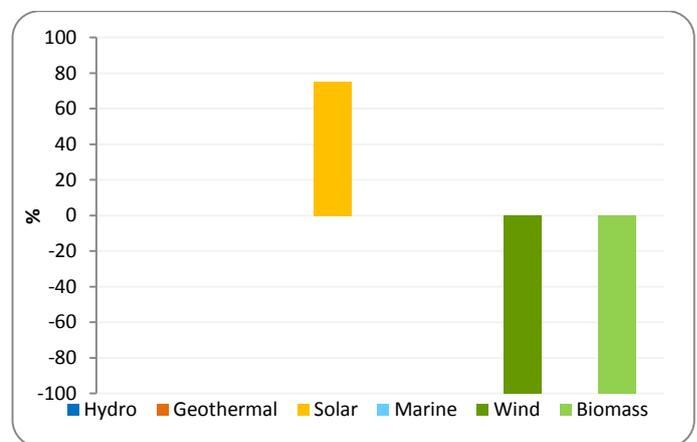


Figure 18-8. Deviation from NREAP in the RES installed capacity in Malta in 2012.

Even that a very marginal introduction of other technologies as wind and biomass was planned for period 2011 – 2012 no such capacities were registered in Malta for this period.

In 2020 the whole picture of the contributions of different renewable technologies is expected to change having as main actor the wind technology with a share of 65%. The rest is expected to be covered by biomass (18%) and solar photovoltaic (17%).

18.4.2 Consumption

Renewable electricity production in Malta amounted to 13.9 GWh (0.1 PJ) in 2011 increasing further by 19.3% (+3.0 GWh) in 2012. In comparison with expected NREAP consumption renewable electricity in Malta surpassed 49.3% (+4.6 GWh) the respective plan for year 2011 but missed it by 11% (-2.0 GWh) in year 2012. In 2020 the renewable electricity consumption in Malta is expected to amount to 468.9 GWh (1.7 PJ).

81.8% of total renewable electricity consumption in Malta in year 2012 was coming from solar photovoltaic and the rest from biomass (18.2%) even that no biomass installed capacities were reported for this year (see the section over).

Solar technology produced more renewable electricity than planned during period 2005-2011, 76.5% (+5.4 GWh) more. Nevertheless due to the decrease that took place between

Additional biomass electricity between 2011 and 2012 covered more than half of additional renewable electricity consumption in Malta during the same time span

2011 and 2012 this technology remained 16.8% (-2.7 GWh) behind the expected NREAP plan for this year.

Biomass use for renewable electricity purposes in Malta amounted to 1.6 GWh in 2011 increasing further by 95.5% (+1.4 GWh) in 2012. In 2011 biomass use missed

the expected NREAP value by 31.4% (-0.7 GWh) while in 2012 this source was over the respective expected plan with 34.1% (+1.4 GWh).

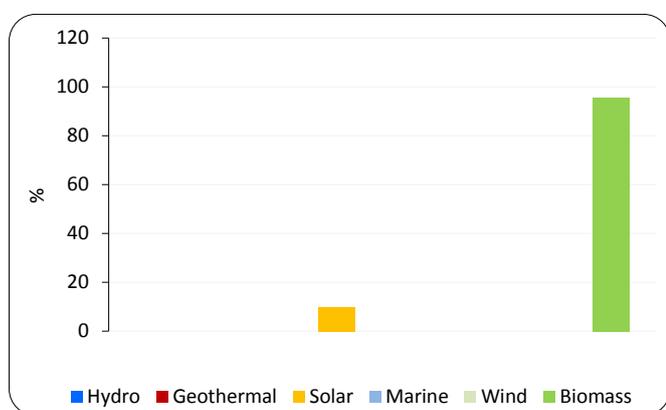


Figure 18-9. Relative increase/decrease of RES electricity sources in Malta, 2011-12

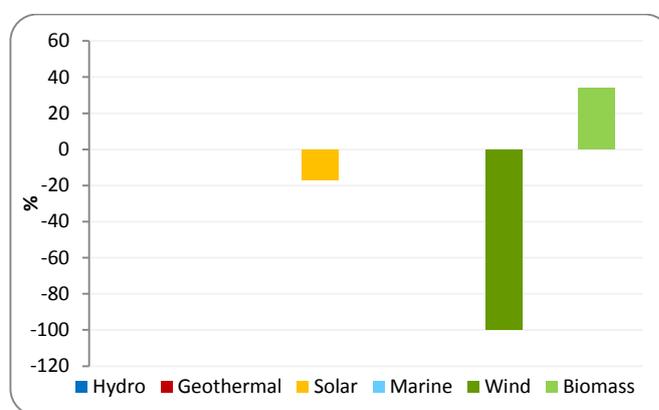


Figure 18-10. Deviation from NREAP in the RES electricity consumption in Malta in 2012.

In 2020 the main increase is expected in wind technology which is planned to provide 54.3% of total renewable electricity planned for this year. Biomass and solar photovoltaic contributions are set respectively at 36.6% and 9.1%.

18.5 Renewable energy in heating & cooling

The use of renewable energy in heating and cooling in Malta reached 3.8 ktoe (0.16 PJ) in 2011 increasing further by 74.5% (+2.86 ktoe) in 2012. The development between 2005 and 2011 was slower than planned in the NREAP missing the respective expected heat by 16.2% (-0.7 ktoe). Due to the fast increase between 2011 and 2012 renewable energy consumed in this sector exceeded in 2012 the respective NREAP plan by 35.9% (+1.8 ktoe) being also over the expected 2020 NREAP plan of 4.5 ktoe (0.19 PJ).

In 2012 solar thermal contributed with 57.9% in total heat coming from renewable energy sources in Malta followed by heat pumps with 26.3% and biomass with 15.8%.

Solar thermal contribution in heating/cooling sector reached 2.9 ktoe in 2011 increasing then with 34.7% (+1.0 ktoe) in 2012. This technology exceeded since in 2011 the expected

2020 NREAP contribution of 2.8 ktoe. Comparing with expected NREAP heat plans for 2011 and 2012 this source was over in both years: 9.9% (+0.3 ktoe) over in 2011 and 42.6% (+1.2 ktoe) over in 2012.

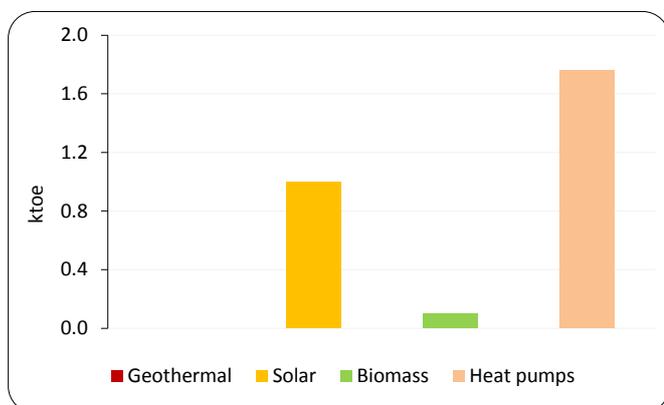


Figure 18-11. Absolute increase/decrease of RES heating/cooling sources in Malta, 2011-12.

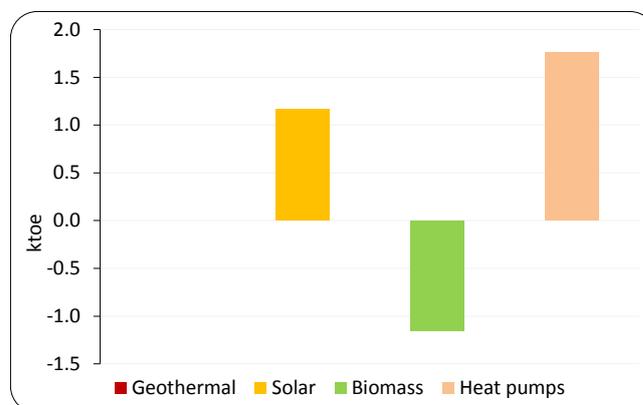


Figure 18-12. Absolute deviation from NREAP in the RES heat consumption in Malta in 2012.

Biomass contribution in this sector reached the level of 1.0 ktoe in 2011 increasing then with 10.4% (+0.1 ktoe) in 2012. This development was slower than what was planned in the NREAP for both years: 51% (-1.0 ktoe) slower in 2011 and 52% (-1.2 ktoe) slower in 2012.

More than 60% of 2011-2012 additional heat in Malta was coming from heat pumps

While no contribution from heat pumps was planned for period 2011-12 this technology registered in 2012 a contribution of 1.76 ktoe (0.07 PJ).

The 2012 introduction of heat pumps technology may change the 2020 picture of the contribution of different renewable energy sources in heating/cooling sector. According to its NREAP Malta has planned to get 61.6% of the heat production from solar thermal and the rest (38.4%) from biomass.

18.6 Renewable energy in transport

The consumption of renewable energy in transport reached 1.32 ktoe (0.06 PJ) in 2011 and 3.03 ktoe (0.13 PJ) in 2012 being nevertheless 61.1% (-2.1 ktoe) and 20.5% (-0.8 ktoe) under the respective NREAP projected values of 3.4 ktoe (0.14 PJ) and 3.8 ktoe (0.16 PJ). The use of renewable energy in transport sector in 2020 is expected to be 13.5 ktoe (0.57 PJ).

In 2012 renewable energy consumed in transport sector was totally represented by biodiesel coming from wastes, residues and ligno-cellulosic material. The development of biodiesel use in this sector was faster than what was planned in the NREAP exceeding the respective planned use in both years: 5.6% (+0.1 ktoe) over in 2011 and 138.6% (+1.8 ktoe) over in 2012.

No use of bioethanol/bio-ETBE, renewable electricity and other biofuels in transport sector was registered in Malta during period 2011-12.

In 2020 the contribution of different renewable energy sources planned to be used in Malta in transport sector is dominated by biodiesel with 52% followed by bioethanol/bio-ETBE with 42.8% and renewable electricity with 5.2%.

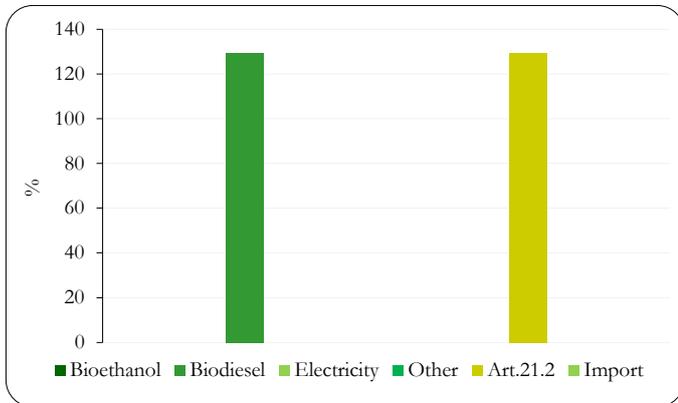


Figure 18-13. Relative increase/decrease of RES transport uses in Malta, 2011-12.

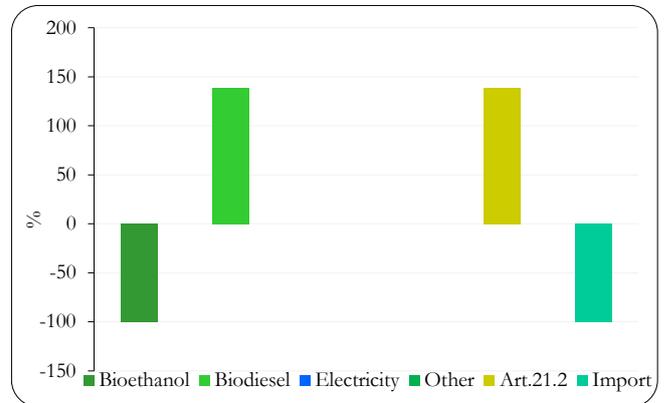


Figure 18-14. Deviation from NREAP in the RES use in transport in Malta in 2012.

19. Renewable energy in the Netherlands

19.1 Deployment of renewable energy

The renewable energy consumed in Netherlands increased from 1386.3 ktoe (58.0 PJ) in 2005 to 2256.7 ktoe (94.5 PJ) in 2011 and 2365.8 ktoe (99.0 PJ) in 2012. Renewable energy consumed in Netherlands is expected to further increase to 7411.1 ktoe (310.3 PJ) until 2020 (Figure 19-1).

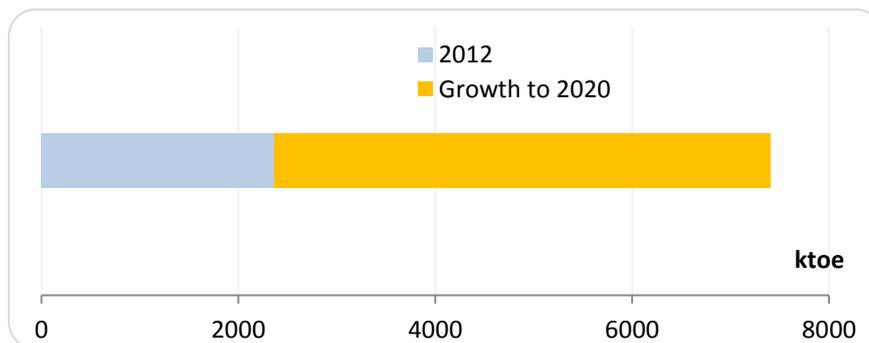


Figure 19-1. RES total in Netherlands in 2012 and the expected growth to 2020 target

Renewable energy consumption in Netherlands remained lower than expected in both 2011 and 2012 by 5.9% (-141.3 ktoe) and by 18.2% (-525.6 ktoe) respectively.

Renewable energy consumed in electricity sector increased to 1031.7 ktoe (43.2 PJ) in 2011 and furthermore to 1077.8 ktoe (45.1 PJ) in 2012 over 623.3 ktoe (26.1 PJ) in 2005. The development between 2005 and 2011 was faster than what planned in the

NREAP exceeding the respective level by 5.2% (+50.7 ktoe). Despite the increase by 4.5% (+46.1 ktoe) between 2011 and 2012 renewable electricity production in Netherland missed by 20.5% (-278.6 ktoe) the planned NREAP level of 1356.3 ktoe (56.8 PJ) for year 2012.

The use of renewable energy in heating/cooling sector in Netherland in year 2011 reached 876 ktoe (36.7 PJ) increasing further with 7.3% (+64 ktoe) in 2012. Nevertheless the use of renewable energy in this sector was under the expected NREAP uses in both 2011 and 2012: 11.2% (-111.0 ktoe) under in 2011 and 12.6% (-136.0 ktoe) under in 2012.

Renewable energy consumed in transport sector increased very fast between 2005 and 2012 with 710.4% per annum in average over 8.0 ktoe in year 2005. Nevertheless this development was not enough to exceed the expected NREAP uses in both 2011 and 2012 respectively by 18.8% (-81.0 ktoe) and 24% (-111.0 ktoe).

The main increase in renewable energy consumed among sectors is expected to take place in electricity sector (+301.5%) followed by transport sector (+160.1%) and heating/cooling sector (+131.8%).

The development of renewable energy in Netherland missed the expected NREAP plans in all sectors in both 2011 and 2012.

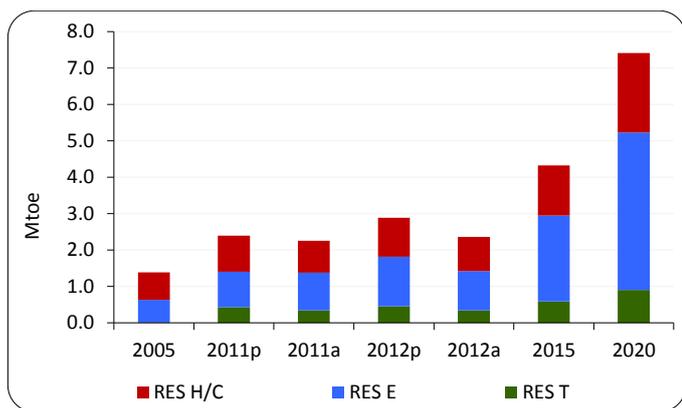


Figure 19-2. RES deployment in Netherlands: projected growth and actual progress until 2020.

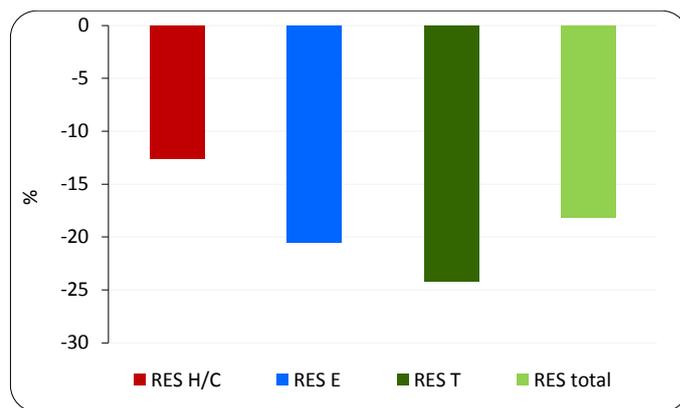


Figure 19-3. Deviation from NREAP in the RES production in Netherlands in 2012.

19.2 Sources of renewable energy

In 2012 biomass covered 59.7% of total renewable energy mix in Netherland followed by wind with 18.2%, biofuels with 13.6%, heat pumps with 5.6%, solar with 2.0%, geothermal with 0.5% and hydropower with 0.4%.

The fastest development between 2005 and 2012 was registered in solar technology use for electricity and heating/cooling with 20.9% per annum in average reaching 47.8 ktoe (2.0 PJ) in 2012. The development was fast enough to exceed the expected NREAP uses in both years: 20.2% (+5.7 ktoe) more in 2011 and 57.6% (+17.5 ktoe) more in 2012.

Biomass use for electricity and heating/cooling in Netherlands reached 1393.6 ktoe (58.3 PJ) in year 2012 increasing with 4.1% per annum in average over 2005 level. Comparing with expected NREAP use, this source was 0.6% (+7.6 ktoe) over in year 2011 but 10.9% (-171.3 ktoe) under in 2012.

Use of geothermal technology for electricity and heat production amounted to 8.0 ktoe (0.3 PJ) in 2011 increasing further with 50% (+4.0 ktoe) in 2012. Nevertheless this development was slower than what was planned in the NREAP for this technology in both years: 86.0% (-49.0 ktoe) less in 2011 and 84.0% (-63.0 ktoe) less in 2012.

Biofuels use in transport sector in Netherlands amounted to 321 ktoe (13.4 PJ) in 2011 decreasing slightly (0.9% or -3.0 ktoe) up to 2012. In comparison with expected NREAP uses biofuels missed the plans in both 2011 and 2012: 22.8% (-95.0 ktoe) under in 2011 and 28.1% (-124.0 ktoe) under in 2012.

Additional use of biofuels between 2005 and 2012 covered one-third of additional renewable energy mix in Netherlands during the same time span.

In 2020 it is expected that the contribution of biomass in total renewable energy mix will decrease up to 40.2%. Contributions of biofuels, heat pumps, solar and hydropower are also expected to decrease respectively to 11.4%, 5.1%, 1.0% and 0.2%. In meanwhile the contributions of wind and marine are expected to be increase respectively to 38.0% and 0.6%.

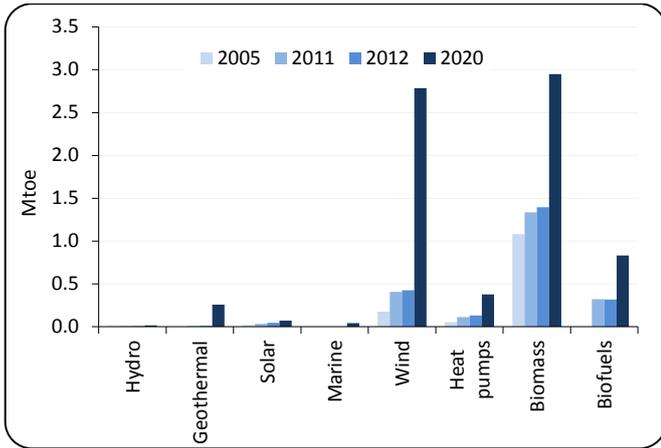


Figure 19-4. Contribution of renewable energy sources in Netherlands: actual and projected in 2020

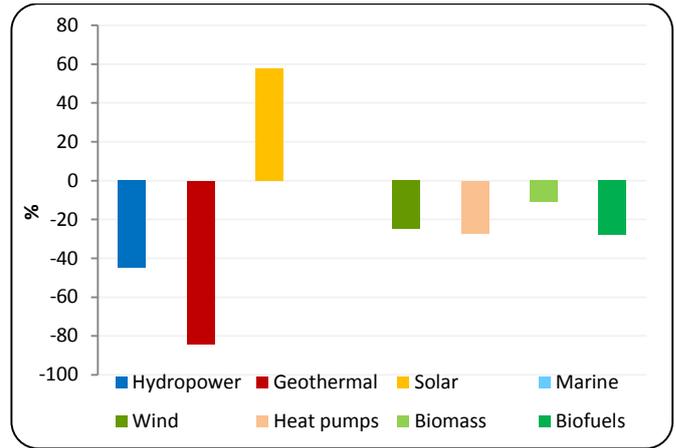


Figure 19-5. Deviation from NREAP in the contribution of renewable sources in Netherlands in 2012

19.3 Renewable energy share

Overall, the Netherlands received 4.3% in 2011 and 4.5% in 2012 of its energy from renewable energy sources rising from 2.5% in the baseline year. Nevertheless this increase was not enough to meet the expected NREAP planned shares in both 2011 and 2012: 0.3% points under in 2011 and 1.1% points under in 2012. The 2020 target that Netherlands has to reach for the overall RES share is 23%.

The overall RES share in Netherlands remained lower than the respective NREAP target shares for the whole 2009-2012 period. The overall RES share for 2012 missed both the NREAP target and the lower 2011/12 indicative minimum trajectory. Based on data reported in 2011 and 2012 The Netherlands need to accelerate their RES deployment in order to reach the 2020 targets

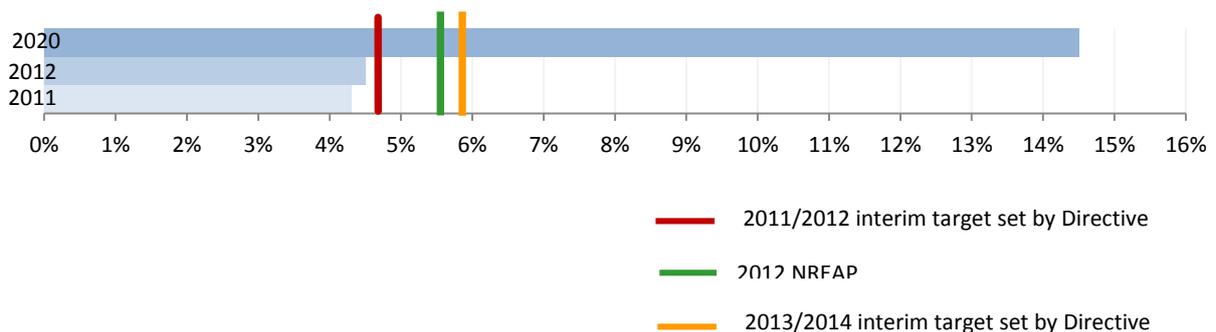


Figure 19-6. Overall RES share in Netherlands, 2011-12

The share of renewable energy in transport sector increased by +6.7% points in 2011 comparing with 2005 increasing further with 1.0% points in 2012. This development was faster than what was planned in the NREAP for both years: 2.6% points over in 2011 and 3.2% points over in 2012.

Renewable energy share in electricity sector increased with 3.8% points in 2011 and further with 0.7% points in 2012 from 6.0% in the baseline year. This development was enough to surpass the expected NREAP share in year 2011 with 0.7% points but not enough to be over the respective NREAP share in 2012 missing it with 2.0% points.

The development of renewable energy share in heating/cooling sector was slow increasing with 0.8% points between 2005 and 2011 but with only 0.1% points more in 2012. Comparing with expected NREAP renewable energy shares in this sector Netherlands was behind in both years: 0.7% points behind in 2011 and 1.0% points behind in 2012.

Major increase from year 2012 is expected to be achieved until 2020, according to the NREAP, in electricity sector (from 10.5% to 37.0%), followed by heating/cooling sector (from 3.4% to 8.7%) and transport (from 7.8% to 10.3%).

19.4 Renewable electricity

19.4.1 Installed capacity

The renewable energy installed capacity in Netherlands amounted to 3795 MW in 2011 and 4078 MW in 2012 over 2440 MW in 2005. Nevertheless these capacities are 4.4% (-176 MW) and 19.7% (-1000 MW) under the respective NREAP planned capacities for 2011 and 2012. In 2020 the Netherlands planned to reach an installed renewable energy capacity equal to 14995 MW.

In 2012 wind technology installed capacity covered 59.7% of total renewable energy installed capacity in Netherlands. Biomass contribution was 30.5% and the rest was covered by solar with 9.0% and hydropower with 0.9%.

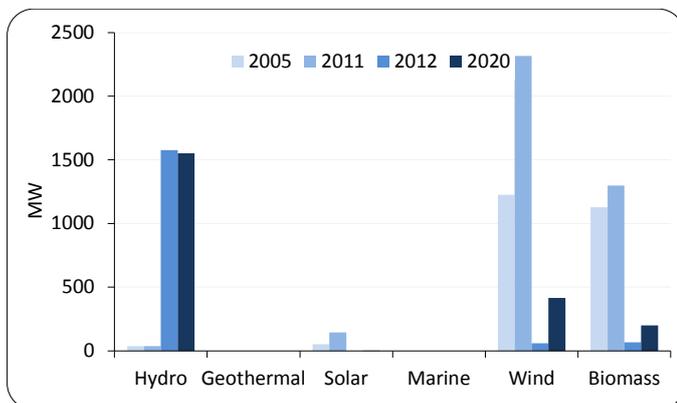


Figure 19-7. RES capacity deployment and progress until 2020 in Netherlands.

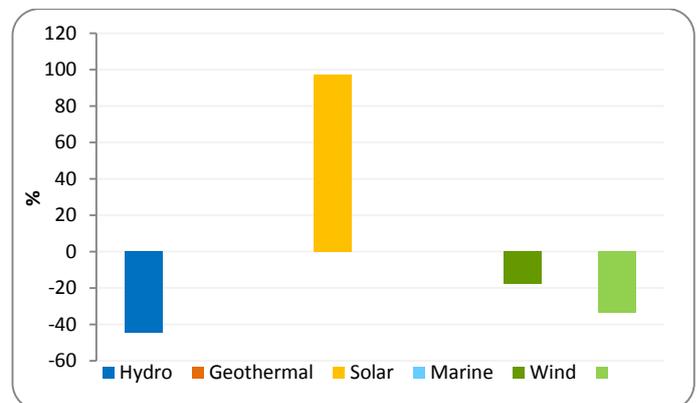


Figure 19-8. Deviation from NREAP in the RES installed capacity in Netherlands in 2012.

Solar photovoltaic technology had the fastest development between 2005 and 2011 increasing by 30.7% per annum in average over 51 MW in the baseline year. Despite of this development this technology missed the expected NREAP capacity for this year being 2.7% (-4.0 MW) under the respective expected capacity. Solar photovoltaic had also the fastest increase during

78% of additional renewable electricity capacity between 2011 and 2012 in Netherlands came from solar photovoltaics

2011-12 with 151.7% (+220 MW) reaching 365 MW in 2012. This development was faster than what was planned in the NREAP for this year being 97.3% (+180 MW) over the respective expected capacity.

Wind technology had the highest additional capacity, +1209 MW, between 2005 and 2012 over 1224 MW installed capacity in baseline year. Nevertheless wind installed capacity was found to be over the expected NREAP capacity only in year 2011 (+4.2% or +93 MW) missing the respective expected capacity in year 2012 (-17.7% or -522 MW).

Biomass installed capacity reached 1297 MW in year 2011 over 1128 MW in the baseline year decreasing slightly in 2012 by 4.2% (-54 MW). Comparing with expected NREAP developments these capacities were found to be under the respective expected capacities in both 2011 and 2012: 15.9% (-246 MW) under in 2011 and 33.6% (-628 MW) under in 2012.

Hydropower installed capacity in Netherlands remained at the level of 37 MW between 2005 and 2012 even that an increase during this period was planned. This capacity was found to be under the expected NREAP capacities: 33.9% (-19 MW) under in 2011 and 44.8% (-30 MW) under in 2012.

In 2020 wind power is expected to extend its contribution in the total renewable energy installed capacity in Netherlands to 74.5% while a reduction is expected for biomass (19.3%), solar photovoltaic (4.8%) and hydropower (0.5%). Marine technology is expected to have a very marginal contribution with 0.9%.

19.4.2 Consumption

Renewable electricity consumption in Netherlands amounted to 11996 GWh (43.2 PJ) in 2011 and 12532 GWh (45.1 PJ) in 2012 from 7248 GWh in 2005. The development of renewable electricity consumption in Netherlands was faster than planned between 2005 and 2011 surpassing the NREAP planned production for 2011 with 5.2% (+589 GWh). The increase that took place between 2011 and 2012 was not enough to meet the planned NREAP consumption for year 2012 being 20.5% (-3239 GWh) under the respective value. In 2020 the renewable electricity consumption in Netherlands is expected to amount to 50315 GWh (181 PJ).

In 2012 biomass provided 57.8% of total renewable electricity consumed in Netherlands followed by wind technology (39.4%), solar (2.0%) and hydropower (0.8%).

Renewable electricity coming from solar photovoltaic had the fastest development between 2005 and 2011 by 25% per annum in average

Despite the very fast growth by 154% between 2011 and 2012, PV still remains a marginal contributor to the renewable energy mix in the Netherlands

over 40 GWh in the baseline year. Nevertheless in 2011 the renewable electricity from this technology missed the expected NREAP production by 3.8% (-4.0 GWh). Between 2011 and 2012 solar photovoltaic had the fastest increase with 154% (154 GWh) surpassing the expected NREAP plan for this year by 92.4% (+122 GWh).

In 2011 the renewable electricity originated from wind technology was found to be over the expected NREAP production for this year with 5.7% (+253 GWh). This technology experienced the highest additional renewable electricity between 2011 and 2012, +214 GWh (+4.5%) reaching 4939 GWh. Nevertheless this amount of renewable electricity from wind was under the expected NREAP plan for year 2012 missing it with 24.9% (-1637 GWh). Biomass use for renewable electricity purposes increased with 43.6% (+2198 GWh) between 2005 and 2012. It exceeded the expected NREAP plan for year 2011 being 5.9% (+391 GWh) over the respective level. Between 2011 and 2012 biomass use increased with only 2.4% (+168 GWh) which was not enough to surpass the NREAP planned level for 2012 missing it by 18.5% (-1643 GWh).

Penetration of wind technology in total renewable energy mix in Netherland reached 18.2% in 2012

Renewable energy coming from hydropower technology in Netherlands remained at the level of baseline year, 100 GWh (0.4 PJ), during period 2011-12 being under the expected NREAP planned levels for both years: 33.8% (-51.0 GWh) under in 2011 and 44.8% (-81.0 GWh) under in 2012.

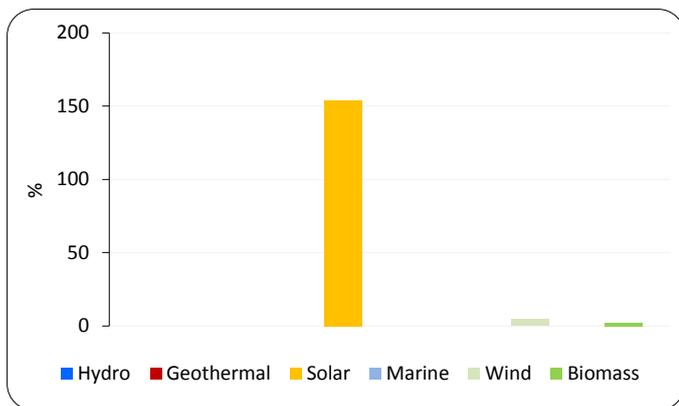


Figure 19-9. Relative increase/decrease of RES electricity sources in Netherlands, 2011-12

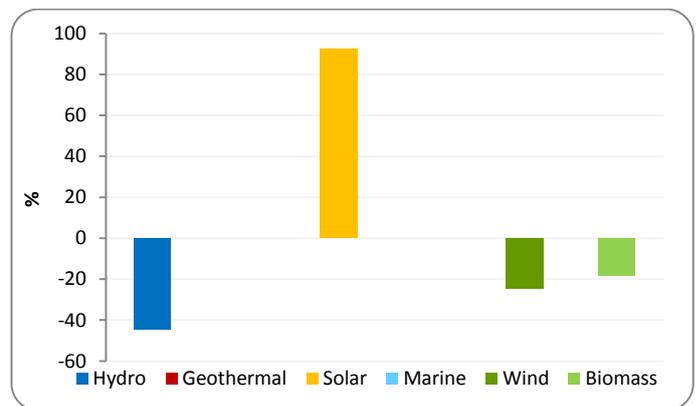


Figure 19-10. Deviation from NREAP in the RES electricity consumption in Netherlands in 2012.

In 2020 the contribution of wind is expected to cover 64.4% of total renewable electricity in Netherlands surpassing the biomass contribution which will reach 33.1%. The rest will be covered by solar, marine and hydropower respectively with 1.1%, 1.0% and 0.4%.

19.5 Renewable energy in heating & cooling

Between 2005 and 2012 the use of renewable energy in heating and cooling in Netherlands increased with 4.4% per annum in average reaching 940 ktoe (39.4 PJ) over 717 ktoe (30.0 ktoe) in the baseline year. This development was slower than what was planned according to the NREAP missing the respective uses in both years: 11.2% (-110 ktoe) under in 2011 and 12.6% (-135 ktoe) under in 2012. The 2020 planned renewable energy consumed in heating/cooling sector in Netherlands is expected to amount to 2179 ktoe (91.2 PJ).

The main progress in this sector from 2005 happened in solar thermal technology which increased with 8.9% per annum in average reaching in 2012 the level of 26.0 ktoe surpassing

so the 2020 expected NREAP plan of 23.0 ktoe for this technology. In comparison with expected NREAP levels for 2011 and 2012 this technology was respectively over with 31.6% (+6.0 ktoe) and 36.8% (+7.0 ktoe).

Heat pumps technology used in this sector had the fastest increase between 2005 and 2012 with an average growth rate of 20.4% (+77.0 ktoe) reaching 131 ktoe (5.5 PJ). It had also the fastest increase rate between 2011 and 2012, +13.9% (+16.0 ktoe). Nevertheless in comparison with expected NREAP developments this technology was behind in both years: 26.3% (-41.0 ktoe) less in 2011 and 27.2% (-49.0 ktoe) in 2012.

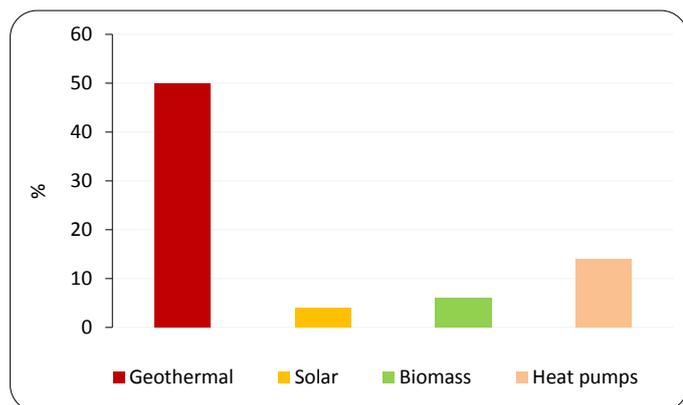


Figure 19-11. Relative increase/decrease of RES heating/cooling sources in Netherlands, 2011-12.

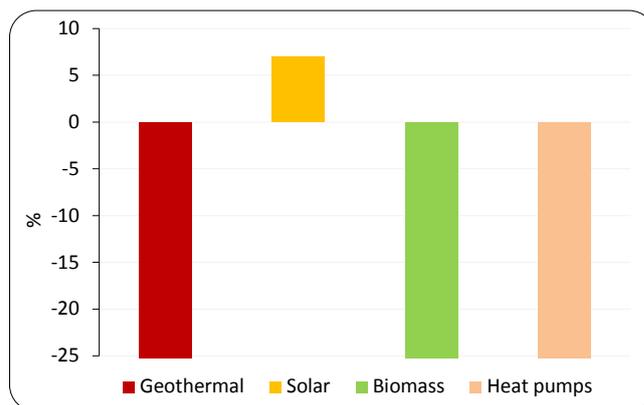


Figure 19-12. Deviation from NREAP in the RES heat consumption in Netherlands in 2012.

Biomass use for heat production in Netherlands reached 728 ktoe in 2011 increasing further in 2012 with 5.9% (+43.0 ktoe). Nevertheless the biomass uses for heat production reached in 2011 and 2012 were found to be under the expected NREAP uses respectively with 3.4% (-26.0 ktoe) and 3.7% (-30.0 ktoe).

In 2012 biomass used for heating purposes in Netherlands contributed with 33% in renewable energy mix

Netherlands had planned a significant development for geothermal technology in heating/cooling sector.

Despite of these plans this technology reached only 8 ktoe in 2011 increasing then further to 12 ktoe in 2012. This slow development was reflected at the negative deviations that this technology had in comparison with expected NREAP levels in both years: 86.0% (-49 ktoe) under in 2011 and 84.0% (-63.0 ktoe) in 2012.

In 2020 biomass and solar thermal use for heat production is expected to decrease their contributions respectively up to 69.8% and 1.1% while the contribution of other technologies as heat pumps and geothermal will increase significantly respectively to 17.3% and 11.9%.

19.6 Renewable energy in transport

The use of renewable energy in transport reached 349 ktoe (6.2 PJ) in 2011 decreasing then slightly in 2012 with only 1 ktoe (-0.3%). Comparing with expected NREAP renewable energy consumeds in this sector Netherlands was behind in both years: 18.8% (-81.0 ktoe) behind in 2011 and 24% (-110 ktoe) behind in 2012. The use of renewable energy in transport sector in 2020 is expected to be 905 ktoe (37.9 PJ).

In 2012 biodiesel contribution reached 55.7% followed by bioethanol/bio-ETBE with 35.6% and renewable electricity with 8.6%.

Renewable electricity used in this sector made the main progress between 2005 and 2011 reaching 28 ktoe, tripling its use over baseline level. This development made possible that in comparison with expected NREAP developments these uses are well over in both years: 100% (+14 ktoe) over in 2011 and 87.5% (+14 ktoe) over in 2012.

Biodiesel use in this sector reached 172 ktoe in year 2011 increasing then further with 12.8% (+22.0 ktoe) in 2012. Nevertheless this development was not enough to meet the expected NREAP uses being under the respective levels in both years: 18.1% (-38.0 ktoe) under in 2011 and 19.2% (-46.0 ktoe) under in 2012.

Bioethanol/bio-ETBE use in transport sector reached 149 ktoe in 2011 decreasing then in 2012 by 16.8% (-25.0 ktoe). These developments were slower than the expected NREAP developments in both 2011 and 2012: 27.7% (-57.0 ktoe) below in 2011 and 38.6% (-78.0 ktoe) under in 2012.

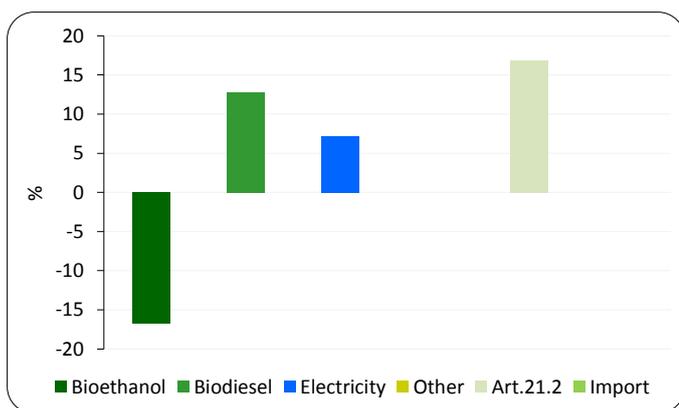


Figure 19-13. Relative increase/decrease of RES transport uses in Netherlands, 2011-12.

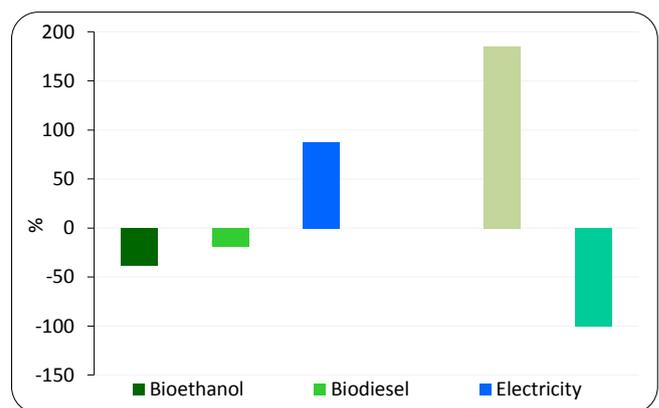


Figure 19-14. Deviation from NREAP in the RES use in transport in Netherlands in 2012.

No other biofuels (biogas and vegetable oils) were used in Netherlands in 2011 and 2012.

The contribution of biofuels from wastes, residues, ligno-cellulosic material in Netherlands grew very fast between 2005 and 2011 reaching 166 ktoe which is 7.1% over the 2020 NREAP planned use for this year. The use of these biofuels increased further in 2012 with 16.9% (+28.0 ktoe) over the 2011 use. In comparison with expected NREAP uses these biofuels were well over in both years: 163.5% (+155 ktoe) over in 2011 and 185.3% (+126 ktoe) over in 2012.

While a contribution of imported biofuels was expected in Netherlands during period 2011-12 no use of imported biofuels took place in this sector.

In 2020 the contribution of biodiesel is expected to increase up to 61% while bioethanol/bio-ETBE and renewable electricity are expected to decrease their contribution respectively to 31.2% and 7.8%.

20. Renewable energy in Austria

20.1 Deployment of renewable energy

The renewable energy consumed in Austria increased from 6971 Mtoe (292PJ) in 2005 to 8379.4 ktoe (350.8 PJ) in 2011 and 8707.4 ktoe (364.6 PJ) in 2012. Renewable energy consumed in Austria is expected to further increase to 9539 ktoe (39934 PJ) until 2020 (Figure 20-1).

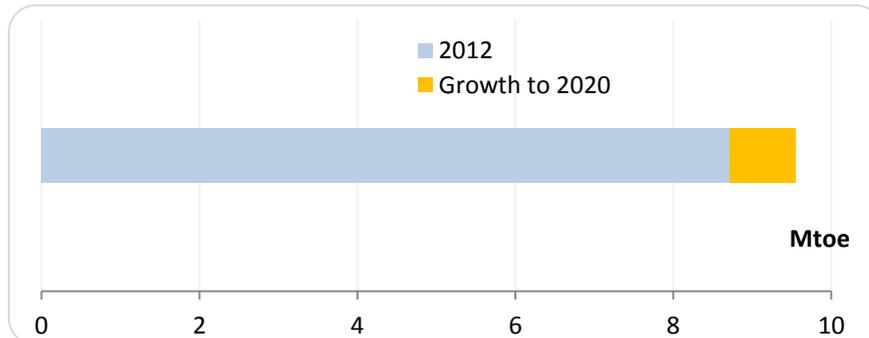


Figure 20-1 RES total in Austria in 2012 and the expected growth to 2020 target

Renewable energy consumed in heating/cooling sector made the most significant progress from year 2005. It experienced a fast increase up to 2011 with nearly 1 Mtoe (+41.7 PJ) or +5.2% per annum in average reaching 4208 ktoe (176.2 PJ) exceeding with 0.7% (+30 ktoe) the 2020 plan. It had also the highest additional renewable energy in 2012 with +226 ktoe (+5.4%). Comparing with planned NREAP levels this sector surpassed the expected levels in 2011 and 2012 respectively with 14.4% (+531 ktoe) and 19.7% (+731 ktoe).

Renewable energy consumption in Austria exceeded the expected values in both 2011 and 2012 respectively by 2.2% (177.2 ktoe) and by 5.1% (+424 ktoe).

The development of renewable energy in transport sector had the higher annual growth rate, + 30% during period 2005-2011 reaching 574 ktoe (24 PJ). A further increase in this sector with only 2.4% (+14 ktoe) took place between 2011 and 2012. In 2011 renewable energy consumed in this

sector met the expected NREAP use for this year while in 2012 the achieved use was over the expected on with 1% (+6 ktoe).

Renewable energy in electricity sector developed slowly during period 2005-2011 increasing with only 0.2% per annum in average (+44 ktoe) from 3553 ktoe (148.8 PJ) in the baseline year. A slightly increase with 2.4% (+88.1 ktoe) took place between 2011 and 2012. Due to this slow development the renewable energy in this sector didn't reach the expected NREAP levels being under with 9% (-353.8 ktoe) in 2011 and 7.8% (-313 ktoe) in 2012.

From 2012 until 2020 the highest additional renewable energy is expected in electricity sector with +819 ktoe (+34.3 PJ) followed by transport sector with +268 ktoe (+11.2 PJ)

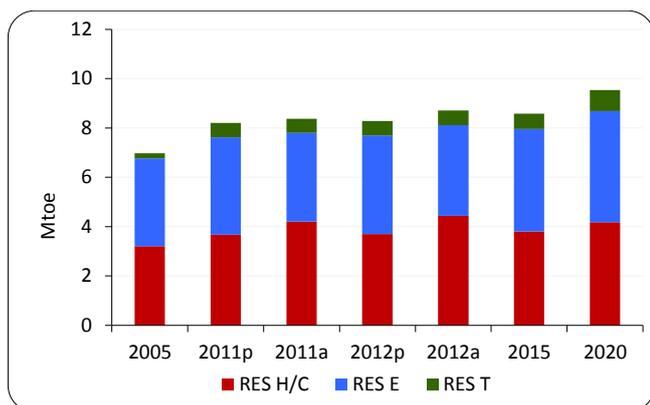


Figure 20-2. RES deployment in Austria: projected growth and actual progress until 2020.

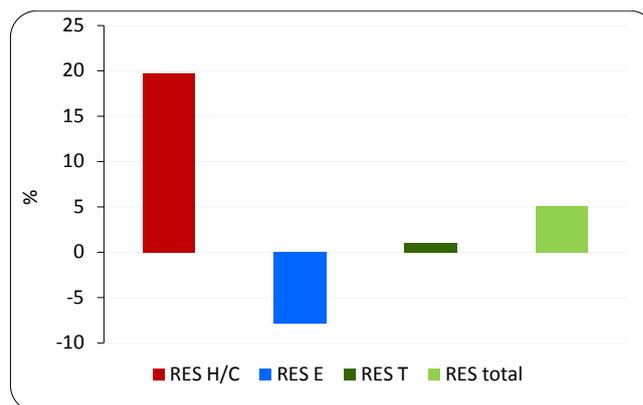


Figure 20-3. Deviation from NREAP in the RES production in Austria in 2012.

20.2 Sources of renewable energy

Biomass was the main renewable energy source in Austria with a 52.7% contribution in renewable energy consumed in 2012, followed by hydropower with 35.7%, biofuels with 4.9%, wind and solar with 2.4% each and heat pumps with 1.7%.

Biomass saw the main progress among renewable energy sources during period 2005-2011

Biomass used for energy purposes in Austria covered 16.6% of gross final energy consumption in 2012

with an additional use of +1001 ktoe (+41.9 PJ) from 3275.7 ktoe (137.1 PJ) in the baseline year. This use increased then further in 2012 with 5.3% (+216.2 ktoe). Comparing with projected NREAP uses this source was found over the respective expected uses in both 2011

and 2012: 11.7% (+449 ktoe) more in 2011 and 17.1% (+655.7 ktoe) more in 2012.

Biofuels use in transport sector had the fastest development between 2005 and 2011 with 138% per annum in average (+356 ktoe) from 43 ktoe (1.8 PJ) in baseline year increasing then further in 2012 with 4% (+16 ktoe). The use of biofuels in Austria during period 2011-12 met the expected NREAP use for year 2011 and surpassed it with 2.2% (+9 ktoe) in 2012.

Solar technology increased with 15.6% per annum in average (+88.2 ktoe) between 2005 and 2011 from 93.8 ktoe (3.9 PJ) in baseline year increasing further in 2012 with 11% (+20 ktoe). This development was fast enough to surpass the expected NREAP levels in both 2011 and 2012: 25.9% (+37.4 ktoe) more in 2011 and 30.5% (+47.2 ktoe) more in 2012.

Geothermal use for energy production in Austria increased with only 2.2% per annum in average (+2.9 ktoe) between 2005 and 2012 reaching 22.1 ktoe (0.8 PJ). Nevertheless this development was slower than the NREAP projected one missing both 201 and 2012 expected levels with 0.4% (-0.1 ktoe).

In 2020, the share of biomass in renewable energy mix in Austria is expected to decrease its contribution up to 43.7% while an increase is expected in the contribution of other sources: hydropower (39.1%), biofuels (6.3%), wind (4.5%), solar (3.2%), heat pumps (2.8%) and geothermal (0.4%).

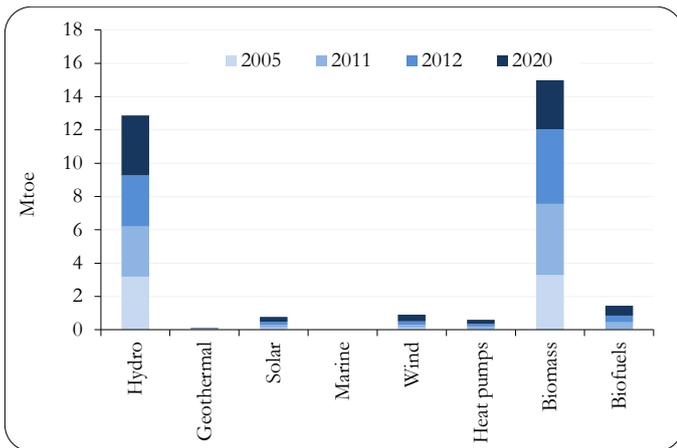


Figure 20-4. Contribution of renewable energy sources in Austria: actual and projected in 2020

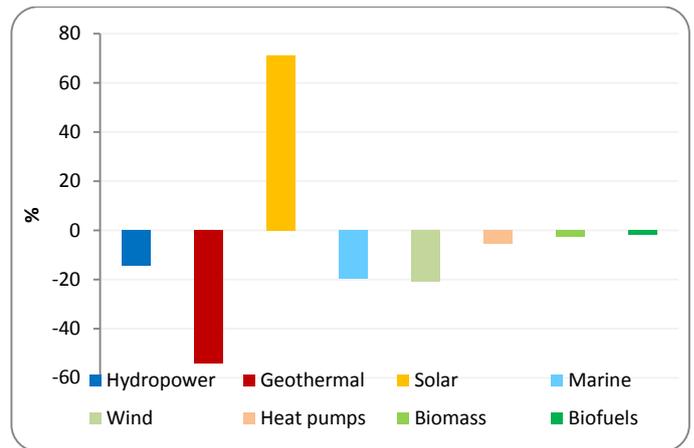


Figure 20-5. Deviation from NREAP in the contribution of renewable sources in Austria in 2012

20.3 Renewable energy share

The overall renewable energy contribution in Gross Final Energy Consumption in Austria increased from 23.3% in the baseline year reaching 30.7% in 2011 and 32.2% in 2012. Despite of this development the overall RES share in Austria missed the NREAP planned overall RES share for year 2011 with 0.7% points but surpassed it in 2012 with 0.6% points. In 2020 the overall RES share target for Austria is 34.2%.

Despite the decrease that the overall RES share experienced in 2011, Austria has exceeded in 2012 both the 2011/12 and 2013/14 indicative minimum trajectories and the higher NREAP planned value. Based on data reported in 2011 and 2012 Austria seems to be in a good position for the achievement of 2020 RES share target

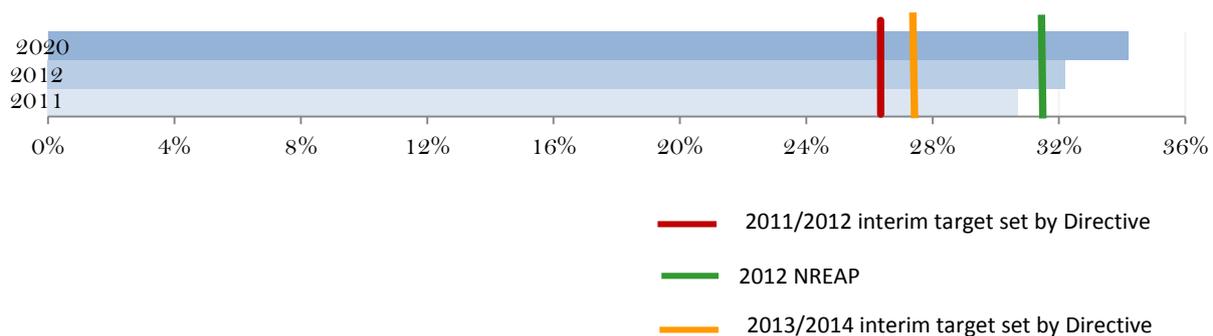


Figure 20-6. Overall RES share in Austria, 2011-12

The development of renewable energy share in heating/cooling sector in Austria was very fast during period 2005-2011 reaching 45.5% which was 12.9% points over the 2020 planned share for this sector and 15.2% points over the 2011 expected share. During period 2011-12 the share of renewable energy in this sector decreased with 0.5% points remained still over the 2020 and 2012 (+14.6% points) planned shares.

The development of renewable energy share in electricity sector increased with +5.2% points between 2005 and 2011 from 59.3% in the baseline year but furthermore in 2012 with only 0.8% points. This development was slower than the NREAP projected one missing both 201 and 2012 expected shares: 9.2% points under in 2011 and 8.8% points under in 2012.

Transport sector experienced an increase with +4.4% points between 2005 and 2011 in renewable energy share which nevertheless was found to be 0.2% points under the planned share for this year. The increase with +0.3% points that took place between 2011 and 2012 make possible that renewable energy share in this sector met the 2012 planned share.

Up to 2020 the main progress is expected in electricity sector (+5.6% points) followed by transport sector (+4.4% points). Austria needs to review or maintain the 2012 level in the renewable energy share in heating/cooling sector.

20.4 Renewable electricity

20.4.1 Installed capacity

The renewable energy installed capacity in Austria increased from 9600 MW in 2005 to 11360 MW in 2011 and 11710 MW in 2012. Comparing with expected installed capacities for years 2011 and 2012 the current capacities were found over respectively with 5.1% (+553 MW) and 5.9% (+651 MW).

In 2012 hydropower contribution in total renewable energy installed capacity reached 68% followed by biomass with 17.6%, wind with 11.2% and solar photovoltaic with 3.1%.

Solar photovoltaic had the fastest development between 2005 and 2011 with 223.5% per annum in average (+295 MW) from 22 MW in the baseline year being 204.8% (+213 MW) over the expected capacity for year 2011. Solar photovoltaic capacity increased further in 2012 with 14.5% (+46 MW) reaching 363 MW which is 12.7% (+41 MW) over the 2020 plan and 202.5% (+243 MW) over the 2012 plan.

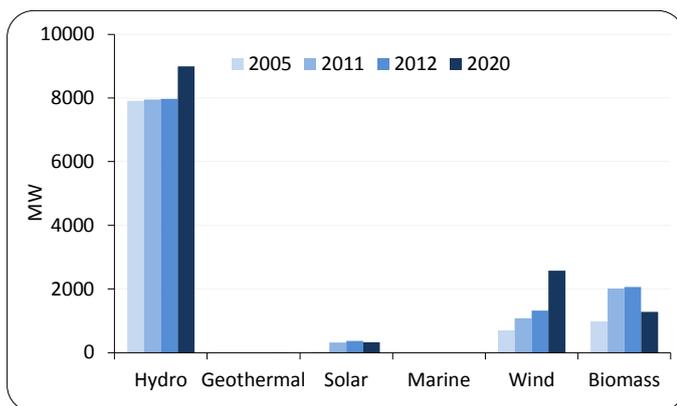


Figure 20-7. RES capacity deployment and progress until 2020 in Austria.

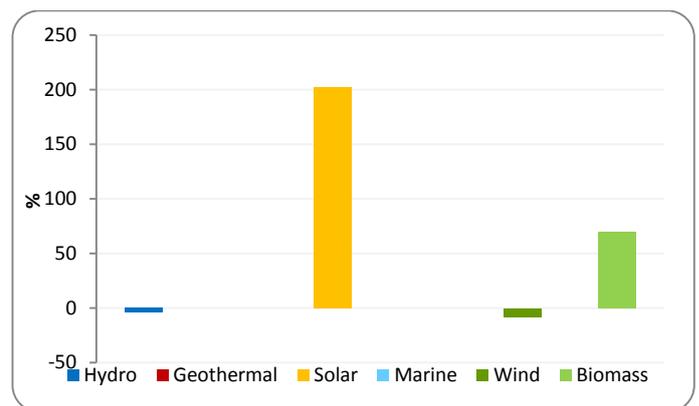


Figure 20-8. Deviation from NREAP in the RES installed capacity in Austria in 2012.

Biomass installed capacity developed between 2005 and 2011 with an average growth rate of 17.7% (+1039 MW) from 976 MW in 2005 and furthermore in 2012 with 2.3% (+47 MW).

These capacities were found to be over the expected capacities for 2011 and 2012 respectively with 66.1% (+802 MW) and 69.6% (+846 MW).

Wind capacity increased with 55.6% (+386 MW) during period 2005-2011 reaching 1080 MW in 2011 and further more in 2012 with 21.9% (+236 MW). Nevertheless this development was found slower than the NREAP projected one missing both 2011 and 2012 expected capacities: 12.3% (+152 MW) under in 2011 and 8.3% (+118 MW) under in 2012.

More than two-third of additional renewable electricity capacity in Austria between 2011 and 2012 was provided by wind power

Hydropower capacity increased with only 0.5% (+40 MW) between 2005 and 2011 reaching 7947 MW and further in 2012 with only 0.3% (+21 MW). These capacities were found to be under the expected hydropower capacities in both 2011 and 2012: 3.8% (-310 MW) less in 2011 and 3.8% (-319 MW) less in 2012.

Geothermal capacity development between 2005 and 2012 follow the NREAP projected one remaining in the level of 1 MW of baseline year.

In 2020 the share of hydropower in total renewable electricity installed capacity is expected to remain at level of 68%, biomass and solar shares are expected to decrease up to 9.7% and 2.4 while the contribution of wind is expected to be increased to 19.6%.

20.4.2 Consumption

Renewable electricity consumed in Austria amounted to 41.8 TWh (150.6 PJ) in 2011 and 42.8 TWh (154.3 PJ) in 2012 from 41.3 TWh (148.7 PJ) in 2005. Nevertheless the renewable electricity consumption in Austria didn't reach the NREAP planned values missing the respective values by 9% (-4114 GWh) in 2011 and 7.8% (-3639 GWh) in 2012. In 2020 the renewable electricity consumption in Austria is expected to amount to 52.4 TWh (188.6 PJ).

In 2012 almost 83% of renewable electricity was coming from hydropower and the rest 10.8% from biomass, 5.6% from wind and only 0.8% from solar photovoltaic.

During period 2005-2011 solar photovoltaic renewable electricity developed very fast with 250.8% per annum in average (+153 GWh) from 21 GWh (0.1 PJ) in the baseline year. The increase continued also fast between 2011 and 2012 with 93.4% (+163 GWh) reaching 337 GWh (1.2 PJ). In comparison with expected NREAP productions solar photovoltaic source was over the respective levels planned for 2011 and 2012: 75.8% (+75 GWh) over in 2011 and 195.6% (+223 GWh) over in 2012.

In 2012 renewable electricity from solar photovoltaics in Austria exceeded by 10.1% (+31 GWh) its 2020 planned value.

Biomass use for electricity in Austria had an increase from 2823 GWh (10.2 PJ) in the baseline year with 60.2% (+1700 GWh) during period 2005-2011 and furthermore with 2.6% (+119 GWh) in 2012. Nevertheless this development was not fast enough to met the

expected NREAP uses in both 2011 and 2012: 4.5% (-211 GWh) under in 2011 and 2.3% (-108 GWh) under in 2012.

Even that an increase from the baseline level of 1343 GWh (4.8 PJ) with 79.6% (+1069 GWh) took place in renewable electricity coming from windpower during period 2005-2012 this source didn't meet the expected NREAP productions in both 2011 and 2012: 15.1% (-371 GWh) under in 2011 and 15.2% (-432 GWh) under in 2012.

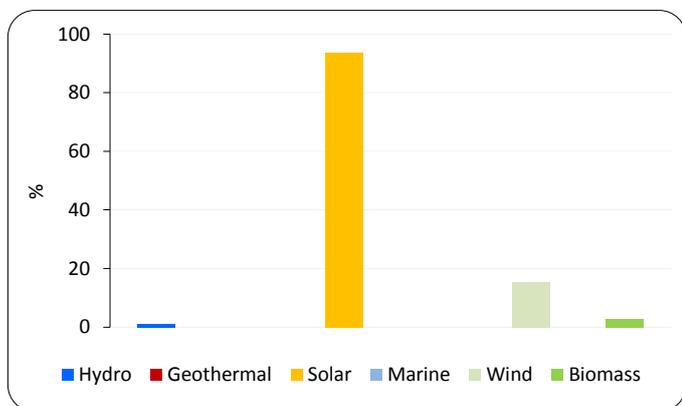


Figure 20-9. Relative increase/decrease of RES electricity sources in Austria, 2011-12

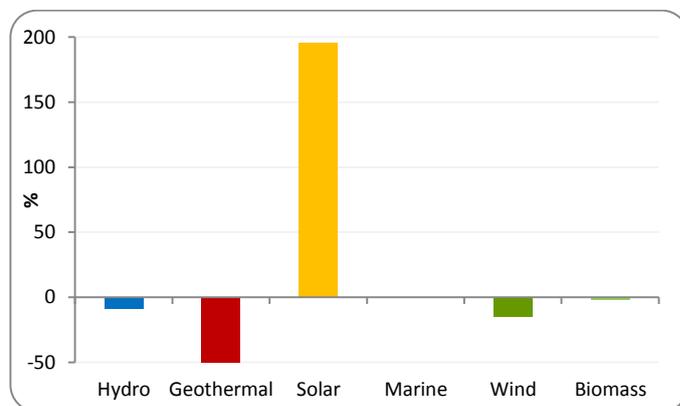


Figure 20-10. Deviation from NREAP in the RES electricity consumption in Austria in 2012.

Hydropower renewable electricity decreased from the baseline level of 37.1 TWh (133.7 PJ) during period 2005-2011 with 5.6% (-2082 GWh). Even that an increase with 1.2% (+419 GWh) took place further in 2012 this source missed both 2011 and 2012 NREAP expected plans: 9.3% (-3606 GWh) less in 2011 and 8.6% (-3321 GWh) less in 2012.

Geothermal contribution in electricity sector decreased during period 2005-2011 with 50% (-1 GWh) from the very low level of 2 GWh (0.007 PJ) in the baseline year. This contribution remained unchanged between 2011 and 2012 missing both expected NREAP plans for these years with 50% (-1 GWh) each.

In 2020 hydropower will remain the main source of renewable electricity consumption in Austria with 80.4% followed by biomass (9.8%), wind (9.2%) and solar (0.6%).

20.5 Renewable energy in heating & cooling

Renewable energy consumed in heating/cooling sector in Austria increased 3213 ktoe (134.5 PJ) in the baseline year to 4208 ktoe (176.2 PJ) in 2011 and 4434 ktoe (185.6 PJ) in 2012. The exceedances from the 2011 and 2012 NREAP plans were respectively 14.4% (+531 ktoe) and 19.7% (+731 ktoe).

Renewable heat in Austria in 2012 exceeded by 6.1% (+256 ktoe) its 2020 planned value. The share of renewable energy in this sector was 12.4 pp over the planned 2020 share of 31.6%.

Biomass consumed for heat purposes had the main role in exceeding the 2020 plan of renewable energy consumed in this sector. It

exceeded the expected 2020 plan of 3607 ktoe (151 PJ) since in 2010 with 4.4% (+160 ktoe) developing further with 8.9% (+327 ktoe) between 2010 and 2012 reaching 4094 ktoe

(171.4 PJ). The exceedances from NREAP plans for 2011 and 2012 were respectively 13.7% (+467 ktoe) and 19.4% (+655 ktoe).

The development of heat pumps in this sector from 69 ktoe (2.9 PJ) in baseline year took place with 110% (+76 ktoe) during 2005-2012 period. It exceeded with 33% (+33 ktoe) and 35.5% (+38 ktoe) the expected levels for 2011 (100 ktoe) and 2012 (107 ktoe).

The heat originated from solar thermal reached only 20 ktoe (0.84 PJ) in 2011 from 19 ktoe (0.8 PJ) in 2005 increasing further to 22 ktoe (0.92 PJ) in 2012. This source met both 2011 and 2012 expected NREAP plans.

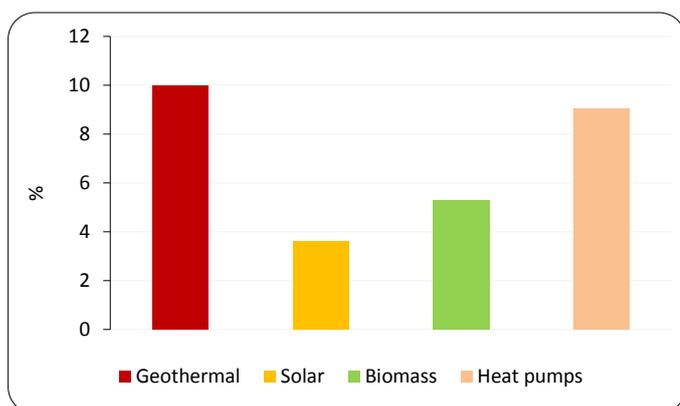


Figure 20-11. Relative increase/decrease of RES heating/cooling sources in Austria, 2011-12.

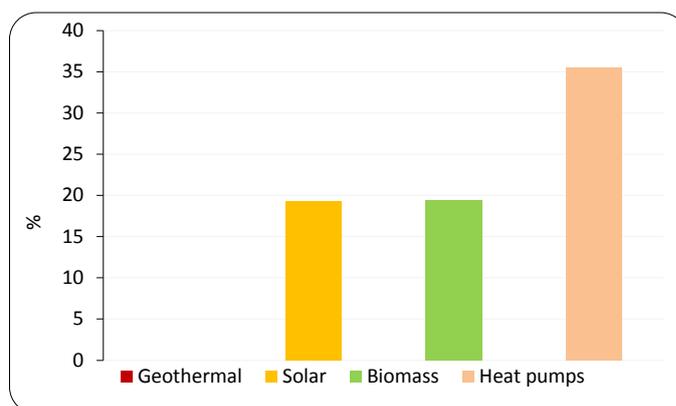


Figure 20-12. Deviation from NREAP in the RES heat consumption in Austria in 2012.

20.6 Renewable energy in transport

The use of renewable energy in transport sector increased with 30% per annum in average (+369 ktoe) in 2011 over 205 ktoe (8.6 PJ) in the baseline year. It increased further in 2012 with 2.4% (+14 ktoe) reaching 588 ktoe (24.6 PJ). In 2011 the use of renewable energy in this sector met the respective expected NREAP level while in 2012 exceeded it with 1% (+6 ktoe). In 2020 renewable energy consumed in transport sector is expected to reach 856 ktoe (35.8 PJ).

In 2012 the contribution of renewable energy sources in this sector was as following: biodiesel 59.2%, renewable electricity 29.4% and bioethanol/bio-ETBE 11.4%.

Biodiesel made the main progress in transport sector during 2005-2011 increasing with 142% per annum in average (+298 ktoe) from 35 ktoe (1.5 PJ) in the baseline year increasing then further in 2012 with 4.5% (+15 ktoe). The use of biodiesel in this sector was found to be over the expected NREAP plans in both 2011 and 2012: 18.9% (+53 ktoe) over in 2011 and 22.1% (+63 ktoe) over in 2012.

Bioethanol/bio-ETBE use in this sector reached 66 ktoe (2.8 PJ) in 2011 increasing with only 1.5% (+1 ktoe) in 2012. This development was enough to exceed the 2011 and 2012 NREAP plans respectively with 20% (+11 ktoe) and 19.6% (+11 ktoe).

Renewable electricity in transport sector in Austria increased with 8% (+13 ktoe) in 2011 from 162 ktoe (6.8 PJ) in 2005 decreasing then in 2012 with 1.1% (- 2.2 ktoe). This development was enough to meet the expected NREAP level for year 2011 but not in 2012 missing it with 1.7% (-3 ktoe).

Even that planned no contribution of other biofuels was registered in Austria during period 2011-12.

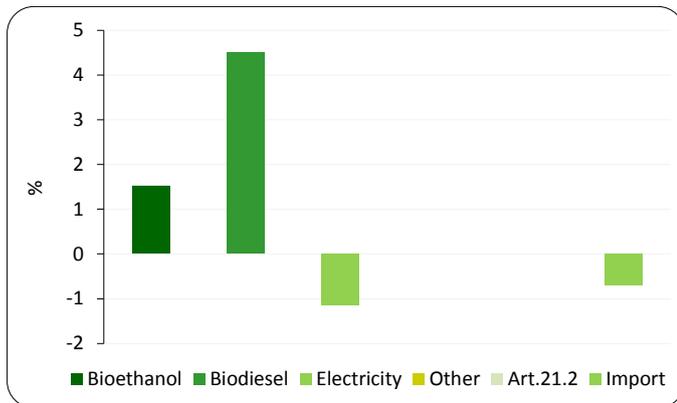


Figure 20-13. Relative increase/decrease of RES transport uses in Austria, 2011-12.

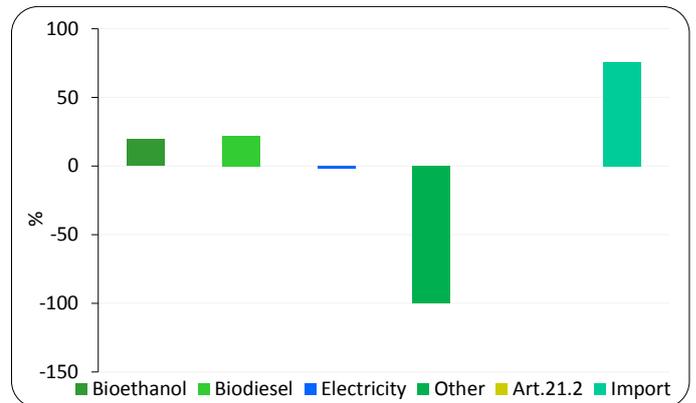


Figure 20-14. Deviation from NREAP in the RES use in transport in Austria in 2012.

The use of imported biofuels increased significantly with 125.5% per annum in average (+256 ktoe) in 2011 from the baseline level of 34 ktoe (1.4 PJ) surpassing with 56% (+104 ktoe) the 2020 plan for this biofuel category. The exceedance from 2011 and 2012 NREAP plans were respectively 74.7% (+124 ktoe) and 75.6% (+124 ktoe).

In 2020 biodiesel is expected to have a lower contribution reaching 47.9% followed by renewable electricity (31.8%), other biofuels (11%) and bioethanol/bio-ETBE (9.3%).

21. Renewable energy in Poland

21.1 Deployment of renewable energy

The renewable energy consumed in Poland increased from 480 ktoe (20.1 PJ) in 2005 to 6762.8 ktoe (283.1 PJ) in 2011 and 7335.4 ktoe (307.1 PJ) in 2012. Renewable energy consumed in Poland is expected to further increase to 10666 ktoe (446.6 PJ) until 2020 (Figure 21-1).

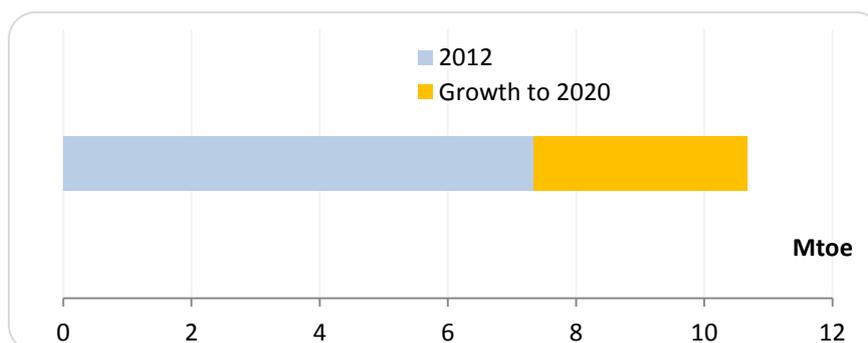


Figure 21-1. RES total in Poland in 2012 and the expected growth to 2020 target

Renewable energy consumed in heating/cooling sector made the most significant progress from year 2005. It experienced a very fast increase up to 2012 with 704% per annum in average (+4933.6 ktoe). Comparing with expected NREAP levels the renewable energy consumed in this sector was over in both years: 20% (+815.8 ktoe) over in 2011 and 20.6% (+887.3 ktoe) over in 2012.

Renewable electricity increased with +1132 ktoe (+47.4 PJ) in 2012 over 325.8 ktoe (13.6 PJ) in 2005 reaching 1457.9 ktoe (61.0 PJ). Comparing with expected NREAP levels renewable electricity in Poland was found to be over in both years: 1.4% (+15.5 ktoe) over in 2011 and 14.3% (+181.9 ktoe) over in 2012.

The use of renewable energy in transport sector increased by 220.4% per annum in average between 2005 and 2011 and further more by 9.8% (+75.6 ktoe) in 2012. Nevertheless the use of renewable energy in this sector was found to be under the expected NREAP levels in both 2011 and 2012: 28.3% (-302.9 ktoe) under in 2011 and 27.4% (-318.2 ktoe) under in 2012.

The development of renewable consumption in Poland was fast enough to exceed the expected NREAP levels in both years: by 8.5% (+528.4 ktoe) in 2011 and by 10.9% (+722.4 ktoe) in 2012.

The main progress up to 2020 is expected to happen in transport sector (+137.7%) followed by electricity sector (+87.9%) and heating/cooling sector (16.9%).

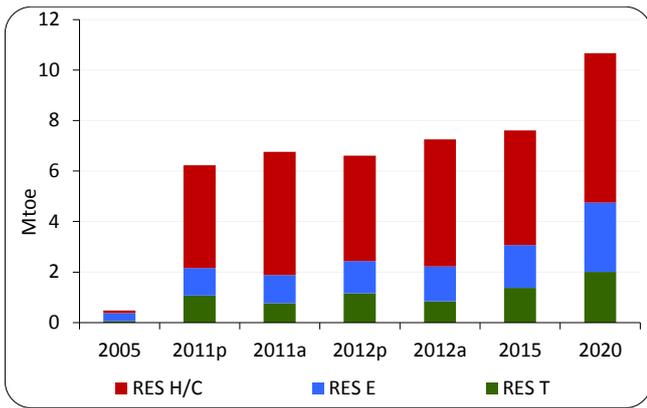


Figure 21-2. RES deployment in Poland: projected growth and actual progress until 2020.

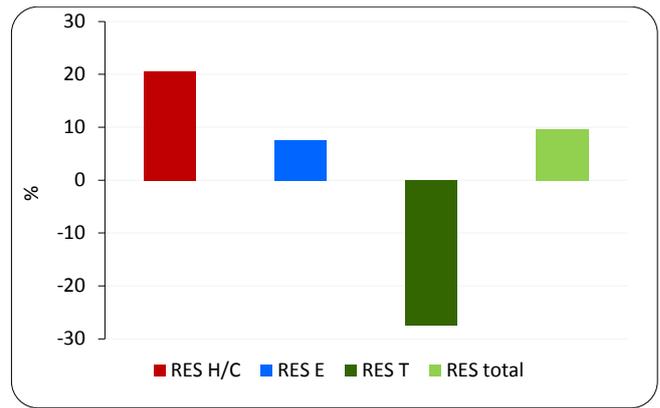


Figure 21-3. Deviation from NREAP in the RES production in Poland in 2012.

21.2 Sources of renewable energy

In 2012 biomass was the main renewable energy source in Poland with 80.6% in contribution to the total RES mix use, followed by biofuels with 10.8%, wind with 5.3%, hydropower with 2.8%, solar and geothermal with 0.2% each and heat pumps with 0.1%.

Between 2005 and 2012 all renewable energy sources increased their energy production. Significant increase of the use was registered especially by biomass (+5553.2 ktoe) with an average annual growth rate of 379% over 213.3 ktoe (8.9 PJ) in 2005. Comparing with expected NREAP levels this development was over in both years: 20.4% (+933.1 ktoe) over in 2011 and 24.1% (1141.1 ktoe) over in 2012.

The development of biofuels had the second additional use between 2005 and 2012 with 194% per annum in average (+735.5 ktoe). Nevertheless in comparison with expected NREAP use this source in Poland was found to be under in both years: 32.2% (-339.6 ktoe) under in 2011 and 30.9% (-353.5 ktoe) under in 2012.

16.4% of additional biofuels use in EU28 during period 2011-2012 took place in Poland

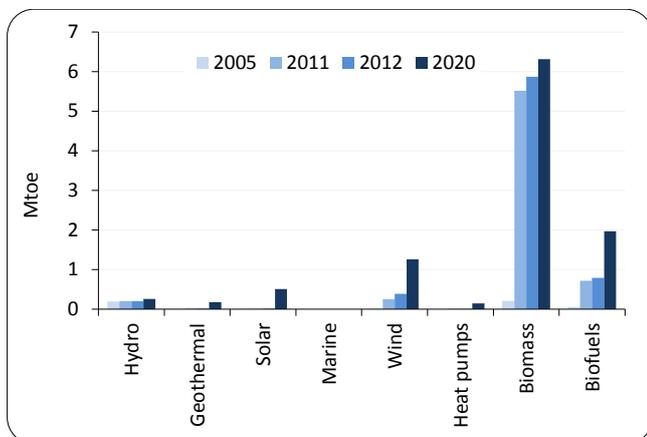


Figure 21-4. Contribution of renewable energy sources in Poland: actual and projected in 2020

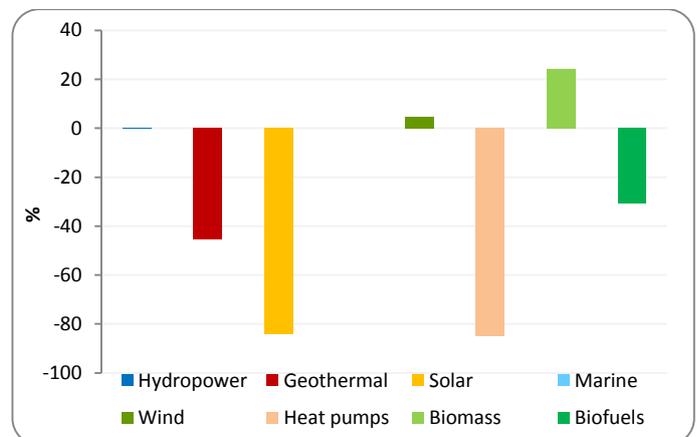


Figure 21-5. Deviation from NREAP in the contribution of renewable sources in Poland in 2012

Solar technology had the fastest relative increase between 2005 and 2012 with 921% per annum in average reaching 13.1 ktoe in 2012. Nevertheless this development was well under the expected NREAP development in both years: 76.9% (-34.8 ktoe) under in 2011 and 84.3% (-70.1 ktoe) under in 2012.

Geothermal technology reached only 15.8 ktoe in 2012 over 11.4 ktoe in 2005. This development was under the expected NREAP plans in both years: 47.1% (-11.3 ktoe) under in 2011 and 45.5% (-13.2 ktoe) under in 2012.

In 2020, the contribution of biomass in renewable energy mix is expected to decrease up to 59.4%. Hydropower also is expected to decrease slightly its contribution reaching 2.4%. Other technologies are expected to increase their contribution in 2020: biofuels 18.5%, wind 11.9%, solar 4.8%, geothermal 1.7% and heat pumps 1.4%.

The main increase in renewable energy source between 2012 and 2020 is expected to happen in biofuels use in transport sector (+1178.5 ktoe) followed by wind (+872.7 ktoe) and solar (+493.2 ktoe).

21.3 Renewable energy share

Poland didn't report about renewable energy shares in heating/cooling and electricity sectors as well as on overall RES share in year 2005. In 2011 the overall renewable energy contribution in Gross Final Energy Consumption in Poland reached 10.42% increasing further to 11.04% in 2012. Comparing with the expected NREAP shares for 2011 and 2012 the overall share of RES was over in both 2011 and 2012 by 0.3% points. The 2020 target that Poland has to reach for the overall RES share is 15.85%.

Poland overall RES share has followed the trajectory established in the NREAP in 2011-2012. Poland exceeded already since 2009 the RES minimum indicative share for 2011/2012 and met in 2010 the RES minimum indicative share for 2013/2014. Both in 2011 and 2012 Poland exceeded the NREAP targets for the overall RES shares. Also considering that NREAP targets have been set well above the indicative minimum trajectories, based on data reported in 2011 and 2012 Poland seems to be in a good position for the achievement of 2020 RES share target

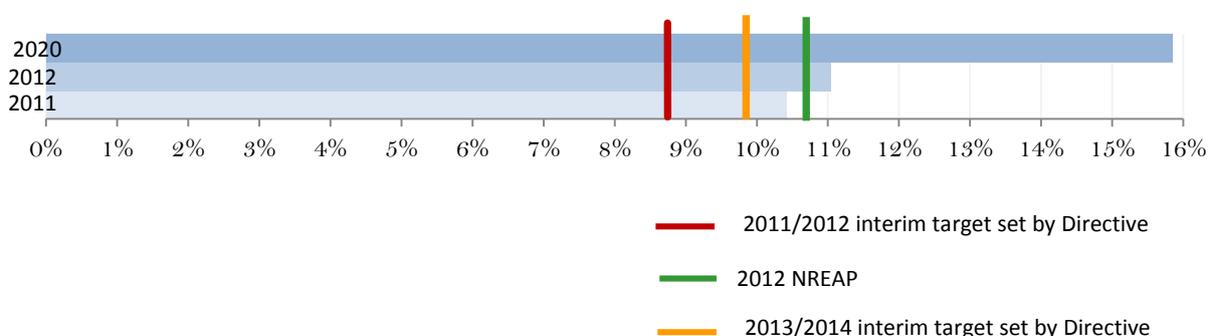


Figure 21-6. Overall RES share in Poland, 2011-12

The share of renewable energy in heating/cooling sector reached 13.4% in 2011 increasing further by only 0.3% points in 2012. Nevertheless this development was enough to be over the expected NREAP planned shares in both years: 0.8% points over in 2011 and 0.9% points over in 2012.

The development of renewable electricity share between 2005 and 2011 was slower than what was expected from the NREAP being under by 0.7% points of 8.9% planned share for this year. The increase with 2.5% points during 2011-12 was enough to exceed the expected NREAP share for this year by 0.5% points.

The renewable energy share in transport sector increased with 8.5% points in 2011 over 0.4% in 2005. This increase makes possible the exceedance of NREAP planned share for this year with 0.3% points. Nevertheless a decrease with 1.9% points in renewable energy in transport share happened between 2011 and 2012 missing the planned 2012 NREAP share by 0.2% points.

Major increase from year 2012 is expected to be achieved until 2020, according to the NREAP, in electricity sector (+8.4% points), followed by transport sector (+4.4% points) and heating/cooling sector (+3.4% points).

21.4 Renewable electricity

21.4.1 Installed capacity

The renewable energy installed capacity in Poland increased from 1322 MW in 2005 to 2642 MW in 2011 and 3717 MW in 2012. Comparing with expected NREAP capacities Poland was under in year 2011 by 10.8% (-321 MW) but over in year 2012 by 0.6% (+23 MW).

In 2012 wind covered 69% of total renewable energy installed capacity followed by biomass with 16% and hydropower with 15%.

The main progress between 2005 and 2012 was made in wind technology with an average

Wind power provided more than 70% of additional renewable electricity capacity installed between 2011 and 2012

growth rate of 288.4% (+2443 MW) over 121 MW of the baseline year. It had also the highest additional capacity (+764 MW) between 2011 and 2012. Comparing with expected installed capacities this technology was over in both years: 16.1%

(+250 MW) over in 2011 and 28.2% (+564 MW) over in 2012.

Biomass installed capacity experienced a decrease by 3.1% (-9.0 MW) between 2005 and 2011 increasing then with 110.5% (+306 MW) in 2012. Nevertheless this development was not enough to meet the expected NREAP levels in both years: 38.4% (-173 MW) under in 2011 and 19% (-137 MW) under in 2012.

Solar photovoltaic met the 2011 target of 1 MW installed capacity. Even that planned no change happened in solar photovoltaic between 2011 and 2012 missing by 50% the expected level of 2 MW in 2012.

Hydropower capacities decreased between 2005 and 2012 by 37.8% (-346 MW) reaching 569 MW in year 2012. This decrease put the installed capacity of this technology under the

expected NREAP capacities in both years: 41.4% (-398.0 MW) under in 2011 and 41.5% (-403 MW) under in 2012.

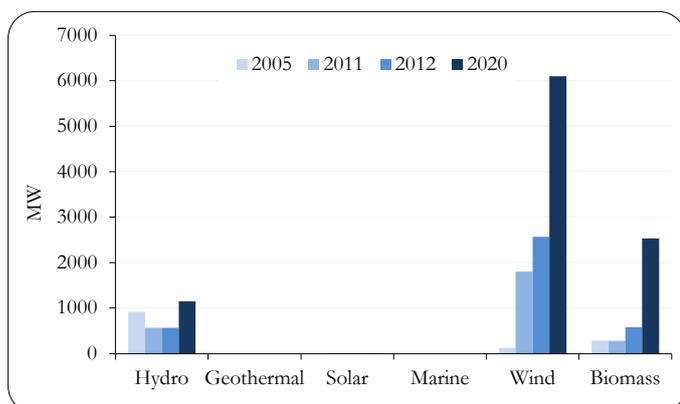


Figure 21-7. RES capacity deployment and progress until 2020 in Poland.

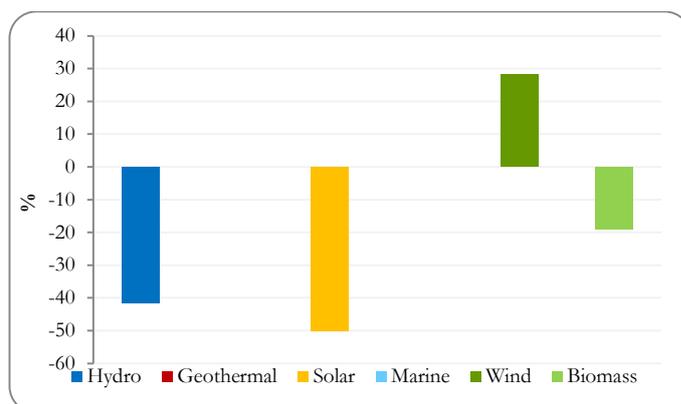


Figure 21-8. Deviation from NREAP in the RES installed capacity in Poland in 2012.

In 2020 wind power is expected to have the main contribution in renewable installed capacities with 62.3% followed by biomass with 25.9% and hydropower with 11.8%.

21.4.2 Consumption

Renewable electricity consumption in Poland amounted to 12.9 TWh (46.3 PJ) in 2011 and 17.0 TWh (61 PJ) in 2012 over 3.8 TWh (13.6 PJ) in 2005. The development of renewable energy in Poland was faster than planned in the NREAP for both years: 1.4% (+180.5 GWh) faster in 2011 and 14.3% (+2115.5 GWh) faster in 2012. In 2020 the renewable electricity consumption in Poland is expected to amount to 31.9 TWh (114.7 PJ).

In 2012 biomass covered 59.5% of total renewable electricity in Poland. The rest was coming from by wind (26.6%) and hydropower (13.8%).

Between 2005 and 2012 the highest additional renewable electricity consumed was coming

Biomass electricity provided 6.4% of 2012 gross final electricity consumption in Poland

from biomass, +8643 GWh (+85% per annum in average) which reached 10.1 TWh (36.3 PJ) in 2012. This development was fast enough to exceed the expected NREAP plans for this source in both years: 6.9% (+489.5 GWh) more in 2011 and 23.2% (+1902 GWh) more in 2012.

Wind technology furnished the second highest additional renewable electricity between 2005 and 2012 with +4374.3 GWh (+459.5% per annum in average). It had also the fastest development during period 2011-12 by 54.4% (+1588 GWh) reaching 2347 GWh in 2012. The development was not fast enough up to 2011 missing the respective NREAP level for this year by 10.2% (-333 GWh). Nevertheless due to the increase between 2011 and 2012 this technology exceeded the expected NREAP level in year 2012 by 4.9% (+210.3 GWh).

Hydropower technology increased the renewable electricity between 2005 and 2012 with 6.6% (+146 GWh) over 2201 GWh in 2005. The renewable electricity originated from this technology was found to be over the expected NREAP plans in both years: 1.1% (+351 GWh) over in 2011 and 0.2% (+4.0 GWh) over in 2012.

Renewable electricity coming from solar photovoltaic reached only 0.2 GWh in 2011 and furthermore 1.1 GWh in 2012. Comparing with expected NREAP plans this technology was under in both years: 90% (-1.8 GWh) under in 2011 and 45% (-0.9 GWh) under in 2012.

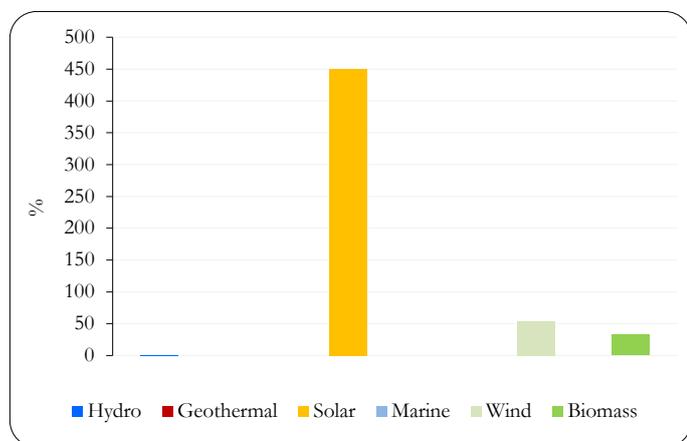


Figure 21-9. Relative increase/decrease of RES electricity sources in Poland, 2011-12

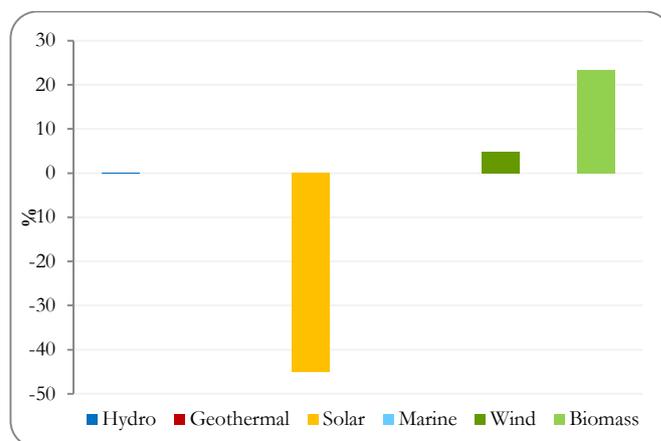


Figure 21-10. Deviation from NREAP in the RES electricity consumption in Poland in 2012.

In 2020 wind technology is expected to cover 46% of total renewable electricity consumption in Poland. Biomass is expected to count for 44.6% and the rest will be hydropower with 9.3%.

21.5 Renewable energy in heating & cooling

The use of renewable energy in heating and cooling in Poland reached 4888.8 (204.7 PJ) in 2011 increasing furthermore with 3% (+144.9 ktoe) in 2012. The use of renewable energy in this sector was over the expected NREAP levels in both years: 20% (+815.8 ktoe) over in 2011 and 20.6% (+858.7 ktoe) over in 2012. In 2020 the Poland expected to get 5921 ktoe (247.9 PJ) energy in form of heat from the use of renewable energy in this sector.

In 2012 almost all heat produced in Poland was coming from biomass, 99.3%. Only 0.26% was coming from solar and the rest was geothermal (0.31%) and heat pumps (0.13%).

The additional heat coming from biomass use between 2005 and 2020 was +4910 ktoe (+205.6 PJ) over 88.5 ktoe (3.7 PJ) in 2005. In comparison with NREAP plans the heat production from biomass was over in both years: 22.4% (+891 ktoe) over in 2011 and 24.3% (+977.5 ktoe) over in 2012.

Geothermal technology increased with only 1.3 ktoe (11.4%) between 2005 and 2011 and furthermore with 3.1 ktoe (24.4%) in 2012. Heat production from this technology missed the expected NREAP heat production in both years: 47.1% (-11.3 ktoe) less in 2011 and 45.5% (-13.2 ktoe) less in 2012.

Solar thermal reached only 10.4 ktoe in 2011 over 0.2 ktoe in 2005 increasing furthermore to 13 ktoe in 2012. This development was slower than the one projected in the NREAP being under the expected levels in both years: 76.9% (-34.6 ktoe) under in 2011 and 84.3% (-70.0 ktoe) under in 2012.

Between 2005 and 2012 the development of heat coming from heat pumps was very slow, with only 6.4 ktoe. It missed the expected NREAP heat plans in both years: 83.7% (-29.3 ktoe) less in 2011 and 84.8% (-35.6 ktoe) less in 2012.

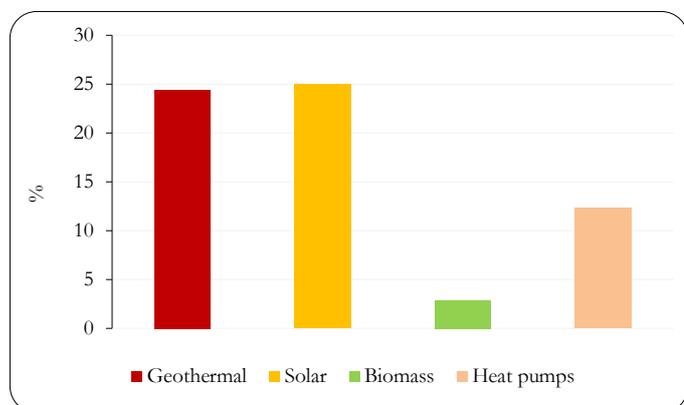


Figure 21-11. Relative increase/decrease of RES heating/cooling sources in Poland, 2011-12.

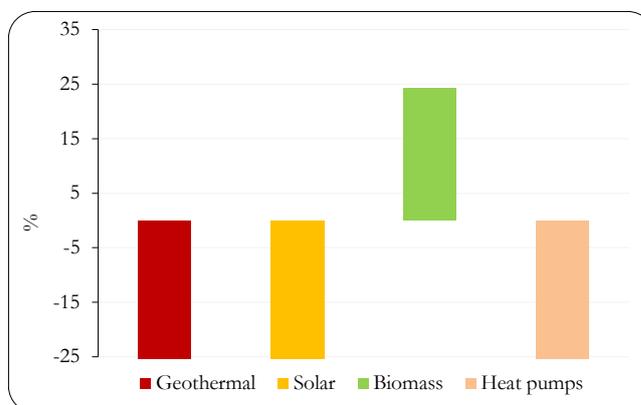


Figure 21-12. Deviation from NREAP in the RES heat consumption in Poland in 2012.

In 2020 the contribution of biomass is expected to decrease to 85.9% while the other technologies will increase it: solar with 8.5%, geothermal with 3% and heat pumps with 2.5%.

21.6 Renewable energy in transport

The use of renewable energy in transport reached 768.1 ktoe (32.2 PJ) in 2011 and 843.8 ktoe (35.3 PJ) in 2012 over 54 ktoe (2.3 PJ) in 2005. This use was nevertheless 28.3% (-302.9 ktoe) under in 2011 and 27.4% (-318.2 ktoe) under in 2012 the respective expected use of 1071 ktoe (44.8 PJ) and 1162 ktoe (48.7 PJ). The use of renewable energy in transport sector in 2020 is expected to be 2006 ktoe (84 PJ).

In 2012 the use of biodiesel in transport sector had a share of 75.3% followed by bioethanol/bio-ETBE with 18.2% and renewable electricity with 6.4%.

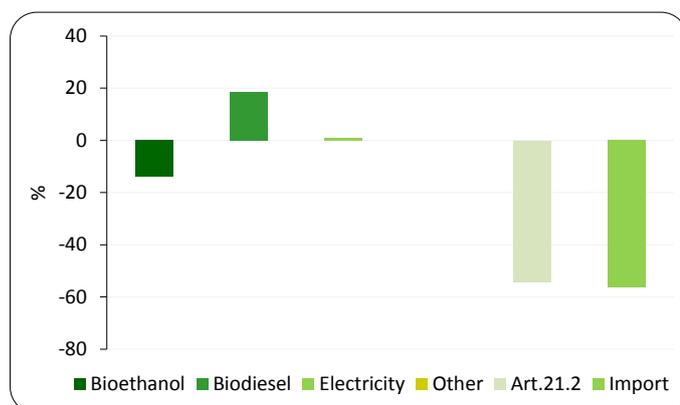


Figure 21-13. Relative increase/decrease of RES transport uses in Poland, 2011-12.

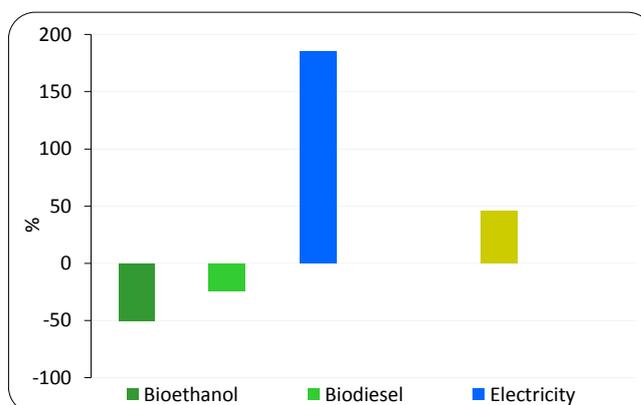


Figure 21-14. Deviation from NREAP in the RES use in transport in Poland in 2012.

Biodiesel made the main progress in transport sector during 2005-2011 increasing with 619.6 ktoe (553.2% per annum in average) increasing then further with 100 ktoe (+18.7%).

In comparison with NREAP planned values the use of biodiesel in Poland was under by 29.1% (-219.4 ktoe) in 2011 and 23.9% (-199.4 ktoe) in 2012.

Bioethanol/bio-ETBE increased with 115.9 ktoe in period 2005-2011 but decreased by 13.9% (-24.8 ktoe) between 2011 and 2012 missing the expected uses in both years: 40.2% (-120.2 ktoe) less in 2011 and 50% (-154.1 ktoe) less in 2012.

Biofuels from wastes, residues, ligno-cellulosic material, grew their use to 281 ktoe (11.8 PJ) in 2011 but decreased by 54% between 2011 and 2012. Nevertheless they were over the expected uses in both years: 538.3% (+236.9 ktoe) over in 2011 and 46.1% (+40.6 ktoe) over in 2012.

No other biofuels (biogas and vegetable oils) were used in Poland in 2011 and 2012.

While no contribution was expected in both years for the use of imported biofuels, they grew to 366 ktoe (15.3 PJ) in 2011 but decreased by 56.4% (-206.4 ktoe) during period 2011-12.

The use of renewable electricity in transport increased faster than expected between 2005 and 2011 exceeding the expected NREAP use by 216% (+36.7 ktoe). It exceeded also the 2020 planned use by 41.3% (+15.7 ktoe). The use of renewable electricity increased further during 2011-12 with 0.9% (+0.5 ktoe) being 185.4% (+35.2 ktoe) over the expected NREAP use remaining also over the 2020 planned use for this source.

In 2020 the contribution of bioethanol/bio-ETBE is expected to decrease slightly to 72.3% of the total heat expected to be consumed in this year. Biodiesel is expected to increase its contribution up to 22.5% while renewable electricity is planned to reach only 1.9% of total renewable heat for this year. In 2020 a contribution of 3.3% is expected to come from the use of other biofuels.

22. Renewable energy in Portugal

22.1 Deployment of renewable energy

The renewable energy consumed in Portugal increased with 5.4% per annum in average in 2012 over 3310.6 ktoe (138.6 PJ) in 2005 decreasing further in 2012 by 15.4. Renewable energy consumed in Portugal is expected to further increase to 6102.3 ktoe (255.5 PJ) until 2020 (Figure 22-1).

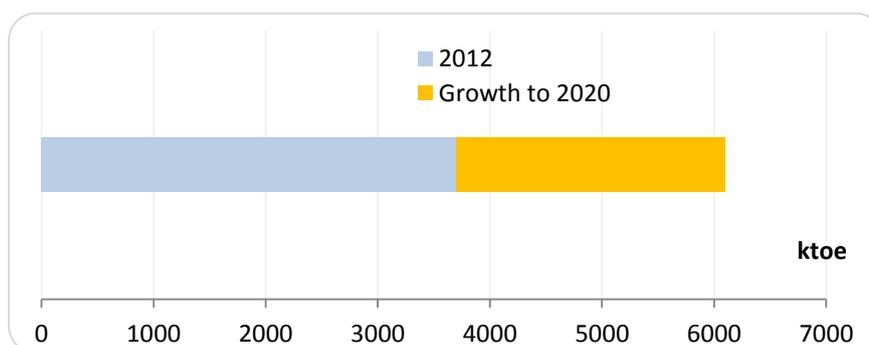


Figure 22-1. RES total in Portugal in 2012 and the expected growth to 2020 target

Renewable energy consumed in electricity sector experienced a significant increase between 2005 and 2011, 30.0% per annum in average. Nevertheless a decrease by 17.3% took place between 2011 and 2012 in renewable electricity use in Portugal. Because of the fast development of renewable electricity between 2005 and 2011 Portugal was over the expected NREAP level in 2011 by 2.4% (+50.2 ktoe) while in 2012 it missed the respective NREAP level by 23.9% (-557.2 ktoe).

Portugal missed the expected NREAPs targets for renewable energy consumption in both 2011 and 2012: by 7.7% (-366.4 ktoe) in 2011 and by 6.5% (-1381 ktoe) in 2012.

Renewable energy in heating/cooling sector decreased by 2.1% per annum in average (-321.2 ktoe) between 2011 and 2005 decreasing further in 2012 with 13.8% (-304.3 ktoe). Comparing with expected developments Portugal was under the respective NREAP levels in both years: 5.5% (-128.2 ktoe) under in 2011 and 21.8% (-532.5 ktoe) under in 2012.

Transport sector was the only sector that experienced an increase between 2011 and 2012 by 6.8% (+1.2 ktoe). It increased in 2011 over 2005 level of 12.0 ktoe with 7.8% per annum in average. Comparing with expected NREAP levels the renewable energy consumed in Portugal was under in both years: 94.2% (-288.4 ktoe) under in 2011 and 93.9% (-291.2 ktoe) under in 2012.

The main progress expected in renewable energy consumed in Portugal up to 2020 will be in transport sector with a yearly average increase of 287.2% over 2012 level followed by electricity sector with an increase of 72.3% over 1776.2 ktoe in 2012.

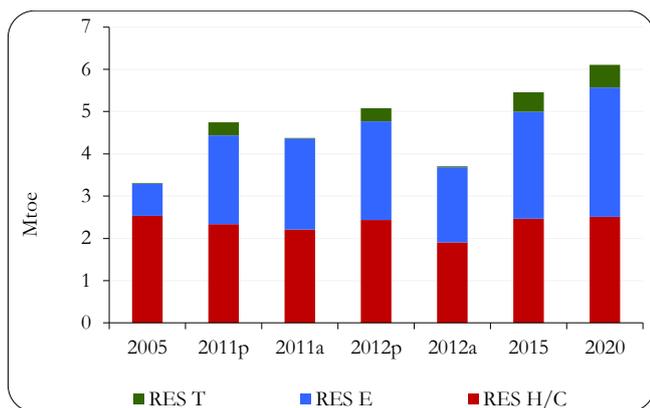


Figure 22-2. RES deployment in Portugal: projected growth and actual progress until 2020.

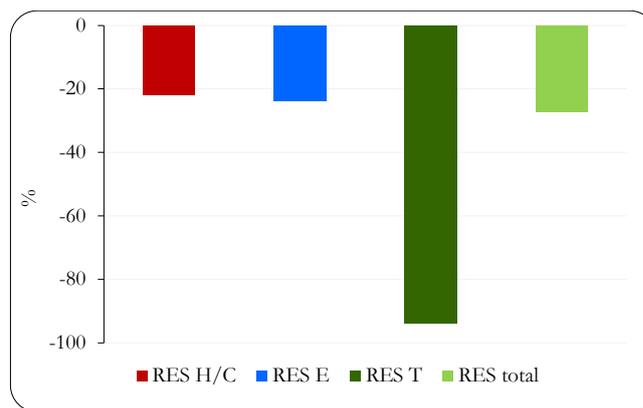


Figure 22-3. Deviation from NREAP in the RES production in Portugal in 2012.

22.2 Sources of renewable energy

In 2012 almost two-third of renewable energy in Portugal was coming from biomass followed by biofuels with 18.2%, wind with 9.5%, solar with 6.2%, hydropower with 1.4% and heat pumps with 1%.

Except biomass all renewable energy sources in Portugal experienced an increased between 2005 and 2012.

The highest additional renewable energy consumed came from wind technology which increased by 68.4% per annum in average between 2005 and 2012. Nevertheless this technology missed in both years the expected NREAP levels: 19.2% (-186.8 ktoe) below in 2011 and 18.6% (-201.2 ktoe) under in 2012.

All renewable energy sources in Portugal missed their respective NREAP planned targets for 2012

Solar technology had the second highest relative increase in 2005-2012 period with 50.7% per annum in average over 22.3 ktoe level of 2005. Comparing with NREAP expected levels Portugal missed them in both years: 12.1% (-11.5 ktoe) under in 2011 and 13.5% (-15.8 ktoe) under in 2012.

Geothermal technology increased by 147% between 2005 and 2012 reaching 14.2 ktoe. This technology missed to meet the expected NREAP levels in both years: 24.4% (-6.4 ktoe) less in 2011 and 49.5% (-13.9 ktoe) less in 2012.

Biomass was the renewable energy source that decreased during period 2005-2012 amounting to 21.2% (-566.7 ktoe) under year 2005. Because of this decrease this technology missed the expected NREAP levels in both 2011 and 2012: 2.8% (-69.1 ktoe) under in 2011 and 19.1% (-498.0 ktoe) under in 2012.

In 2020, the share of biomass in RES mix is expected to decrease up to 43.4%, followed by wind with 20.8%, hydropower with 20%, biofuels with 7.9%, solar with 6.2%, geothermal with 1.1% and marine energy with 0.6%.

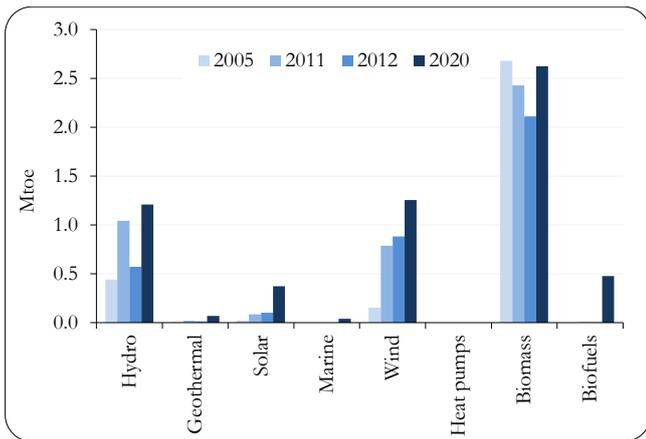


Figure 22-4. Contribution of renewable energy sources in Portugal: actual and projected in 2020

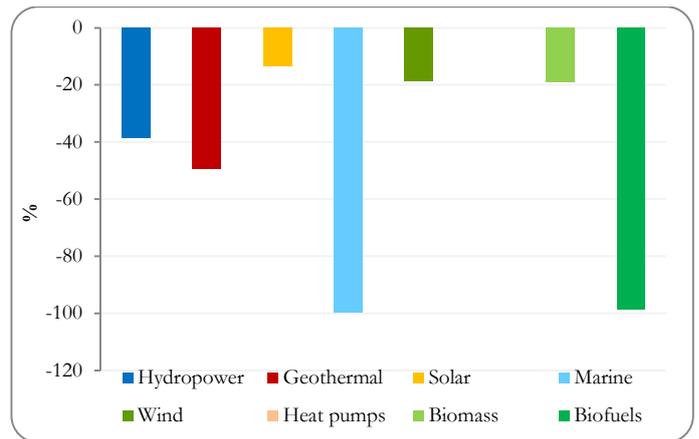


Figure 22-5. Deviation from NREAP in the contribution of renewable sources in Portugal in 2012

22.3 Renewable energy share

The overall renewable energy contribution in Gross Final Energy Consumption in Portugal reached 24.5% in 2011 increasing by only 0.1% points in 2012. Nevertheless comparing with the expected shares for 2011 and 2012 the overall share of RES was under by 0.7% points in year 2011 and 2.3% points in 2012. The 2020 target that Portugal has to reach for the overall RES share is 23%.

The overall RES share in Portugal remained almost unchanged at level of 24.6% since 2009. In the period 2011-2012 the overall RES share exceeded the indicative minimum trajectory set by the RED Directive for both 2011/12 and 2013/14 but remained below the NREAP targets. Although RES share remains well above the minimum trajectories, Portugal seems needing a faster RES deployment in order to achieve its 2020 overall RES share target.

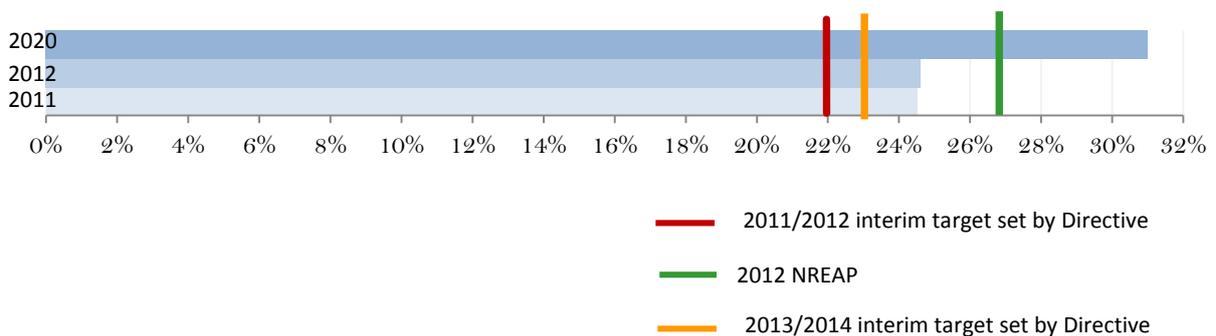


Figure 22-6. Overall RES share in Portugal, 2011-12

Portugal has planned to decrease the overall RES share in heating/cooling sector between 2005 and 2020. Nevertheless an increase took place since in 2009 when the renewable energy share in this sector reached 37.86% exceeding the 2020 planned share for this sector. Since 2009 this share decreased reaching 35.9% in 2011 and furthermore 33.0% in

2012. Comparing with expected NREAP shares Portugal was well over in both 201 and 2012: 4.2% points over in 2011 and 0.3% points over in 2012.

Renewable energy share in electricity sector increased significantly between 2005 and 2011, by 16.6% points and furthermore by 1.7% points in 2012. The development of renewable electricity share in Portugal was fast during 2005-2011 exceeding the expected NREAP share by 1.7% points. Nevertheless between 2011 and 2012 this development was slower than what was expected missing the expected NREAP share in 2012 by 1.2% points.

The development of renewable energy share in transport sector experienced the slowest development between 2005 and 2012 among energy sectors in Portugal. It increased with only 0.3% points in 2011 over 0.2% of 2005 remaining than unchanged in 2012. Comparing with expected NREAP shares Portugal was well under in both years: 4.6% points under in 2011 and 4.8% under in 2012.

The main development in Portugal up to 2020 is expected in transport sector (from 0.5% to 10.0%) followed by electricity sector (from 47.6% to 55.3%).

22.4 Renewable electricity

22.4.1 Installed capacity

The renewable energy installed capacity in Portugal increased from 6.4 GW in 2005 to 10.6 GW in 2011 and 11.0 GW in 2012. Nevertheless these capacities were 2.9% (-318 MW) under in 2011 and 12.1% (-1515.7 MW) under in 2012 the respective NREAP planned capacities for these years. Portugal has planned to have in place in 2020 19.2 GW of installed renewable energy capacities.

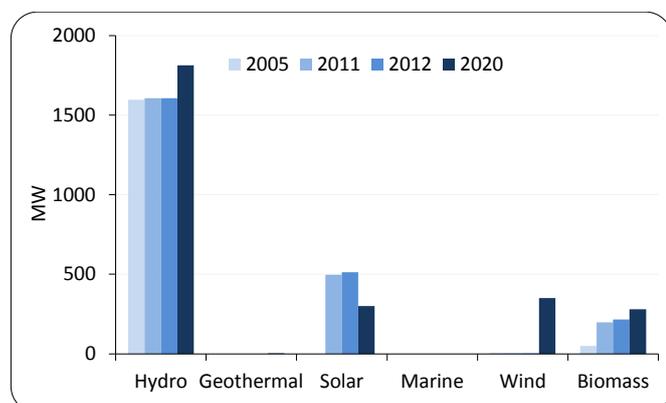


Figure 22-7. RES capacity deployment and progress until 2020 in Slovakia.

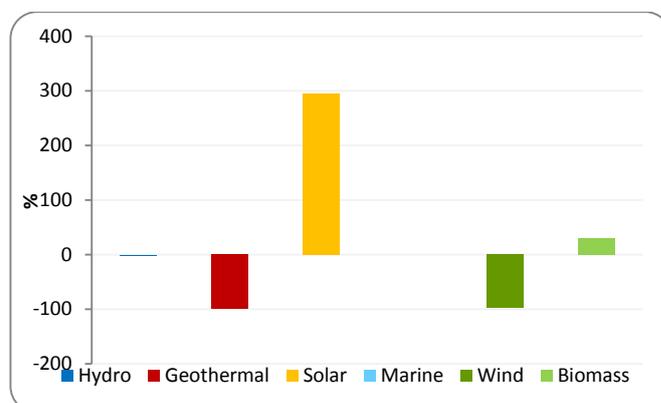


Figure 22-8. Deviation from NREAP in the RES installed capacity in Slovakia in 2012.

Almost 52% of renewable installed capacity in Portugal in 2012 was covered by hydropower while the rest was wind (40.1%), biomass (5.5%), solar (2.2%) and geothermal (0.2%).

40% of added renewable electricity capacity in Portugal between 2011 and 2012 was provided by wind power

The main progress from year 2005 was made in wind technology with an increase in capacity of 3193 MW (50% per annum in average) in 2011 increasing further with 138 MW (+3.7%) in

2012. Nevertheless this development was slower than what was planned in the NREAP in both 2011 and 2012: 13.6% (-672 MW) less in 2011 and 21.2% (-1186 MW) less in 2012.

In relative terms the fastest development took place in solar photovoltaic capacity which increased by nearly 940% per annum in average (+169 MW) between 2005 and 2011 increasing further by 38.7% (+66 MW) in 2012. Despite of this significant increase the solar photovoltaic capacity in Portugal was under the expected NREAP capacity in both years: 33.3% (-86 MW) under in 2011 and 30.0% (-102 MW) under in 2012.

The additional installed capacity in hydropower technology increased with 735 MW (+15.3%) in 2011 over the 2005 level increasing further by 3.0% (+166 MW) in 2012. The development between 2005 and 2011 was fast enough to exceed by 11.4% (+570 MW) the expected NREAP capacity for this year. Nevertheless in 2012 the hydropower capacity missed the NREAP planned capacity by 0.3% (-17.0 MW).

No capacities in marine technology were registered in Portugal between 2011 and 2012 missing the respective NREAP planned capacities of 30 MW and 40 MW.

Biomass capacity in Portugal increased by 4.3% per annum in average between 2005 and 2011 amounting to 598 MW. A further increase by 1.3% (+8.0 MW) took place in 2012 over 2011 level. Nevertheless this source missed the expected NREAP planned capacities in both years: 17.3% (-125 MW) less in 2011 and 25.4% (-206 MW) less in 2012.

In 2020 hydropower is expected to remain the main installed capacity in Portugal with 49.7% in contribution followed by wind (35.8%), solar photovoltaic (7.8%), biomass (5%), marine (1.3%) and geothermal (0.4%).

22.4.2 Consumption

Renewable electricity consumption in Portugal developed fast during period 2005-2011 reaching almost 25 TWh (89.9 PJ) over 9 TWh (32.1 PJ) in 2005. In this year renewable electricity consumption in Portugal was over the expected NREAP production by 2.4% (+584 GWh). Nevertheless a decrease by 17.3% (-4.3 TWh) took place between 2011 and 2012 in renewable electricity consumption in Portugal missing the expected NREAP level for this year by 23.9% (-6.5 TWh). In 2020 the renewable electricity consumption in Portugal is expected to amount to 35.6 TWh (128.1 PJ).

In 2012 almost half (49.7%) of renewable electricity was wind power. The rest was covered by hydropower (32.2%), biomass (15.5%), solar photovoltaic (1.9%) and geothermal (0.7%).

Wind was the technology providing more renewable electricity between 2005 and 2011, +7389 GWh (+416.8%) increasing further by 1098 GWh (+12.0%) in 2012. Nevertheless the development of this technology was not at the expected level as projected in the NREAP in both 2011 and 2012: 19.2% (-2172 GWh) less in 2011 and 18.6% (-2340 GWh) less in 2012.

Almost 24% of gross final electricity consumption in Portugal in 2012 was covered by wind power

Hydropower had the second highest additional renewable electricity in Portugal between 2005 and 2011, +6996 GWh (+136.7%). In this year the electricity from this technology was over the expected NREAP level by 23.2% (+2278 GWh). Between 2011 and 2012 a decrease by 45% (-5454 GWh) in renewable electricity from this technology was recorded in Portugal missing the expected NREAP levels for year 2012 by 38.6% (-4193 GWh).

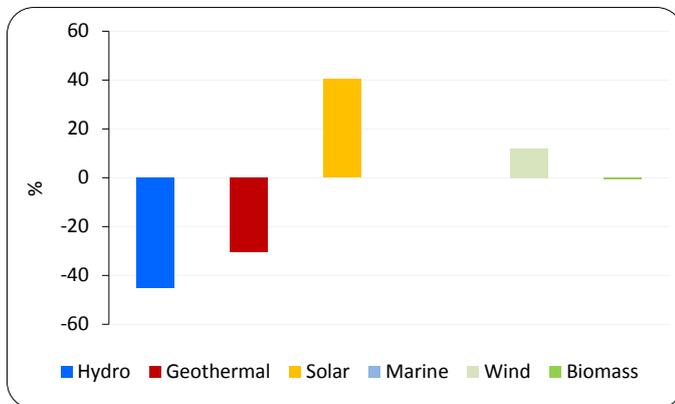


Figure 22-9. Relative increase/decrease of RES electricity sources in Portugal, 2011-12

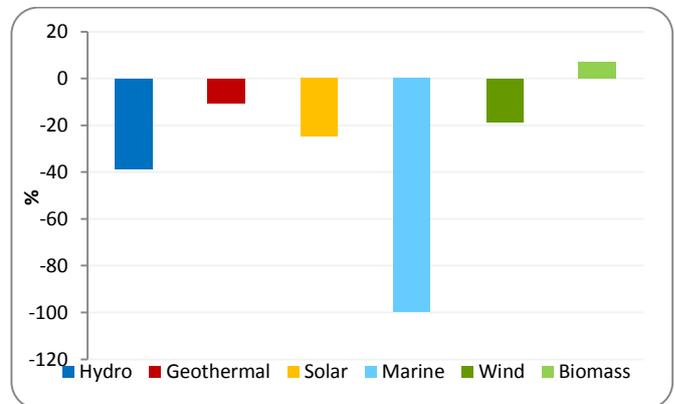


Figure 22-10. Deviation from NREAP in the RES electricity consumption in Portugal in 2012.

The development of solar technology (only photovoltaic) took place with a very high average annual growth rate between 2005 and 2011, +1539%. A further increase in 2012 with 40.4% (+113 GWh) over 2011 level took place in Portugal. Even that planned no electricity coming from CSP technology was reported for both 2011 and 2012. Comparing with expected NREAP levels the solar technology missed the expectations in both years: 29.3% (-116 GWh) under in 2011 and 24.9% (-130.0 GWh) under in 2012.

Biomass was the only source that developed faster than what was planned in the NREAP in both years. It reached 3219 GWh (11.6 PJ) in 2011 over 1976 GWh (7.1 PJ) in 2005 exceeding by 20.6% (+549 GWh) the expected NREAP plan for this year. Renewable electricity coming from biomass decreased by 0.7% (-24.0 GWh) between 2011 and 2012 being nevertheless over by 6.8% (+204 GWh) of expected NREAP level.

Geothermal electricity increased between 2005 and 2011 by 47% per annum in average amounting to 210 GWh (0.8 PJ) decreasing further in 2012 by 30.5% (-64 GWh). Comparing to NREAP levels for this technology Portugal was over by 28.8% (+47 GWh) in 2011 but under by 10.4% (-17 GWh) in 2012.

No electricity from marine technology was in place in Portugal in 2011 and 2012 even that it was planned in its NREAP for this period.

In 2020 wind will remain the source of renewable electricity with 41.0% followed by hydropower (39.5%), biomass (9.9%), solar (7.0%), geothermal (1.4%) and marine (1.2%). Main progress is expected in hydropower (+7413 GWh), wind (+4336 GWh) and solar (+2082 GWh).

22.5 Renewable energy in heating & cooling

In 2011 renewable heat production in Portugal decreased by 12.7% (-321.2 ktoe) from 2531 ktoe in 2005. A further decrease happened between 2011 and 2012 with 13.8% (-304.3 ktoe) in heat production in Portugal reaching 1905.5 ktoe (79.8 PJ). Comparing with expected development heat production was found to be under the NREAP in both years: 5.5% (-128.2 ktoe) under in 201 and 21.8% (-532.5 ktoe) under in 2012. In 2020 the heat production from renewable energy sources in Portugal is expected to reach 2507 ktoe (105.0 PJ).

Almost 96.4% of renewable heat in Portugal was coming from biomass while the contributions of heat pumps and geothermal were limited to 3.54% and 0.08%.

Portugal has planned to decrease the use of biomass for heat production during period 2005-2020, from 2508 ktoe (105 PJ) to 2322 ktoe (97.2 PJ). After the decrease during period 2009-2010 the biomass use for heat in Portugal decreased between 2011 and 2012 reaching 1836.5 ktoe (76.9 PJ) in 2012. Nevertheless this decrease was higher than what was planned in the NREAP, missing the expected levels in both 2011 and 2012: 5.1% (-116.3 ktoe) under in 2011 and 21.9% (-515.5 ktoe) under in 2012.

One – third of gross final heat consumption in 2012 in Portugal was provided by biomass thermal

Between 2005 and 2012 the heat production from solar thermal almost triple its absolute contribution, from 22.0 ktoe (0.9 PJ) to 67.4 ktoe (2.8 PJ). Nevertheless this development was not enough to meet the expected NREAP levels in both years: 2.5% (-1.5 ktoe) under in 201 and 6.4% (-4.6 ktoe) under in 2012.

Even the development of geothermal technology in this sector was slower than what was expected reaching only 1.6 ktoe (0.1 PJ) in period 2011-12. The heat production from this technology missed the NREAP levels in both years: 86.7% (-10.4 ktoe) under in 2011 and 88.6% (-12.4 ktoe) under in 2012.

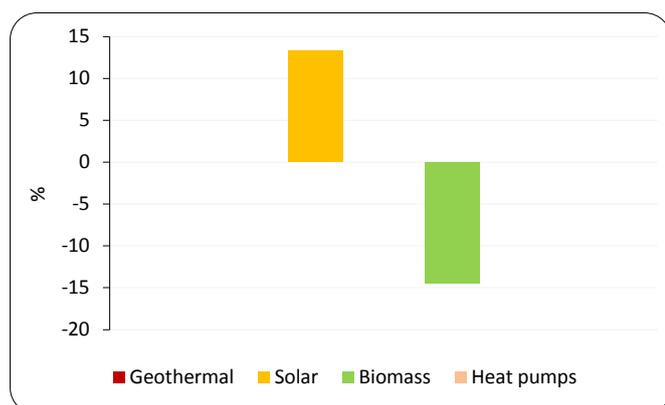


Figure 22-11. Relative increase/decrease of RES heating/cooling sources in Portugal, 2011-12.

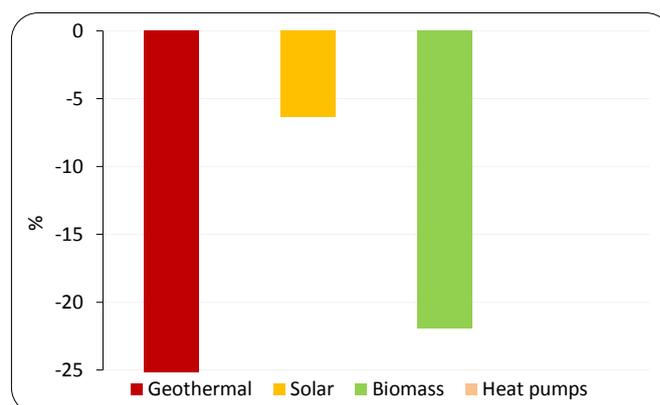


Figure 22-12. Deviation from NREAP in the RES heat consumption in Portugal in 2012.

In 2020 biomass will still remain the main source of heat production even that its share will be decreased slightly to 92.6%. The share of solar thermal is expected to be increased up to 6.4% and geothermal only 1%.

22.6 Renewable energy in transport

The use of renewable energy in transport reached only 17.6 ktoe (0.7 PJ) in 2011 increasing by 6.8% (+1.2 ktoe) in 2012. Comparing with expected NREAP use Portugal was found to be very under in both years: 94.2% (-288.4 ktoe) under in 2011 and 93.9% (-290.2 ktoe) under in 2012. The use of renewable energy in transport sector in 2020 is expected to be 538 ktoe (22.4 PJ).

Biodiesel is the main type of biofuels use in transport sector in Portugal. It reached in 2011 only 4.1 ktoe remaining almost in this level even in 2012 (the additional use was only 0.1 ktoe). Comparing with expected use biodiesel was very under the NREAP respective use in both years: 98.6% (-278.9 ktoe) under in 2011 and 98.5% (-278.0 ktoe) under in 2012.

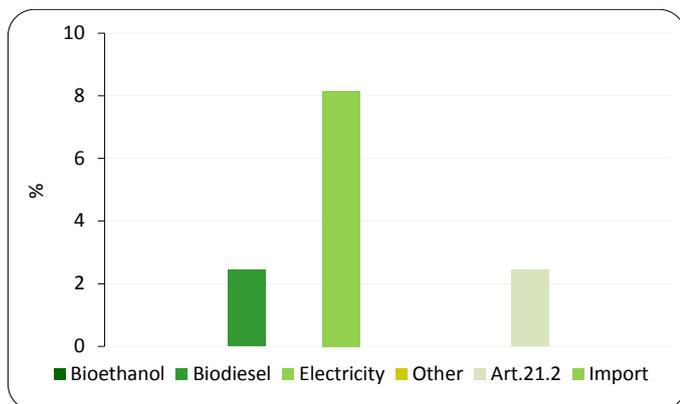


Figure 22-13. Relative increase/decrease of RES transport uses in Portugal, 2011-12.

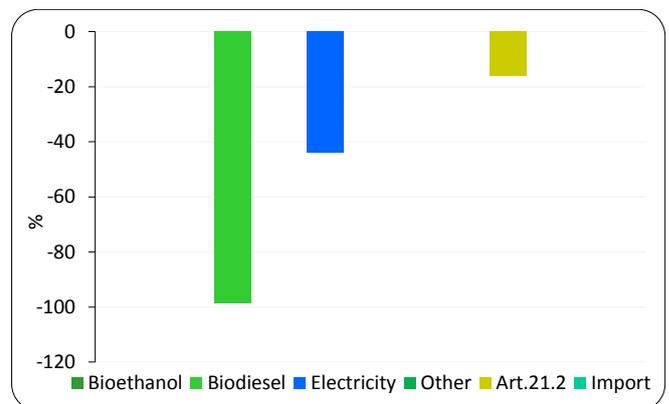


Figure 22-14. Deviation from NREAP in the RES use in transport in Portugal in 2012.

Biodiesel used in Portugal between 2011 and 2012 was totally from wastes, residues, ligno-cellulosic material. This type of biofuel exceeded the expected use in 2011 by 2.5% (-0.1 ktoe) but missed it in 2012 by 16% (-0.8 ktoe).

No other biofuels (biogas and vegetable oils) were used in Portugal in this period.

Renewable electricity was the main use (77.7%) of renewable energy in transport between 2011 and 2012 reaching 14.6 ktoe in 2012. Comparing with expected use Portugal was under the NREAP in both years: 41.3% (-9.5 ktoe) under in 2011 and 43.8% (-11.4 ktoe) under in 2012.

23. Renewable energy in Romania

23.1 Deployment of renewable energy

The renewable energy consumed in Romania reached 4706.3 ktoe (197 PJ) in 2011 from 4608 ktoe (193 PJ) in the baseline year. Renewable energy consumed in Romania is expected to further increase to 7288 ktoe (305 PJ) until 2020 (Figure 23-1).

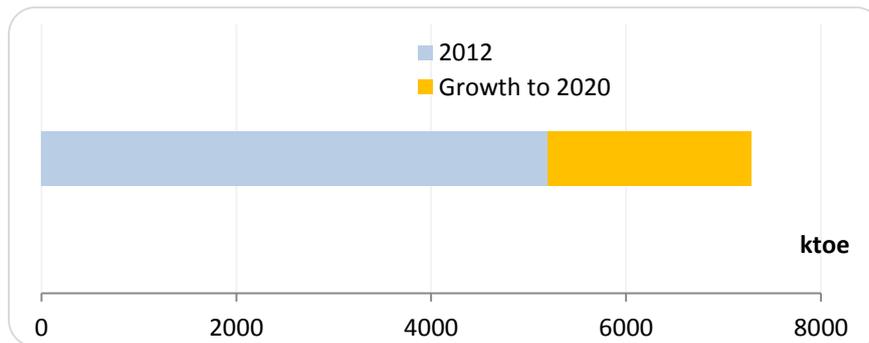


Figure 23-1. RES total in Romania in 2012 and the expected growth to 2020 target

While a reduction was planned in the use of renewable energy in heating/cooling sector in Romania between 2005 and 2011 this use grew with 1.5% per annum in average reaching 3504.2 ktoe (146.7 PJ) in 2011. The increasing trend continued even in 2012 reaching 3687.7 ktoe (154.4 PJ). This development was faster than the one projected in the NREAP

Renewable energy consumption in Romania missed the expected NREAP target in 2011 by 1.6% (-78 ktoe) but exceeded it in 2012 by 0.7% (+38.4 ktoe)

exceeding the respective uses in both 2011 and 2012: 23.6% (+670.2 ktoe) more in 2011 and 22.9% (+687.7 PJ) more in 2012.

The use of renewable energy in transport sector increased fast between 2005 and 2011 with 25.2% per annum in average (+98.5 ktoe) from 41 ktoe (1.7 PJ) in the baseline year. Despite an increase with 107% (+110 ktoe) took place between 2011 and 2012 the use of renewable energy in this sector missed the expected NREAP uses in both 2011 and 2012: 64.6% (-187.6 ktoe) under in 2011 and 33.2% (-105.8 ktoe) under in 2012.

Renewable electricity production in Romania experienced a decrease during period 2005-2011 with 3.4% per annum in average (-284.5 ktoe) from 1384 ktoe (57.9 PJ) in the baseline year. This downward trend was reflected at the negative deviations from expected NREAP levels in both 2011 and 2012: 33.8% (-560.4 ktoe) less in 2011 and 29.6% (-543.6 ktoe) less in 2012.

Up to 2020 the main progress is expected in the use of renewable energy in electricity sector (+1404.7 ktoe or 58.8 PJ) followed by heating/cooling sector (+350.3 ktoe or 14.7 PJ) and transport sector (+337.8 ktoe or 14.1 PJ).

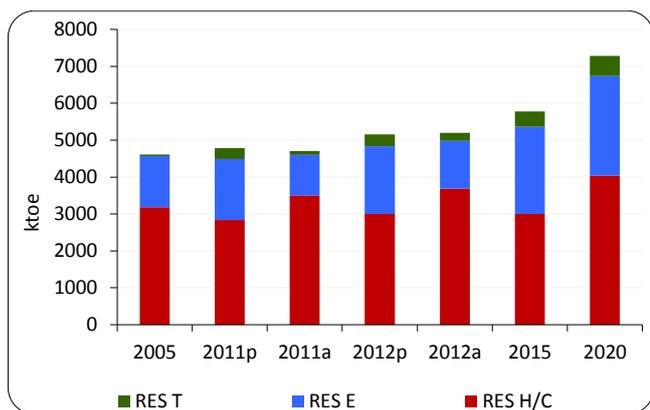


Figure 23-2. RES deployment in Romania: projected growth and actual progress until 2020.

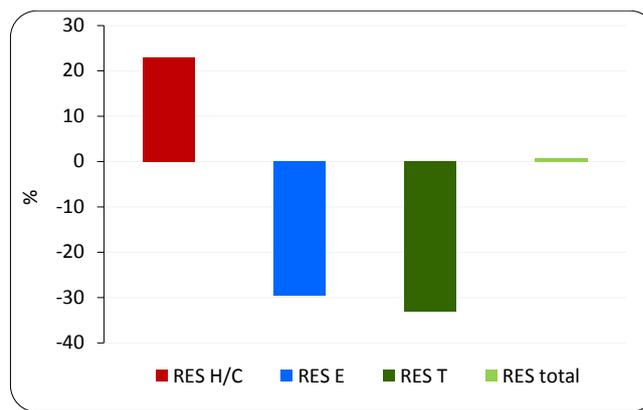


Figure 23-3. Deviation from NREAP in the RES production in Romania in 2012.

23.2 Sources of renewable energy

Already 71% of total renewable energy mix in Romania was biomass and the rest hydropower (20.31%), wind (4.41%), biofuels (3.46%) and geothermal (0.02%).

Biomass use for energy purposes increased with 1.8% per annum in average (+332.8 ktOE) during period 2005-2011 reaching 3498.8 ktOE (146.5 PJ) increasing then further with 5.6% (185.4 ktOE) in 2012. This development was faster than the NREAP projected one exceeding the respective expected uses in both 2011 and 2012: 23.2% (+659.4 ktOE) more in 2011 and 21.6% (-654.8 ktOE) more in 2012.

16.2% of gross final energy consumption in Romania in year 2012 was covered by biomass

Geothermal source developed with 5.1% per annum in average (+5.2 ktOE) between 2005 and 2011 reaching 22.2 ktOE (0.9 PJ) decreasing then with 2.7% (-0.6 ktOE) in 2012. The development of this source was slower than the NREAP projected one missing the respective expected levels in both 2011 and 2012: 26% (-7.8 ktOE) less in 2011 and 38.3% (-13.4 ktOE) less in 2012.

Solar source used for energy purposes in Romania reached only 0.1 ktOE (0.005 PJ) in 2011 increasing then with 554.5% (0.7 ktOE) in 2012. Despite of this increased the solar source use missed the expected NREAP uses in both 2011 and 2012: 93.5% (-1.7 ktOE) under in 2011 and 89.2% (-6.5 ktOE) under in 2012.

The development of biofuels use in transport sector was slower than the NREAP projected one reaching in 2011 only 63 ktOE (2.6 PJ) which was 75.2% (-191 ktOE) under the respective NREAP use for this year. Even that an increase with 183% (+115.3 ktOE) took place between 201 and 2012 the use of biofuels in this sector remained still under the respective NREAP use with 37% (-104.7 ktOE).

In 2020, the share of biomass in renewable energy mix is expected to decrease up to 57% while an increase is expected in other sources: hydropower 23.5%, wind 10%, biofuels 6.9%, solar 1.3%, geothermal 1.1% and heat pumps 0.2%.

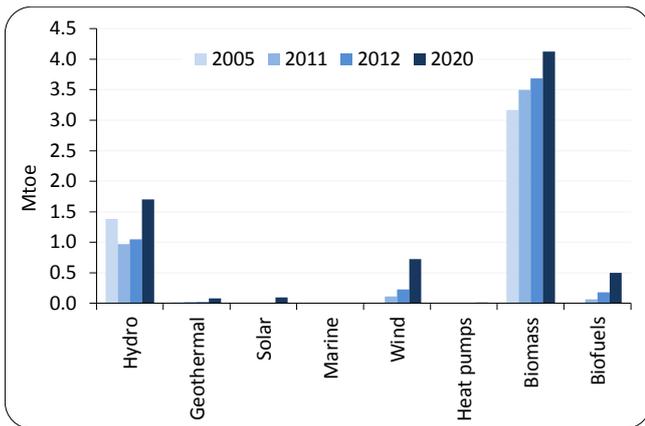


Figure 23-4. Contribution of renewable energy sources in Romania: actual and projected in 2020

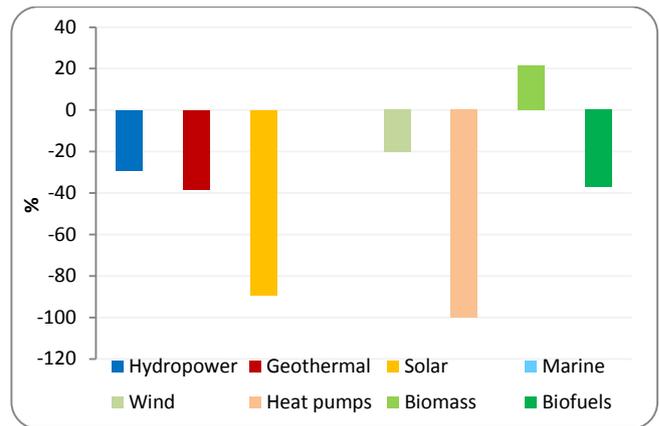


Figure 23-5. Deviation from NREAP in the contribution of renewable sources in Romania in 2012

23.3 Renewable energy share

The overall renewable energy contribution in Gross Final Energy Consumption in Romania reached 21.2% in 2011 and 22.9% in 2012. Comparing with the expected shares for 2011 and 2012 the overall share of RES was over by 3.2% points in year 2011 and 3.9% points in 2012. The 2020 target that Romania has to reach for the overall RES share is 24%.

The overall RES share in Romania in 2011-2012 exceeded the NREAP RES share and the minimum indicative trajectories for both 2011/12 and 2013/14. In 2012 the overall RES share in Romania reached the 2019 NREAP planned share showing that Romania is in very good track to reach the 2020 RES share target.

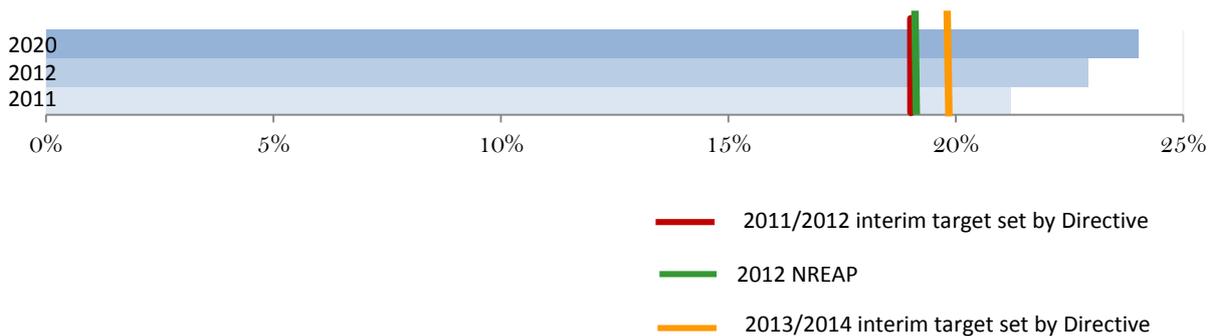


Figure 23-6. Overall RES share in Romania, 2011-12

Renewable energy share in heating/cooling sector increased very fast between 2005 and 2011 reaching 24.31% exceeding so with 2.28% points the 2020 planned share for this sector. The increase trend followed even during period 2011-12 with 1.43% points. Comparing with expected NREAP shares the achieved 2011 and 2012 were over respectively with 6.8% points and 7.6% points.

In electricity sector the share of renewable energy increased from 30.08% in the baseline year with only +1.05% points in 2011 and further with +2.44% points. Nevertheless this share exceeded the NREAP planned share only in 2011 with 0.3% points missing it then in 2012 with 0.3% points.

The share of renewable energy in transport sector developed slower than what was projected in the NREAP increasing with only +0.71% points in 2011 over 1.39% in 2005. Even that an increase with +2.2% points took place between 2011 and 2012 the share of renewable energy in this sector remained under the expected NREAP planned shares in both 2011 and 2012: 4.1% points under in 2011 and 2.4% points under in 2012.

Major increase from year 2012 until 2020 is expected in transport sector (from 4.3% to 12.1%) followed by electricity sector (from 33.57% to 42.62%).

23.4 Renewable electricity

23.4.1 Installed capacity

The renewable energy installed capacity in Romania increased from 6.3 GW in 2005 to 7.4 GW in 2011 and 8.4 GW in 2012. Nevertheless these capacities were 6.0% (-475 MW) and 4.5% (-391 MW) under the respective NREAP planned capacities for these years. In 2020 the expected installed renewable energy capacity in Romania is 12.6 GW.

In 2012 hydropower installed capacity contributed with 77.3% in total renewable energy capacity in Romania followed by wind with 21.8%, solar photovoltaic with 0.5% and biomass with 0.4%.

Wind power technology had the fastest development between 2005 and 2012 increasing with 12458% per annum in average from the very low level of 1.32 MW in the baseline year. This capacity increased further in 2012 with 84.4% (+834 MW). Nevertheless this development was slower than what was planned in the NREAP missing the respective expected capacities in both 2011 and 2012: 21% (-262 MW) less in 2011 and 1.5% (-28 MW) less in 2012.

Nearly 90% of additional renewable electricity capacity installed in Romania in 2012 consisted in wind power

The increase between 2005 and 2011 in solar photovoltaic capacity took place with only 1 MW. This technology increased very fast between 2011 and 2012 its capacity (+4000% or +40 MW) reaching 41 MW in 2012. Despite of this development the installed capacities of solar photovoltaic in 2011 and 2012 were both under the expected NREAP capacities respectively by 87.5% (-7 MW) and 4.7% (-2 MW).

Biomass installed capacity amounted to 30 MW in 2011 and 35 MW in 2012. Nevertheless these capacities were found to be significantly under the expected NREAP ones respectively by 66.7% (-60 MW) in 2011 and -78.8% (-130 MW) in 2012.

Hydropower capacity also developed slower than what was planned in the NREAP. It reached 6391 MW in 2011 and 6456 MW in 2012 which were respectively under by 2.2% (-146 MW) and 3.5% (-231 MW).

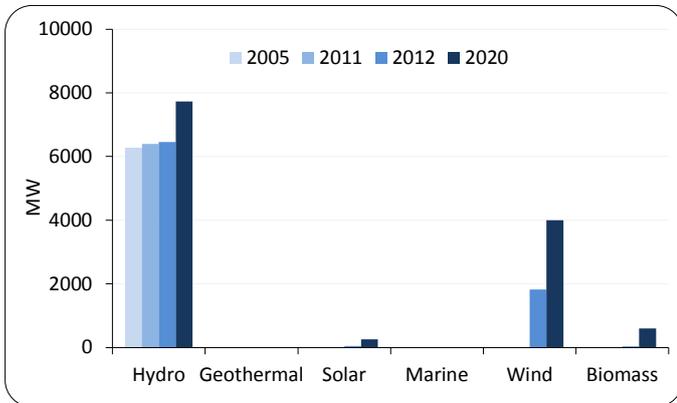


Figure 23-7. RES capacity deployment and progress until 2020 in Romania.

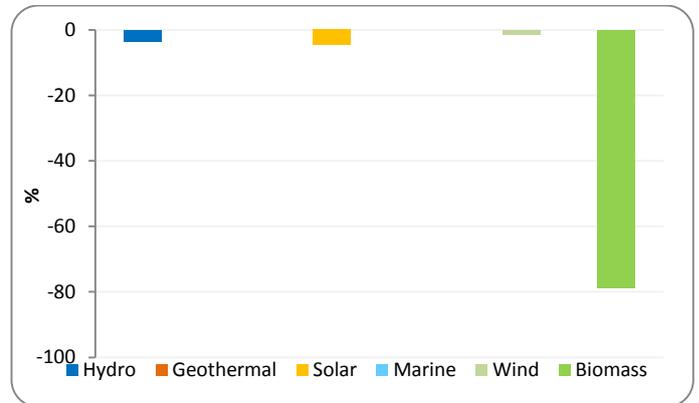


Figure 23-8. Deviation from NREAP in the RES installed capacity in Romania in 2012.

In 2020 windpower is expected to increase its contribution in total renewable energy capacity to 31.8% while the contribution of hydropower is expected to decrease to 61.4%. The rest is expected to be covered by biomass (4.8%) and solar photovoltaic (2.1%).

23.4.2 Consumption

Renewable electricity consumption in Romania amounted to 12.8 TWh (46 PJ) in 2011 and 15.1 TWh (54.2 PJ) in 2012 from 16.1 TWh (57.9 PJ) in 2005. Nevertheless the renewable electricity consumed in Romania didn't reach the NREAP planned values missing the respective values by 33.8% (-6516.4 GWh) in 2011 and 29.6% (-6320.6 GWh) in 2012. In 2020 the renewable electricity consumption in Romania is expected to amount to 31.4 TWh (113 PJ).

In 2012 hydropower provided 81% of renewable electricity in Romania and the rest was wind (17.6%), biomass (1.4%) and solar (0.1%).

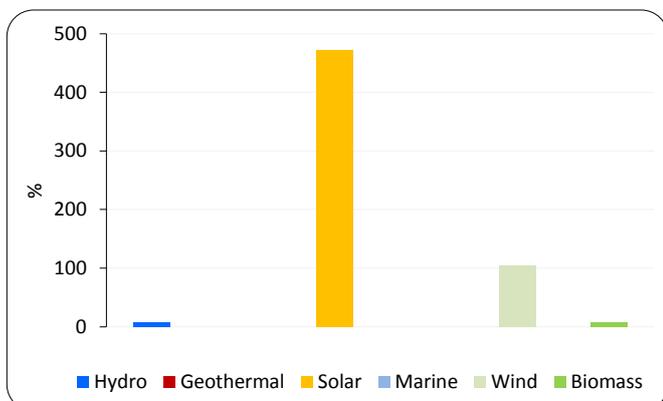


Figure 23-9. Relative increase/decrease of RES electricity sources in Romania, 2011-12

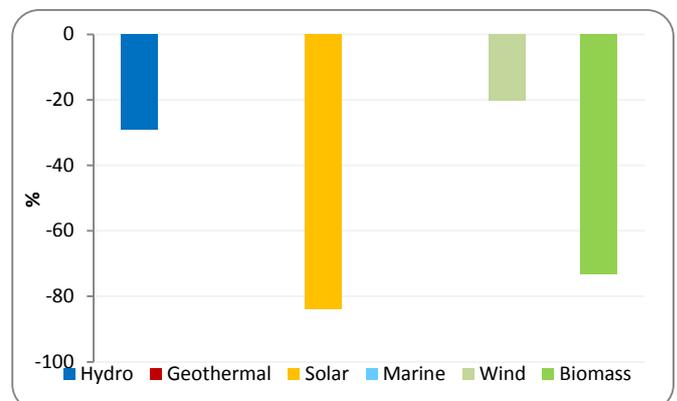


Figure 23-10. Deviation from NREAP in the RES electricity consumption in Romania in 2012.

Wind technology made the fastest progress between 2005 and 2011 having an additional

More than two-third of 2012 gross final electricity consumption in Romania was covered by wind power

renewable electricity of 1299.3 GWh (+95394% per annum in average) from the very low level of 0.2 GWh in the baseline year. Renewable electricity from this technology increased also fast between 2011 and 2012 with 103.5%

(+1345.6 GWh) reaching 2645 GWh (9.5 PJ) in 2012. Nevertheless this development was not fast enough to meet the expected NREAP plans in both 2011 and 2012: 34.9% (-697.5 GWh) less in 2011 and 20.2% (-670.9 GWh) less in 2012.

Renewable electricity coming from solar photovoltaic increased very fast between 2011 and 2012 by 471.4% (+6.6 GWh) from 1.4 GWh (0.005 PJ) in 2011. Nevertheless the contributions in years 2011 and 2012 were found to be significantly under the respective NREAP plans: 86% (-8.6 GWh) less in 2011 and 84% (-42 GWh) under in 2012.

Biomass use in electricity sector reached 196.7 GWh (0.7 PJ) in 2011 increasing then with 7.6% (+15 GWh) in 2012. This development was found to be slower than the expected NREAP one missing the respective expected levels in both 2011 and 2012: 54.8% 8-238.3 GWh) less in 2011 and 73.4% (-583.4 GWh) less in 2012.

Hydropower renewable electricity production decreased between 2005 and 2011 by 5% per annum in average (-4806 GWh) reaching 11.3 TWh (40.6 PJ) in 2011. Even that an increase by 8% (+904.6 GWh) took place between 2011 and 2012 the renewable electricity production from this technology missed the respective NREAP productions in both years: 33.1% (-5572 GWh) less in 2011 and 29.2% 8-5024.4 GWh) less in 2012.

In 2020 hydropower is expected to still remain the main source of renewable electricity production even that its share will be decreased to 63%. The rest of the renewable electricity is expected to be provided by wind (26.8%), biomass (9.2%) and solar photovoltaic (1%).

23.5 Renewable energy in heating & cooling

The use of renewable energy in heating and cooling in Romania reached 3504 ktoe (146.7 PJ) in 2011 and 3687.7 ktoe (154.4 PJ) in 2012 over 3183 ktoe (133.3 PJ) in the baseline year. This development was fast enough to make possible that renewable energy consumed in this sector surpassed the expected NREAP uses in both 2011 and 2012: 23.6% (+670 ktoe)

The share of renewable energy in heat and cool sector was 3.69 pp over the planned 2020 share of 22.05%.

more in 2011 and 22.9% (+687.7 ktoe) more in 2012. In 2020 renewable energy consumed in this sector is expected to reach 4038 ktoe (169 PJ).

In 2012 almost all renewable energy consumed in heating/cooling sector was biomass (99.4%) and a very marginal part was geothermal (0.6%).

Biomass use in heating/cooling sector increased with 10% (+315.9 ktoe) between 2005 and 2011 reaching 3481.9 ktoe (145.8 PJ) increasing further in 2012 by 5.3% (+184 ktoe). This development was fast enough to exceed the expected NREAP levels in both 2011 and 2012: 24.3% (+679.9 ktoe) over in 2011 and 23.8% (+705 ktoe) over in 2012.

Geothermal technology used in this sector increased with 30.6% (+5.2 ktoe) between 2005 and 2011 amounting to 22.2 ktoe (0.9 PJ). Between 2011 and 2012 the use of this technology for heat production experienced a decrease by 2.7% (-0.6 ktoe). In comparison with expected NREAP developments the achieved levels of this technology were under the respective levels in both 2011 and 2012: 26% (-7.8 ktoe) under in 2011 and 38.3% (-13.4 ktoe) under in 2012.

Even that planned for year 2011 the introduction of solar thermal technology in Romania was registered in 2012 with a very low amount (0.1 ktoe) which was found to be 96.7% (-2.9 ktoe) less the respective NREAP level for this year.

Even that planned no introduction of heat pump technology took place in Romania during period 2011-12.

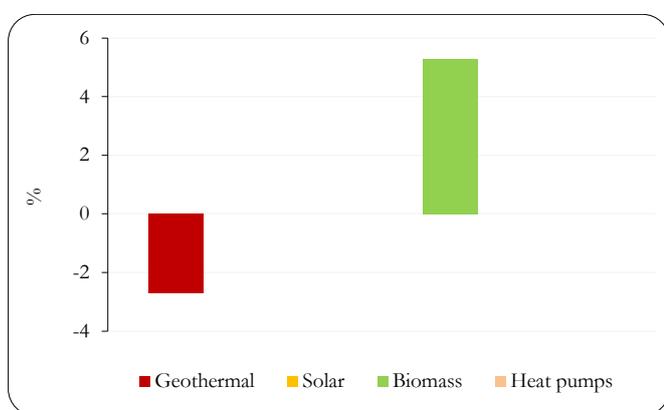


Figure 23-11. Relative increase/decrease of RES heating/cooling sources in Romania, 2011-12.

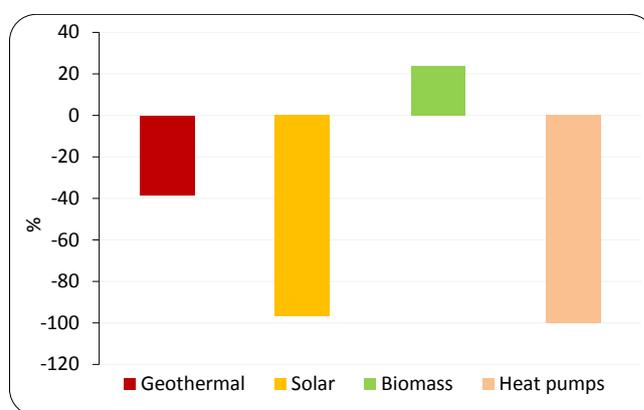


Figure 23-12. Deviation from NREAP in the RES heat consumption in Romania in 2012.

In 2020 the contribution of biomass is expected to reach 96% and the rest is expected to be covered by geothermal (2%), solar thermal (1.7%) and heat pumps (0.3%).

23.6 Renewable energy in transport

The use of renewable energy in transport amounted to 40.9 ktoe (1.7 PJ) in 2005 increasing then with 25.2% per annum in average (+61.9 ktoe) in 2011. A further increase with 107% (+110 ktoe) took place in the renewable energy consumed in transport sector between 2011 and 2012 reaching 212.8 ktoe (8.9 PJ). The use of renewable energy in transport sector in 2020 is expected to reach 550.6 ktoe (23.1 PJ).

One-fourth of additional biofuels use in EU28 between 2011 and 2012 took place in Romania

In 2012 almost two-third (66.4%) of of renewable energy consumed in Romania was in the form of biodiesel and the rest was bioethanol/bio-ETBE (17.4%) and renewable electricity (16.2%).

Biodiesel had the highest additional use between 2005 and 2011 with +38.4 ktoe increasing then further with 268% (+102.9 ktoe) in 2012 reaching 141.3 ktoe (5.9 PJ). Despite of this development the uses of biodiesel in transport sector were found to be under the expected

NREAP uses in both years: 77.3% (-130.6 ktoe) under in 2011 and 47.7% (-25.2 ktoe) under in 2012.

In 2011 the use of bioethanol/bio-ETBE reached 24.6 ktoe (1.0 PJ) increasing then further with 50.4% (+12.4 ktoe) in 2012. Nevertheless this development was slower than what was expected according the NREAP missing the respective levels with 71.1% (-60.4 ktoe) in 2011 and 60.6% (-57 ktoe) in 2012.

While no contribution was expected in both years for the use of imported biofuels their use grew to 38.1 ktoe (1.6 PJ) in 2011 and furthermore with 188.9% (+72 ktoe) in 2012.

The use of renewable electricity in transport decreased with 2.8% (-1.2 ktoe) in period 2005-2011 decreasing then further with 13.2% (-5.2 ktoe) in 2012. In comparison with expected NREAP uses renewable electricity exceeded the respective use in year 2011 with 9.2% (+3.4 ktoe) but missed it in 2012 with 3.1% (-1.1 ktoe).

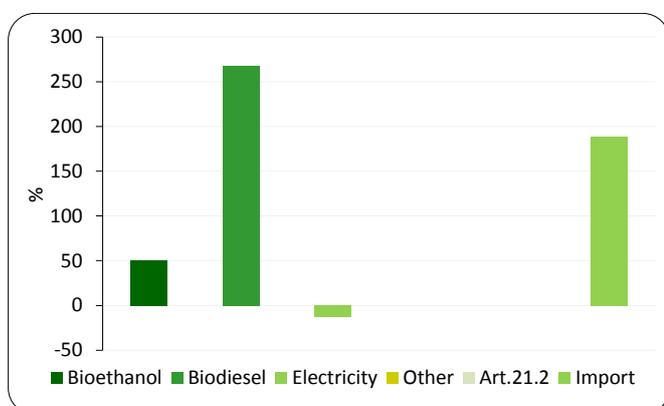


Figure 23-13. Relative increase/decrease of RES transport uses in Romania, 2011-12.

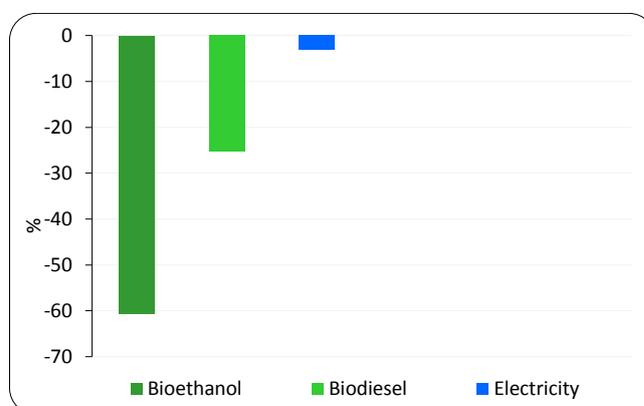


Figure 23-14. Deviation from NREAP in the RES use in transport in Romania in 2012.

In 2020 the contribution of biodiesel is expected to decrease to 59.2% while the bioethanol/bio-ETBE is expected to increase its contribution to 29.6%. The rest is expected to be renewable electricity (9.6%), other biofuels (1.2%) and hydrogen (0.4%).

24. Renewable energy in Slovenia

24.1 Deployment of renewable energy

Renewable energy consumed in Slovenia reached 960 ktoe (40.2 PJ) in 2011 increasing further to 1013.3 ktoe (42.4 PJ) in 2012 over 829 ktoe (38.1 PJ) in 2005. The renewable energy consumed in Slovenia is expected to further increase to 1355 ktoe (56.7 PJ) until 2020 (Figure 24-1).

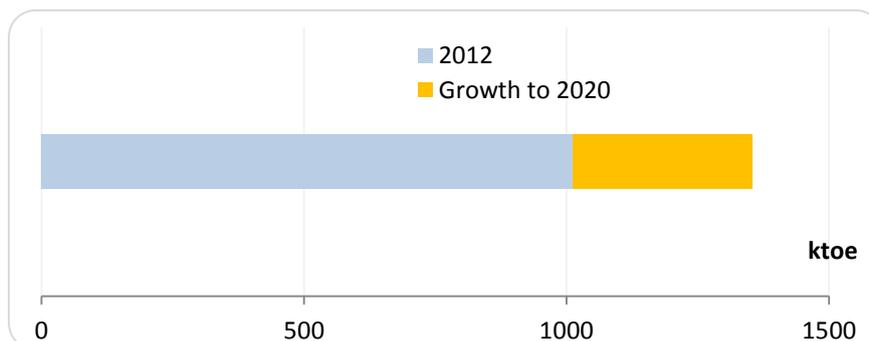


Figure 24-1. RES total in Slovenia in 2012 and the expected growth to 2020 target

Renewable energy development in heating/cooling sector had the highest additional amount between 2005 and 2012 with 126 ktoe more (+3.9%). Comparing with expected NREAP development this sector was over the respective levels in both 2011 and 2012: 24.4% (+115 ktoe) over in 2011 and 19.7% (+97 ktoe) over in 2012.

Renewable energy consumption in Slovenia exceeded the planned NREAP values in both years: by 1.7% (+15 ktoe) in 2011 and by 1.9% (+18 ktoe) in 2012.

The use of renewable energy in transport sector was the fastest among sectors in period 2005-2012 (+188.6% per annum in average) reaching 55.4 ktoe (2.3 PJ). Nevertheless this development was slower than expected to reach the expected 2011 level being under with 18.6% (-9.1 ktoe). The increase with 39.2% (+15.6 ktoe) that took place between 2011 and 2012 was enough to surpass the 2012 planned level with 2.4% (+1.3 ktoe).

The development of renewable energy in electricity sector was slower than what was planned according to the NREAP for period 2005-2011: 1.2% (-25 ktoe) under the baseline level of 362 ktoe. Renewable electricity production in Slovenia was under the expected NREAP planned levels in both 2011 and 2012 even than an increase by 9.5% (+31.5 ktoe) took place between 2011 and 2012: 14.1% (-55 ktoe) under in 2011 and 7.5% (-30 ktoe) under in 2012.

The most significant increase up to 2020 is expected in transport sector with 33.2% per annum in average followed by electricity sector with 5.4% per annum in average.

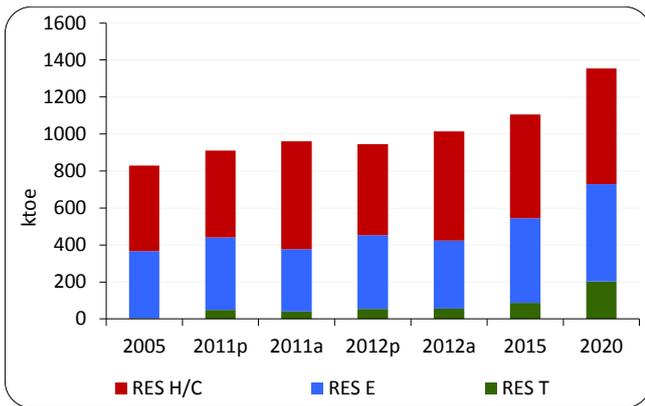


Figure 24-2. RES deployment in Slovenia: projected growth and actual progress until 2020.

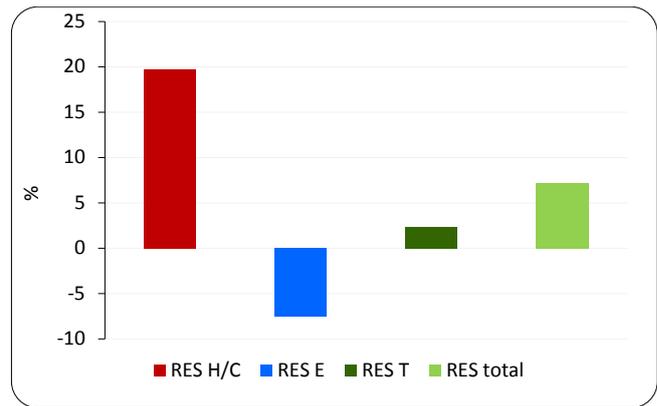


Figure 24-3. Deviation from NREAP in the RES production in Slovenia in 2012.

24.2 Sources of renewable energy

Biomass contribution in total renewable energy mix in Slovenia reached 56.6% in 2012. Hydropower was the second renewable energy source with 32.9% followed by biofuels with 5.1%, geothermal and solar with 3.1% and 2.3%.

Between 2005 and 2012 significant increase of the use of various sources of renewable energy was registered in Slovenia especially by biomass which had an additional production of 117.7 ktoe (+25.9%). This development was fast enough to exceed the expected NREAP values in both years: 23.4% (+107.6 ktoe) more in 2011 and 18.4% (+88.8 ktoe) more in 2012.

11.4% of 2012 gross final energy consumption in Slovenia was covered by biomass

Solar technology had the fastest development between 2005 and 2012 increasing with an average growth rate of 97.1% but only 11.4 ktoe in absolute terms. It had also the fastest development between 2011 and 2012 increasing with 61.9% over 14.4 ktoe in 2011. Comparing with expected developments for this technology Slovenia was well over the respective levels in both years: 93.6% (+7 ktoe) more in 2011 and 163.1% (14.5 ktoe) more in 2012.

Geothermal had the second additional renewable energy production in Slovenia between 2005 and 2012, +12.2 ktoe, reaching 31.0 ktoe which was over not only the expected NREAP level (+72.2% or +13 ktoe) but even over the 2020 planned level (+55.0% or +11 ktoe). The exceedance of this technology from NREAP level for year 2011 was with 56.7% or 10.2 ktoe.

In 2011 the biofuels use in Slovenia reached 35 ktoe (1.5 PJ) increasing further with 16 ktoe (+45.7%) in 2012. This development was slower than expected during period 2005-2011 missing the expected NREAP respective use with 18.4% (-7.9 ktoe). Nevertheless biofuels use in transport sector in Slovenia exceeded the NREAP expected plan in 2012 with 6.5% (+3.1 ktoe).

One-third of additional renewable energy consumption between 2011 and 2012 in Slovenia was covered by biofuels

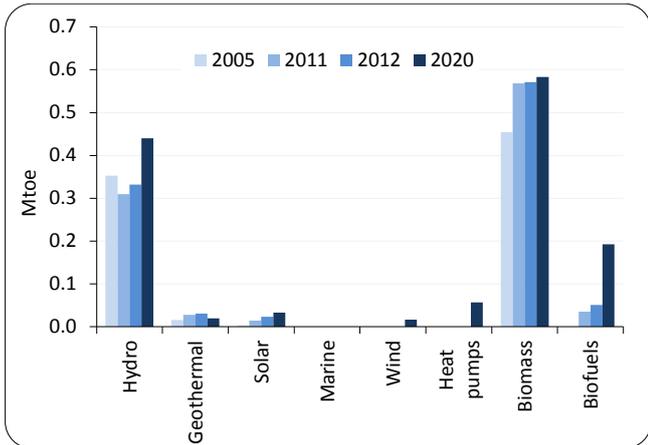


Figure 24-4. Contribution of renewable energy sources in Slovenia: actual and projected in 2020

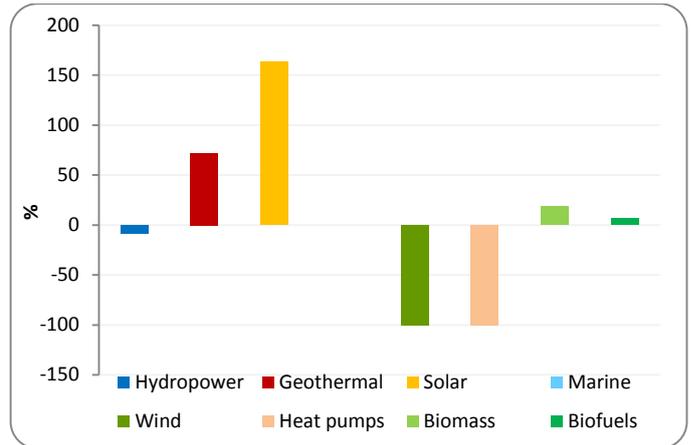


Figure 24-5. Deviation from NREAP in the contribution of renewable sources in Slovenia in 2012

In 2020, the share of biomass in renewable energy mix is expected to decrease to 43.5% while a slightly decrease is expected for hydropower (32.8%) and geothermal (1.5%) contribution. Contribution of biofuels is expected to increase up to 14.3% and the rest will be covered by other technologies: heat pumps 4.2% and solar 2.5%.

24.3 Renewable energy share

The overall renewable energy contribution in Gross Final Energy Consumption in Slovenia increased to 19.42% in 2011 and 20.23% in 2012 over 16.2% in 2005. Comparing with the expected shares for 2011 and 2012 the overall share of RES was over by 1.2% points in year 2011 and 1.53% points in 2012. The 2020 target that Slovenia has to reach for the overall RES share is 25.3%.

The overall RES share in Slovenia exceeded in 2011-2012 the respective NREAP shares as well as the indicative RES trajectories up to 2015/2016. Based on data reported in 2011 and 2012 Poland seems in a good position for the achievement of 2020 RES share target

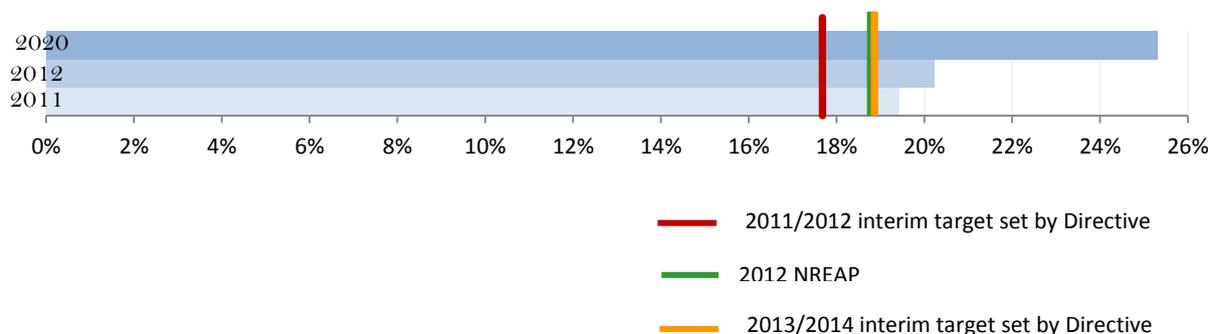


Figure 24-6. Overall RES share in Slovenia, 2011-12

Renewable energy share in heating/cooling sector experienced the fastest development between 2005 and 2011 with 8.68% points increasing further with 1.89% points in 2012.

This development put the share of renewable energy in this sector over the expected NREAP shares in both 2011 and 2012: 5.4% points over in 2011 and 6.17% points over in 2012.

The share of renewable energy in electricity sector increased in 2011 with +2.3% points over 28.5% in 2005. Between 2011 and 2012 the increase in renewable energy share in this sector took place with only +0.6% points. This development was slower than what the Slovenian NREAP has planned for period 2011-12: 1.5% points slower in 2011 and 0.94% points slower in 2012.

Transport sector reported an increase by 3.74% points between 2005 and 2011 increasing further with 1.5% points in 2012. This development was faster than what was planned in the NREAP surpassing the expected shares in both 2011 and 2012: 1.2% points more in 2011 and 2.5% points more in 2012.

Major increase from year 2012 is expected to be achieved until 2020, according to the NREAP, in transport sector (+5% points), followed by electricity sector (+7.9% points) and heating/cooling sector (+0.23% points).

24.4 Renewable electricity

24.4.1 Installed capacity

The renewable energy installed capacity in Slovenia increased from 999 MW in 2005 to 1184 MW in 2011 and 1275 MW in 2012. This development was faster than what was expected according to NREAP during period 2011-12: 3.1% (+36 MW) over in 2011 and 9.7% (+113 MW) over in 2012. In 2020 the expected renewable energy installed capacity is 1693 MW.

In 2012 hydropower installed capacity covered almost 84% of total renewable energy capacity in Slovenia. Solar photovoltaic contribution was 11% followed by biomass with 5%.

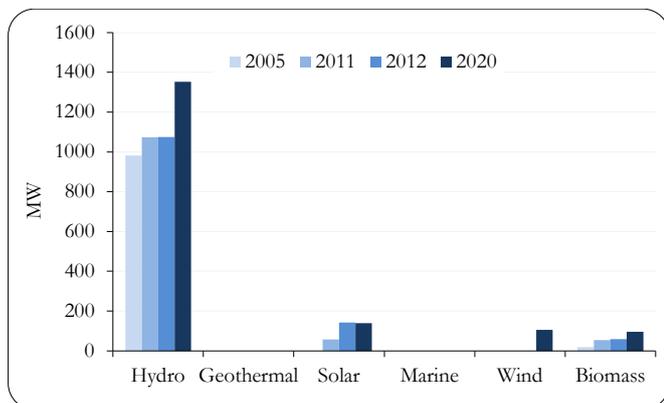


Figure 24-7. RES capacity deployment and progress until 2020 in Slovenia.

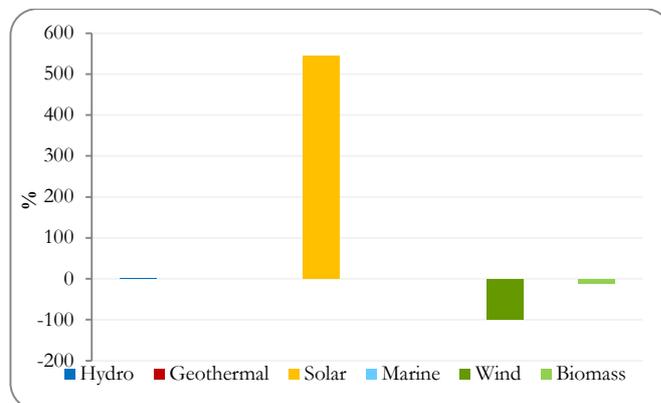


Figure 24-8. Deviation from NREAP in the RES installed capacity in Slovenia in 2012.

The highest additional capacity between 2005 and 2012 took place in solar photovoltaic technology with +142 MW. This technology had also the fastest development during period 2011-12 with 149% (+85 MW) exceeding in this year the 2020 planned capacity of 139 MW. Comparing with expected NREAP capacities

Nearly 94% of additional renewable capacity in Slovenia between 2011 and 2012 was provided by solar photovoltaics

this technology was over in both 2011 and 2012 respectively by 235.3% (+40 MW) and 545.5% (+120 MW).

Hydropower capacity in Slovenia increased with 93 MW between 2005 and 2012 reaching 1074 MW. The 2011 and 2012 capacities of this technology were found to be over the respective expected NREAP capacities with 0.2% (+2 MW) and 0.3% (+3 MW).

Biomass installed capacity increased with 32.5% per annum in average (+41 MW) between 2005 and 2012 reaching 59 MW. Nevertheless this development was slower than expected missing the respective NREAP capacities in both years: 6.9% (-4 MW) under in 2011 and 11.9% (-8 MW) under in 2012.

Even that planned no wind capacities were installed in Slovenia during period 2011 – 2012.

In 2020 hydropower capacity share in total renewable installed capacity is expected to decrease slightly reaching 80% followed by solar with 8%, biomass 6% and wind 6%.

24.4.2 Consumption

Renewable electricity consumption in Slovenia reached 3919.2 GWh (14.1 PJ) in 2011 and 4290.4 GWh (15.4 PJ) in 2012 from 4213 GWh (15.2 PJ) in 2005. The development of renewable electricity in Slovenia in comparison with expected NREAP consumptions was slower in both 2011 and 2012: 14.1% (-644 GWh) less in 2011 and 7.5% (-345 GWh) less in 2012. In 2020 the renewable electricity consumption in Slovenia is expected to amount to 6127 GWh (22.1 PJ).

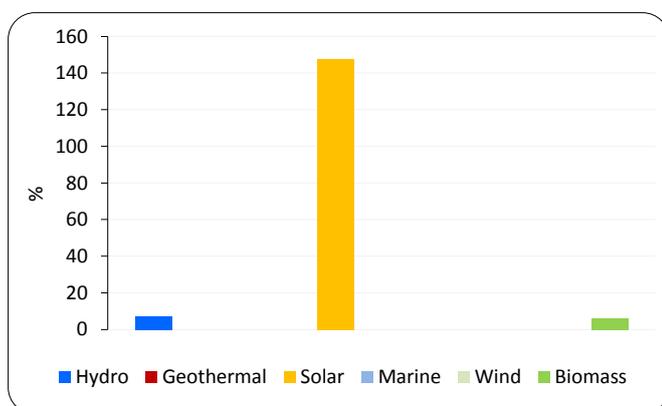


Figure 24-9. Relative increase/decrease of RES electricity sources in Slovenia, 2011-12

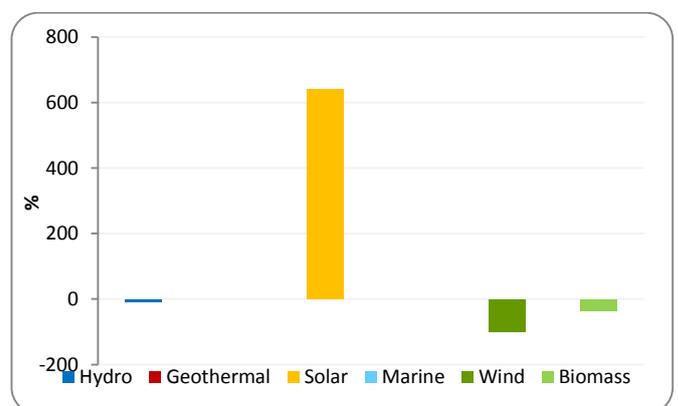


Figure 24-10. Deviation from NREAP in the RES electricity consumption in Slovenia in 2012.

Hydropower was the main source of renewable electricity consumed in Slovenia with a contribution of 90% followed by biomass with 6.2% and solar photovoltaic with 3.8%.

86% of additional renewable electricity in Slovenia between 2011 and 2012 was covered by solar photovoltaics

Between 2005 and 2012 solar photovoltaic had the highest additional renewable electricity with 163 GWh. The development between 2011 and 2012 was very fast with a growth rate of 147.8% (+97 GWh) making possible the

exceedance by 17% (+24 GWh) of 2020 planned renewable electricity production from this technology. This development was also faster comparing with what was planned in the NREAP in both years: 286.5% (+48.7 GWh) over in 2011 and 640% (141 GWh) over in 2012.

Renewable electricity coming from biomass increased with +138 GWh between 2005 and 2011 and furthermore by 16% (+16 GWh) in 2012. Nevertheless this development was slower than what was planned in the NREAP missing the respective plans in both years: 26.8% (-92.2 GWh) less in 2011 and 35.6% (-148 GWh) less in 2012.

28.2% of gross final electricity consumption in Slovenia in 2012 was covered by hydropower

Even that hydropower was the main source of renewable electricity in Slovenia a decrease by 12.1% (-497 GWh) took place between 2005 and 2011. Between 2011 and 2012 renewable electricity coming from this technology increased with 7.2% (+259 GWh) reaching 3860 GWh (13.9 PJ). Nevertheless this technology missed the expected NREAP renewable electricity production in both 2011 and 2012: 14.2% (-596.3 GWh) under in 2011 and 8.0% (-338 GWh) under in 2012.

While a contribution of 4 GWh (0.014 PJ) renewable electricity from wind technology was planned for period 2011-12 no introduction of this technology took place in Slovenia in this period.

In 2020 the shares of hydropower and solar photovoltaic respectively are expected to decrease up to 83.6% and 2.3%. Biomass contribution is expected to reach 11.0% and wind technology 3.1%.

24.5 Renewable energy in heating & cooling

The use of renewable energy in heating/cooling sector reached 583.5 ktoe (24.4 PJ) in 2011 and 588.9 ktoe (24.7 PJ) in 2012 over 463 ktoe (19.4 PJ) in 2005. The development of renewable energy consumed in this sector was faster than what was planned in the NREAP in both 2011 and 2012: 24.4% (+115 ktoe) more in 2011 and 19.9% (+98 ktoe) more in 2012. In 2020 heating/cooling sector in Slovenia has planned to use an amount of renewable energy equal to 623 ktoe (26.1 PJ).

In 2012 biomass covered 93.1% of total renewable energy consumed in this sector while the rest was geothermal (5.3%) and solar thermal (1.6%).

After the fast increase between 2005 and 2010 biomass use in Slovenia reached in 2011 almost the level of year 2009, 546.5 ktoe (22.9 PJ) being still over the 2020 expected use of 525 ktoe (22 PJ). A slightly increase by 0.2% (+ 2 ktoe) in biomass use in this sector took place between 2011 and 2012. In comparison with expected NREAP biomass uses Slovenia was well over in both 2011 and 2012: 26.8% (+115.5 ktoe) over in 2011 and 22.7% (+102 ktoe) over in 2012.

28.5% of gross final heat consumption in Slovenia in year 2012 was covered by biomass thermal

Heat production from geothermal increased faster than what has been planned in the NREAP reaching in 2011 the amount of 28.2 ktoe and 31 ktoe in 2012. Both these values are well over the expected geothermal use of 20 ktoe in year 2020. This development was also well over the expected NREAP uses for both 2011 and 2012: 56.7% (+10.2 ktoe) over in 2011 and 72.2% (+13.0 ktoe) over in 2012.

Solar thermal almost triple the heat production between 2005 and 2011 reaching 8.8 ktoe increasing further in 2012 by 6.8% (+0.6 ktoe). This development was faster than what was planned in the NREAP exceeding the respective values in both years: 46.7% (+ 2.8 ktoe) more in 2011 and 34.3% (+2.0 ktoe) more in 2012.

Even that it was planned no heat production from heat pumps was reported for Slovenia during period 2011-12.

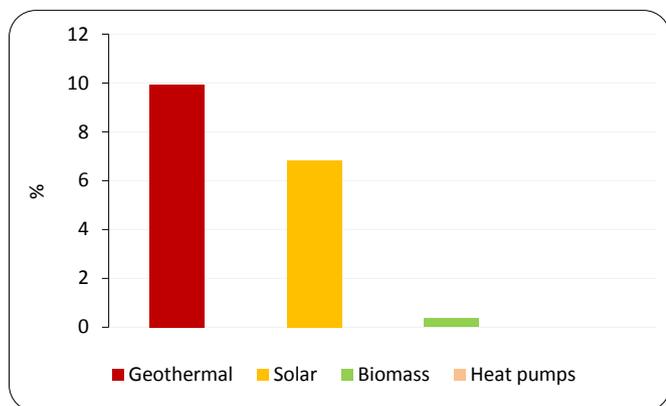


Figure 24-11. Relative increase/decrease of RES heating/cooling sources in Slovenia, 2011-12.

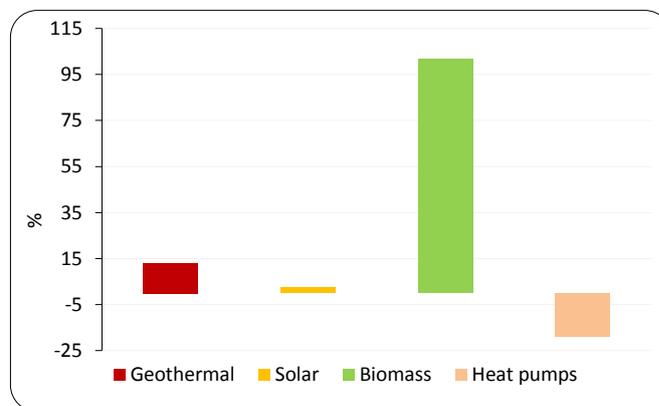


Figure 24-12. Deviation from NREAP in the RES heat consumption in Slovenia in 2012.

In 2020 biomass use for heat production is expected to cover 84.3% of total heat production expected in this year followed by heat pumps with 9.1%, solar thermal with 3.4% and geothermal with 3.1%.

24.6 Renewable energy in transport

The use of renewable energy in transport sector in Slovenia reached 39.8 ktoe (1.67 PJ) in 2011 and 55.4 ktoe (2.32 PJ) in 2012 over 3.9 ktoe (0.16 PJ) in 2005. In comparison with expected developments the use of renewable energy in this sector in Slovenia was under in 2011 with 18.6% (-9.1 ktoe) but over with 2.4% (+1.3 ktoe). The use of renewable energy in transport sector in 2020 is expected to reach 202.7 ktoe (8.5 PJ).

In 2012 biodiesel used in transport sector reached a share of 82.5% and the rest was bioethanol/bio-ETBE (9.6%) and renewable electricity (7.9%).

Bioethanol/bio-ETBE use in transport sector in Slovenia amounted to only 5 ktoe (0.2 PJ) in 2012 increasing by 43.2% (+1.6 ktoe) from 2011. These uses were found to be under the expected NREAP level in 2011 with 9.8% (-0.4 ktoe) less but over in 2012 with 15.2% (+1 ktoe) more.

Biodiesel use in transport sector reached only 31.3 ktoe (1.3 PJ) in 2011 increasing further with 46% (+14.4 ktoe) in 2012. The use of biodiesel was found to be under the expected NREAP uses in 2011 with 19.3% (-7.5 ktoe) less but surpassed the planned 2012 level with 5.5% (+2 ktoe).

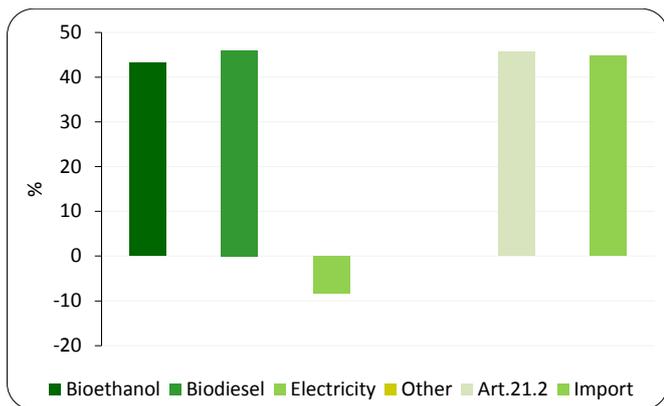


Figure 24-13. Relative increase/decrease of RES transport uses in Slovenia, 2011-12.

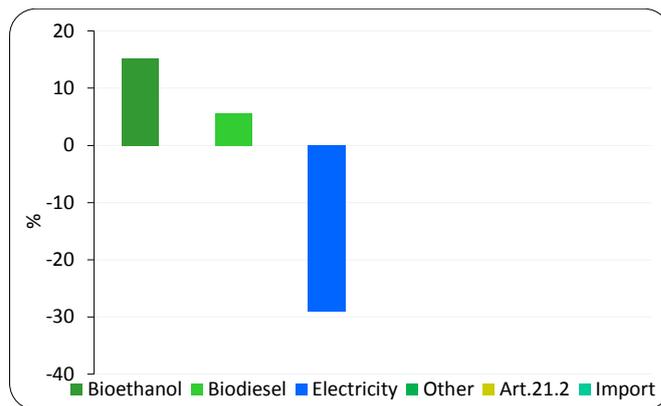


Figure 24-14. Deviation from NREAP in the RES use in transport in Slovenia in 2012.

No other biofuels (biogas and vegetable oils) and no biofuels from wastes, residues, and lingo-cellulosic material were used in Slovenia in 2011 and 2012.

Renewable electricity use in transport sector increased with 22.1% (+0.9 ktoe) between 2005 and 2011, amounting to 4.8 ktoe but decreased with 7.6% (-0.4 ktoe) in 2012. Comparing with expected NREAP levels the use of renewable electricity in transport sector in Slovenia was under in both years: 20.7% (-1.2 ktoe) under in 2011 and 29.0% (-2.0 ktoe) under in 2012.

In 2020 is expected that biodiesel will have a share of 85.7% and the rest will be bioethanol/bio-ETBE (9.1%) and renewable electricity (5.2%).

25. Renewable energy in Slovakia

25.1 Deployment of renewable energy

Renewable energy consumed in Slovakia increased to 1183 ktoe (49.5 PJ) in 2011 and 1134 ktoe (47.5 PJ) in 2012 over 771 ktoe (32.3 PJ). The renewable energy consumed in Slovakia is expected to further increase to 1715 ktoe (71.8 PJ) until 2020 (Figure 25-1).

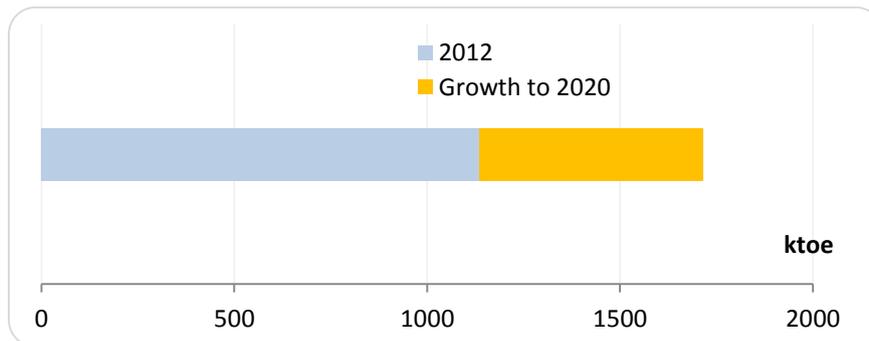


Figure 25-1. RES total in Slovakia in 2012 and the expected growth to 2020 target

The development of renewable energy in heating/cooling sector had the highest additional use in period 2005-2011 with 203 ktoe (+56.2%). A decrease by 5.7% (-32 ktoe) happened between 2011 and 2012. Nevertheless the use of renewable energy in this sector was over the expected NREAP levels in both years: 19.0% (+90 ktoe) more in 2011 and 6.0% (+30 ktoe) more in 2012.

Transport sector experienced the fastest increase in the use of renewable energy in Slovakia between 2005 and 2011 with a yearly average growth rate of 156% reaching 96 ktoe over 8 ktoe in 2005. This development was enough to exceed the expected NREAP level by 29.3% (+28 ktoe). Due to the decrease by 21.4% (-26.0 ktoe) that took place between 2011 and 2012 Slovakia missed the expected NREAP use in 2012 by 2.6% (-3 ktoe).

Renewable energy consumption in Slovakia exceeded the expected NREAP levels in both years: by 11.5% (+122 ktoe) in 2011 and by 1.1% (+13 ktoe) in 2012.

Renewable electricity use in Slovakia reached in 2011 the amount of 497 ktoe (20.8 PJ) being 0.9% (+5 ktoe) over the expected NREAP use. Even that renewable electricity use in Slovakia didn't decrease between 2011 and 2012 it missed the respective NREAP use for this year by 2.8% (-15.0 ktoe).

The main increase up to 2020 is expected in the use of renewable energy in heating/cooling sector with + 288 ktoe (+54.1%) followed by electricity sector (+181 ktoe or 35.8%) and transport sector (+112 ktoe or 116.8%).

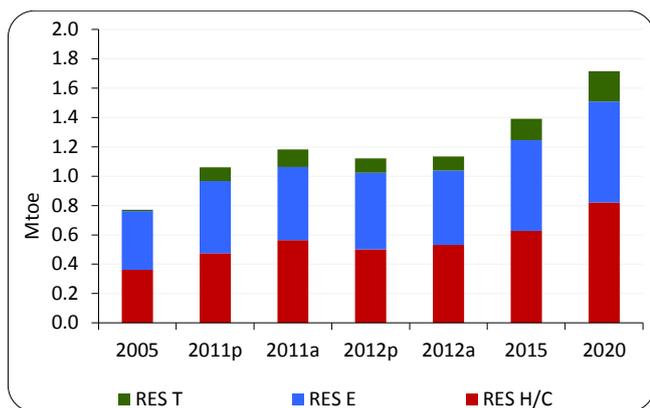


Figure 25-2. RES deployment in Slovakia: projected growth and actual progress until 2020.

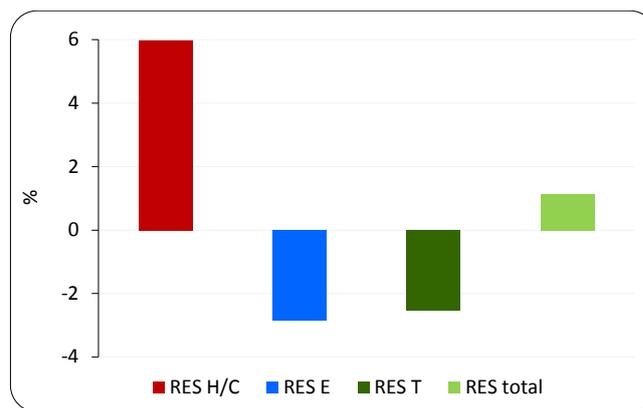


Figure 25-3. Deviation from NREAP in the RES production in Slovakia in 2012.

25.2 Sources of renewable energy

The main source of renewable energy in Slovakia in year 2012 was biomass with a 53.52% of contribution, followed by hydro with 34.57%, biofuels with 7.65%, solar with 3.69% and geothermal with 0.52% and wind 0.05%.

Between 2005 and 2012 biomass had the highest additional use in Slovakia for energy purposes by +241.2 ktoe (+9.5% per annum in average) reaching 602 ktoe (25.2 PJ). Comparing with expected developments biomass use exceeded the NREAP values in both years: 16.9% (+90.2 ktoe) more in 2011 and 5.2% (+29.5 ktoe) more in 2012.

In year 2012 biomass and hydropower provided 10.2% of gross final energy consumed in Slovakia.

Solar technology had the highest relative deviations from expected NREAP levels with 264.4% (+28.4 ktoe) more in 2011 and 192.4% (+27.3 ktoe) more in 2012. After introduction in 2010 with 0.95 ktoe (0.04 PJ) the use of solar technology for energy purposes in Slovakia reached 41.5 ktoe (1.7 PJ) in 2012.

Geothermal technology use for energy purposes²⁰ in Slovakia in year 2012 was found to be 3 ktoe (0.13 PJ) over the baseline level of 3 ktoe (0.13 PJ) but 3 ktoe (0.13 PJ) under the 2009 level of 9 ktoe (0.38 PJ). Compared to the expected NREAP plans this technology exceeded the plans by 100% (+3 ktoe) in year 2011 and by 11% (+0.6 ktoe) in year 2012.

Biofuels use in transport sector increased to 112 ktoe in 2011 being 30.6% over the expected NREAP use. Due to the decrease by 3.5% (-21.5%) between 2011 and 2012 biofuels use in Slovakia missed the NREAP plan for year 2012 by 3.4% (- 3 ktoe).

In 2020, the shares of biomass and hydropower in renewable energy mix in Slovakia are expected to decrease respectively to 49.3% and 27.35%. The rest will be covered by biofuels with 11.19%, geothermal with 5.45%, solar with 3.29%, wind with 2.84% and heat pumps with 0.59%.

²⁰In the 2013 progress report Slovakia reported the use of geothermal technology only in heating/cooling sector

During period 2012-2020 more progress is expected in the biomass use for heat and electricity (+235 ktoe), followed by biofuels (+104 ktoe), geothermal (+86.6 ktoe), hydropower (+75.5 ktoe), wind power (+47.6 ktoe), solar (+14.3 ktoe) and heat pump (+10 ktoe).

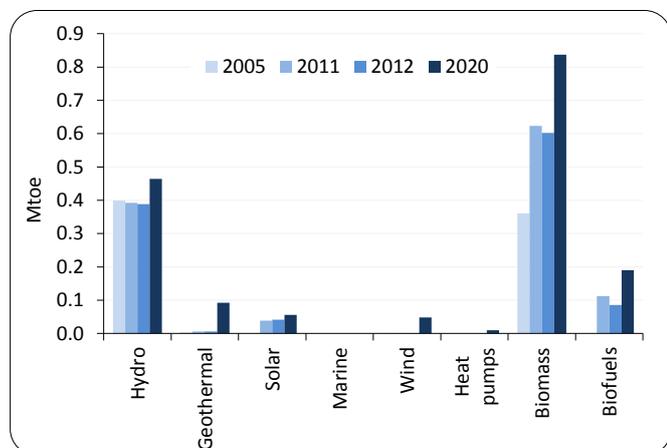


Figure 25-4. Contribution of renewable energy sources in Slovakia: actual and projected in 2020

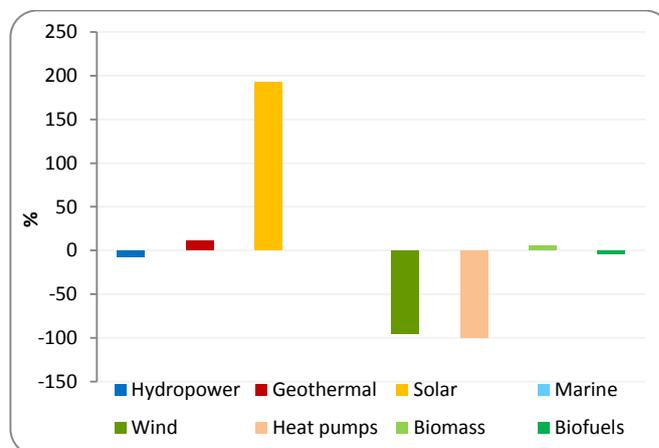


Figure 25-5. Deviation from NREAP in the contribution of renewable sources in Slovakia in 2012

25.3 Renewable energy share

The overall renewable energy contribution in Gross Final Energy Consumption in Slovakia reached 11.9% in 2011 and 11.7% in 2012 increasing from 6.7% in 2005. Comparing with the expected shares for 2011 and 2012 the overall share of RES was over by 3.7% points in year 2011 and 3.5% points in 2012. The 2020 target that Slovakia has to reach for the overall RES share is 14%.

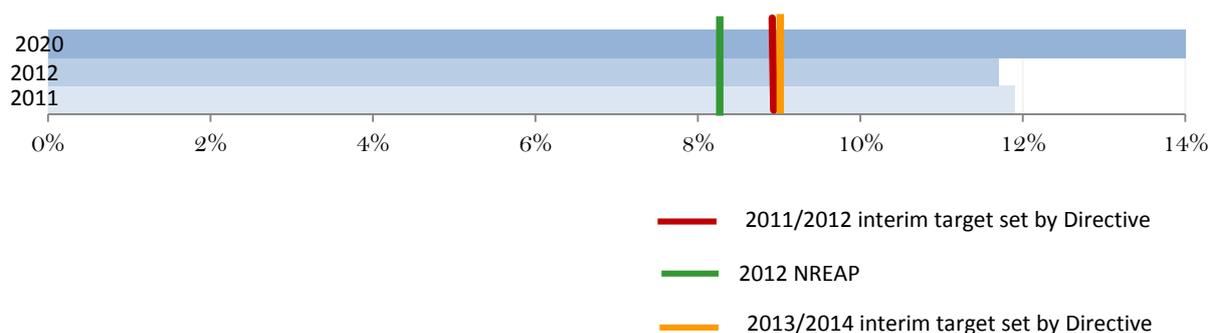


Figure 25-6. Overall RES share in Slovakia, 2011-12

The increase of renewable energy share in heating/cooling sector from 2005 was with +4.6% points in 2011 decreasing then with 0.2% points in 2012. The development of renewable energy share in this sector was over the planned shares in both years, respectively by 2.7% points and 2.0% points.

Renewable electricity share increased with +3.2% points in 2011 over 2005 share, but only with +0.6% points more in 2012. Renewable energy share in this sector was found to be

over the NREAP planned share in both years: 0.6% points over in 2011 and 0.3% points over in 2012.

The share of renewable energy in transport sector increased by +5.1% points in 2011 compared with 2005 but in 2012 this share decreased by 1.1% points compared with 2011. Nevertheless the share of RES in this sector was found to be over the expected shares in both years: +1.4% points in 2011 and +0.2% points in 2012.

The overall RES share in Slovakia remained above the respective NREAP planned shares all along the 2009-2012 period with the main increase taking place in 2010-2011.. Although a slight decrease in overall RES share took place in 2012 based on data reported in 2011 and 2012, Slovakia seems to be in good position for the achievement of 2020 RES share target

Major increase from year 2012 is expected to be achieved until 2020, according to the NREAP, in transport sector (from 4.5% to 10.0%), followed by heating/cooling sector (from 10.5% to 14.6%) and electricity sector (from 20.5% to 24.0%).

25.4 Renewable electricity

26.4.1 Installed capacity

The renewable energy installed capacity in Slovakia amounted to 2303 MW in 2011 and 2338 MW in 2012 over 1651 MW of 2005. In regards to expected NREAP installed capacities Finland was well over in both years: 21.4% (+406 MW) over in 2011 and 11.9% (+249 MW) over in 2012. In 2012 Slovakia has planned to reach a capacity of 2746 MW in renewable energy.

In 2012 the hydropower presented 68.7% of renewable energy installed capacity in Slovakia followed by solar with 21.9%, biomass with 9.2% and wind with only 0.1%.

The main progress from year 2005 was made in solar photovoltaic capacity which reached 496 MW in 2011 increasing further by 3.4% (+17 MW) in 2012. Comparing with the NREAP expectations this technology was over in both 2011 and 2012: 313.3% (+376 MW) over in 2011 and 294.6% (+383 MW) over in 2012.

More than half of additional renewable electricity capacity installed between 2011 and 2012 in Slovakia consisted in bioelectricity

Biomass installed capacity increase in 2012 from baseline year by 48.4% per annum in average reaching 215 MW. It had the fastest increase between 2011 and 2012 by 9.1% (+18.0 MW). This development was enough to be over the expected NREAP capacities in both years: 40.7% (+57.0 MW) over in 2011 and 30.3% (+50.0 MW) over in 2012.

Hydropower capacities in Slovakia increased with only 10 MW between 2005 and 2011 remaining then unchanged up to 2012, 1607 MW. Comparing with expected NREAP

capacities this technology was found to be under in both years: 1.5% (-25.0 MW) under in 2011 and 2.0% (-33.0MW) under in 2012. Even that planned no geothermal capacities were introduced in Slovakia during period 2011-12.

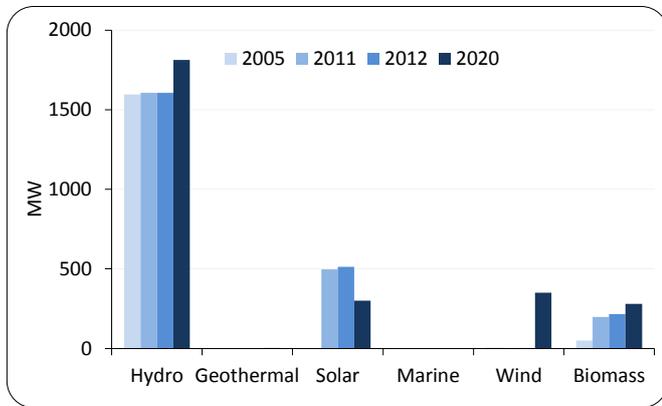


Figure 25-7. RES capacity deployment and progress until 2020 in Slovakia.

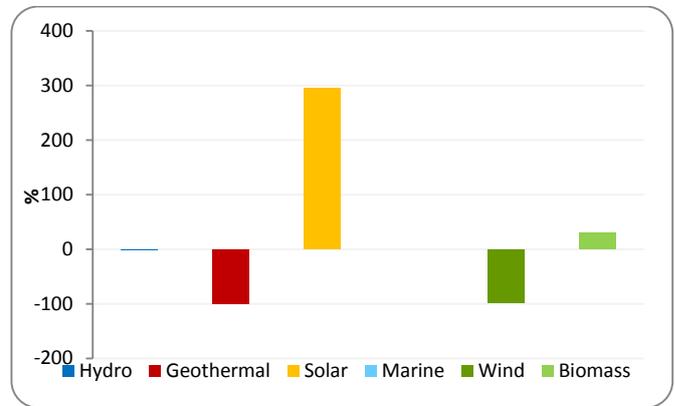


Figure 25-8. Deviation from NREAP in the RES installed capacity in Slovakia in 2012.

In 2020 the contribution of hydropower will decrease slightly to 66.0% while solar photovoltaic will be 11% points under the 2012 contribution. The main increase is expected in wind power which is expected to cover 12.7% of total renewable energy installed capacities in Slovakia. Biomass contribution will increase slightly to 10.2% while the geothermal will present only 0.1% of the total renewable energy capacity in Slovakia in this year.

25.4.2 Consumption

Renewable electricity consumption in Slovakia amounted to 5784 GWh in 2011 and 5893 GWh in 2012 over 4677 GWh in 2005. The development of renewable electricity consumption was fast between 2005 and 2011 exceeding the NREAP plan for this year by 0.9% (+53 GWh). Despite an increase by 1.9% (+109 GWh) happened during 2011-12 the renewable electricity consumption in Slovakia missed the expected NREAP level for 2012 by 2.8% (-172.0 GWh). In 2020 the renewable electricity consumption in Slovakia is expected to amount to 8000 GWh (28.8 PJ).

15.7% of gross final electricity consumption in Slovakia in year 2012 was covered by hydropower

In 2012 renewable electricity originated from hydropower covered 76.7% of total renewable electricity in Slovakia. Biomass contribution was limited to 16% while the rest is solar (7.2%) and wind (0.1%).

Biomass had the highest additional and the fastest increase in renewable electricity consumption in Slovakia between 2005 and 2012, +909 GWh (+405.8% per annum in average) reaching 941 GWh in 2012. It had also the fastest development during period 2011-12, 14.9% (+122 GWh). Comparing with expected NREAP plan this source was over in both years: 6.4% (+49 GWh) over in 2011 and 4.6% (+41.0 GWh) over in 2012.

Solar photovoltaic had a renewable electricity contribution of 397 GWh in 2011 which increased further in 2012 with only 27 GWh (+6.8%). Comparing with expected NREAP plans Slovakia was over in both years: 341% (+307 GWh) over in 2011 and 226% (+294 GWh) over in 2012.

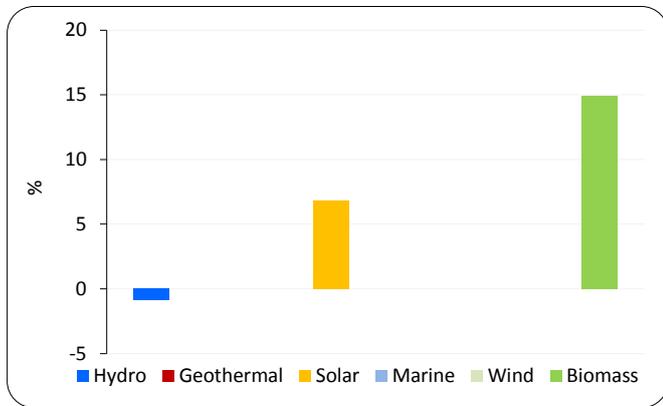


Figure 25-9. Relative increase/decrease of RES electricity sources in Slovakia, 2011-12

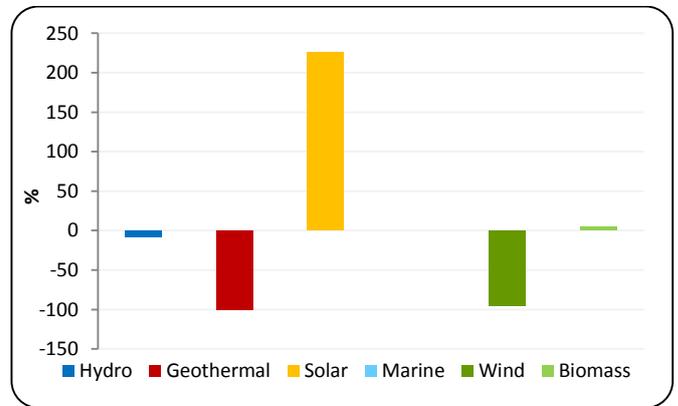


Figure 25-10. Deviation from NREAP in the RES electricity consumption in Slovakia in 2012.

Hydropower and wind decreased their renewable electricity contributions between 2005 and 2011: 1.6% (-76 GWh) less for hydropower and 14.3% (-1.0 GWh) less for wind. Hydropower decreased further in 2011 by 0.9% (-40 GWh) while no changes happened in renewable electricity from wind. Comparing with expected NREAP plans both these technologies were under in 2011 and 2012: respectively 6.2% (-301 GWh) and 25.0% (-2.0 GWh) under in 2011; 7.5% (-365 GWh) and 95% (-114 GWh) under in 2012. Even that expected, no renewable electricity from geothermal technology was reported in Slovakia between 2011 and 2012.

In 2020 hydropower and solar contributions will decrease respectively to 67.5% and 3.8%. The contributions of biomass, wind and geothermal are expected to be increased to 21.4%, 7.0% and 0.4%.

25.5 Renewable energy in heating & cooling

The use of renewable energy in heating and cooling in Slovakia reached 564 ktoe (23.8 PJ) in 2011 and 532 ktoe (22.3 PJ) in 2012 over 361 ktoe (15.1 PJ) in 2005. The development was fast enough to exceed the expected NREAP heat productions in both years: 19.0% (+90 ktoe) over in 2011 and 6.0% (+30 ktoe) over in 2012. In 2020 heat production from renewable sources in Slovakia is expected to reach 820 ktoe (34.3 PJ).

In 2012 renewable heat production in Slovakia was coming almost totally from biomass, 98%. The rest was covered: 1.1% solar thermal and 0.9% geothermal.

The main progress from 2005 happened in biomass which increased by +195 ktoe (+54.5%) in 2011 but decreased further with 5.8% (-32.0 ktoe) in 2012. Comparing with expected NREAP heat production this source was over in both years: 18.4% (+86 ktoe) over in 2011 and 5.3% (+26 ktoe) over in 2012.

Heat production from geothermal doubled in absolute level between 2005 and 2011, from 3 ktoe to 6 ktoe remaining then unchanged in 2012. Comparing with expected NREAP productions this technology was over in both years 100% (+3 ktoe).

More than 10% of gross final heat consumption in Slovakia in year 2012 was covered from bioheat

Solar thermal increased to 5 ktoe in 2011 over 3 ktoe in 2005 remaining then unchanged at this level in 2012. In comparison with NREAP heat production this technology was found to be over by 66.7% (+2 ktoe) in both years.

Even that projected no heat production from heat pumps took place in Slovakia in 2011 and 2012.

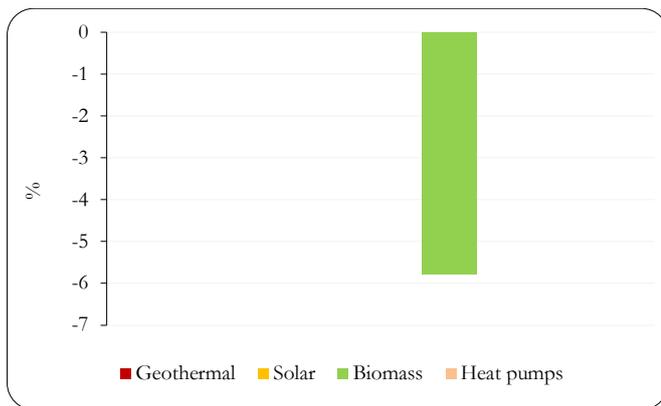


Figure 25-11. Relative increase/decrease of RES heating/cooling sources in Slovakia, 2011-12.

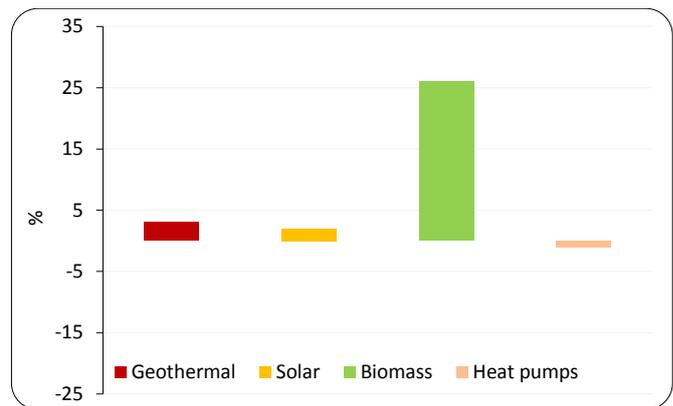


Figure 25-12. Deviation from NREAP in the RES heat consumption in Slovakia in 2012.

In 2020 biomass contribution is expected to decrease to 84.1% while geothermal, solar and heat pumps are expected to reach respectively 11%, 3.7% and 1.2%.

25.6 Renewable energy in transport

The use of renewable energy in transport reached 121 ktoe (5.1 PJ) in 2011 and 95.9 ktoe (4.0 PJ) in 2012 over 8.0 ktoe (0.3 PJ) in 2005. Comparing with expected NREAP uses Slovakia was over by 29.3% (+27.5 ktoe) in 2011 but under by 2.1% (-2.1 ktoe) in 2012. The use of renewable energy in transport sector in 2020 is expected to be 207 ktoe (8.7 PJ).

In 2012 almost 75% of renewable energy consumed in transport sector was in the form of biodiesel. Bioethanol-bio/ETBE reached a contribution of 15.1% and the rest was renewable electricity.

Biodiesel use in transport sector reached to 97.7 ktoe in 2011 being 39.6% (+27.7 ktoe) over the expected NREAP use. Between 2011 and 2012 the use of biodiesel in Slovakia decreased by 26.8% (-26.2 ktoe) being 0.7% (-0.5 ktoe) under the expected use.

The use of bioethanol/bio-ETBE reached 14.6 ktoe in 2011 decreasing further by only 0.1 ktoe in 2012. This development was not fast enough to meet the expected use of this type of biofuel being under in both years: 8.8% (-1.4 ktoe) under in 2011 and 14.7% (-2.5 ktoe) under in 2012.

No use of other biofuels, biofuels from wastes, residues, ligno-cellulosic material and imported biofuels in transport sector took place in Slovakia between 2011 and 2012. Renewable electricity use in transport sector reached 9 ktOE in 2011 increasing further by 0.7 ktOE in 2012. This use was over the expected use in both years: 15% (+1.2 ktOE) over in 2011 and 10% (+0.9 ktOE) over in 2012.

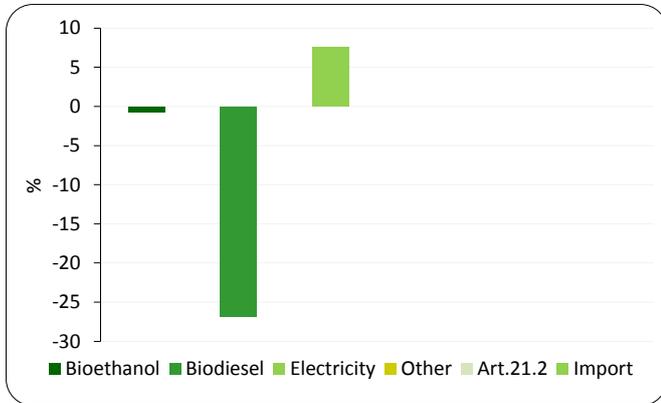


Figure 25-13. Relative increase/decrease of RES transport uses in Slovakia, 2011-12.

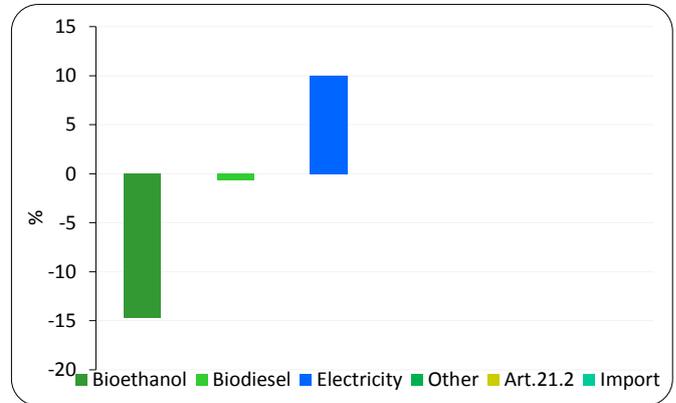


Figure 25-14. Deviation from NREAP in the RES use in transport in Slovakia in 2012.

In 2020 biodiesel use in Slovakia is expecting to decrease its contribution up to 53.1% while the contribution of bioethanol-bio/ETBE will be more than double, 36.2%. Renewable electricity is expected to have a contribution of 8.2% and the rest (2.4%) will be other biofuels.

26. Renewable energy in Finland

26.1 Deployment of renewable energy

The renewable energy consumed in Finland increased from 7590 ktoe (317.8 PJ) in 2005 to 8461.6 ktoe (354.3 PJ) in 2011 and 9001 ktoe (376.8 PJ) in 2012. The renewable energy consumed in Finland is expected to further increase to 10736.4 ktoe (449.5 PJ) until 2020 (Figure 26-1).

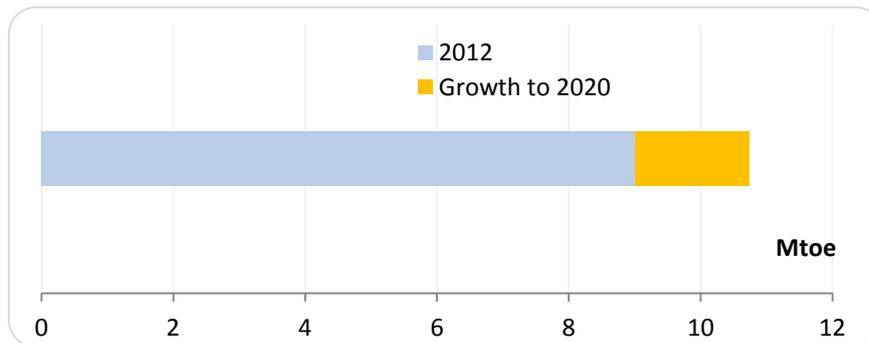


Figure 26-1. RES total in Finland in 2012 and the expected growth to 2020 target

Renewable energy in heating/cooling sector developed faster between 2011 and 2012 (7.1% per annum in average) compared with the development during 2005-2011 period (2.1% per annum in average). In 2012 renewable energy consumed in this sector covered 74% of total renewable energy consumed in Finland.

Renewable energy consumption in Finland exceeded the expected NREAP development in both years: by 6.4% (+512 ktoe) in 2011 and by 8.8% (+727 ktoe) in 2012.

Comparing with expected NREAP level the renewable energy in this sector was over the respective levels in both years: 10.8% (+609 ktoe) over in 2011 and 13.8% (+811 ktoe) over in 2012.

Renewable energy in electricity sector developed slower than what was expected between 2005 and 2011 missing by 1.5% (-30 ktoe) the expected NREAP level of 2040 ktoe. Nevertheless an increase by 4.7% (+94.3 ktoe) happened during 2011-12 making possible the exceedance of NREAP level for this year by 1.0% (+20 ktoe).

Renewable energy consumed in transport sector in Finland increased very fast between 2005 and 2011 by 161% per annum in average (+216 ktoe) over the 2005 level of 20 ktoe. The development during period 2011-12 happened only with +3 ktoe (+1.4%). Nevertheless the use of renewable energy in transport sector missed both 2011 and 2012 NREAP expected levels: 23.9% (-67 ktoe) under in 2011 and 32.5% (-104 ktoe) under in 2012.

Renewable energy use in transport sector is expected to have the fastest development beyond 2012 with an average growth rate of 22.2% while the increase in heating/cooling sector will have an increase with only 8.8%. The highest additional renewable energy up to 2020 will be seen in electricity sector with +8866 GWh (+762.5 ktoe).

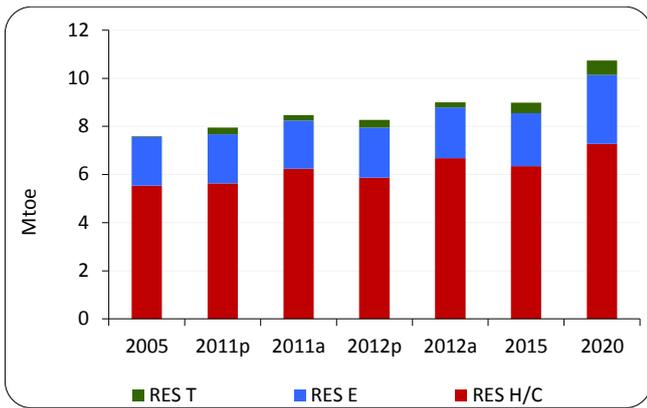


Figure 26-2. RES deployment in Finland: projected growth and actual progress until 2020.

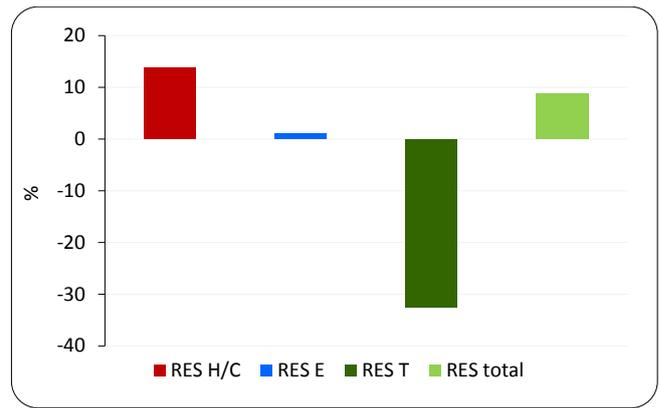


Figure 26-3. Deviation from NREAP in the RES production in Finland in 2012.

26.2 Sources of renewable energy

Biomass was the main renewable energy source in Finland with a contribution of 81.24% in total renewable energy consumed in 2012, followed by hydro with 12.58%, heat pumps with 3.51%, biofuels with 2.2%, wind with 0.45% and solar with 0.02%.

More than 28% of gross final energy consumption in Finland in year 2012 was covered by biomass

Between 2005 and 2012 biomass had the highest additional use for energy purposes in Finland with 977 ktOE more than the baseline level of 6321 ktOE (264.6 PJ) developing with an average growth rate of 2.2% per annum. Comparing with expected developments these uses were found to be over the NREAp plans in both years: 13.6% (+827.7 ktOE) more in 2011 and 16.6% (+1037.4 ktOE) more in 2012.

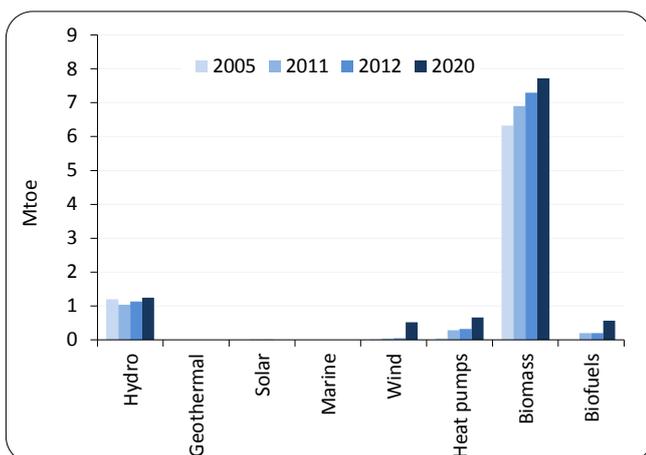


Figure 26-4. Contribution of renewable energy sources in Finland: actual and projected in 2020

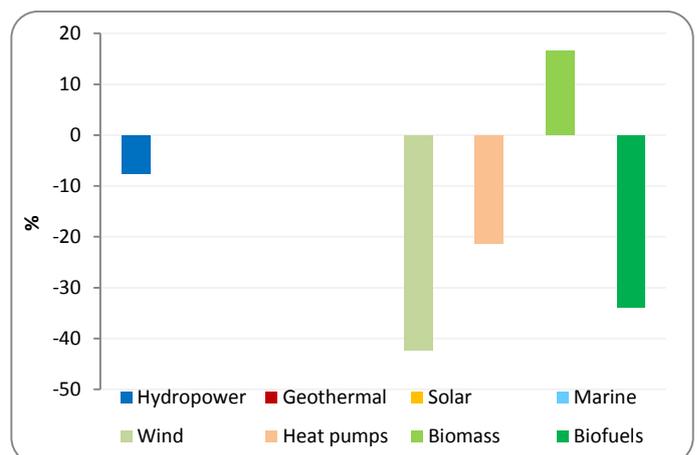


Figure 26-5. Deviation from NREAP in the contribution of renewable sources in Finland in 2012

No development on solar, geothermal and marine technology is planned in the Finland NREAP up to 2020. Nevertheless Finland introduced since 2009 the contribution of solar

technology²¹ reaching 0.3 ktoe (0.02 PJ) which increased to 1.4 ktoe (0.1 PJ) during period 2011-12.

Biofuels use in Finland for transport amounted to 198.3 ktoe (8.3 PJ) in year 2012 increasing with only 1.1% from the level of 196.1 ktoe (8.2 PJ) in year 2011. Despite this increase the use of biofuels in transport sector missed the expected NREAP plans in both years: 24.6% (-63.9 ktoe) under in 2011 and 33.9% (-101.7 ktoe) under in 2012.

In 2020, the share of biomass in renewable energy mix in Finland is expected to decrease to 72.2%, followed by hydro with 11.6%, heat pump with 6.2%, biofuels with 5.2% and wind with 4.8%. During period 2012-2020 more progress is expected in wind power (+5.5 TWh) together with biomass (+422.5 ktoe).

26.3 Renewable energy share

The overall renewable energy contribution in Gross Final Energy Consumption in Finland reached 33.5% in 2011 and 35.1% in 2012 increasing over 28.8% overall RES share in 2005.. Comparing with the expected shares for 2011 and 2012 the overall share of RES was over by 3.4% points in year 2011 and 4.1% points in 2012. The 2020 target that Finland has to reach for the overall RES share is 38.0%.

The overall renewable energy share in Finland in 2011-2012 remained well above the established NREAP values for this period. Also considering that NREAP targets have been set above the indicative minimum trajectories, based on data reported in 2011 and 2012 Finland seems to be in a good position for the achievement of 2020 RES share target.

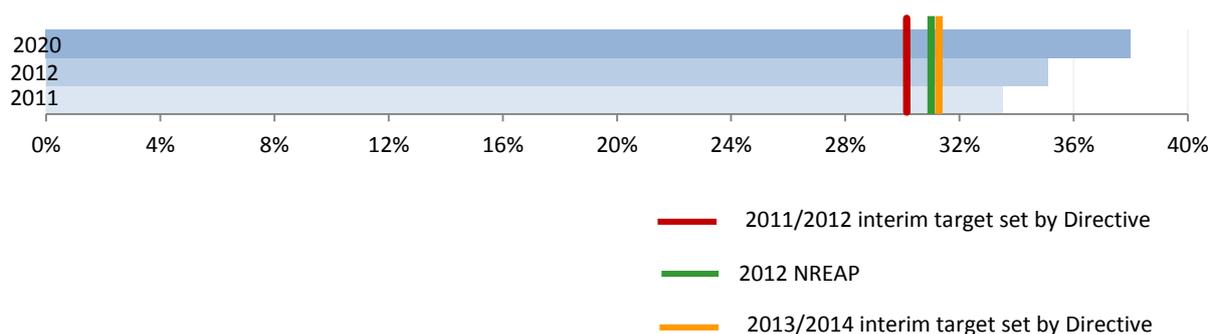


Figure 26-6. Overall RES share in Finland, 2011-12

Development of renewable energy share in heating/cooling sector in Finland was faster than planned in the NREAP exceeding by 1.2% points in 2012 the 2020 plan for this share. Regarding the 2011 and 2012 NREAP shares of renewable energy in this sector Finland was well over in both years: 6.9% points over in 2011 and 8.2% points over in 2012.

The share of renewable energy in transport sector had the highest absolute increase between 2005 and 2012 by +11.2% points. Comparing with expected NREAP shares in this

²¹ During period 2009-2010 solar technology contribution was introduced only in electricity sector.

sector Finland was over in both years: 0.8% points over in 2011 and 3.4% points over in 2012.

The development of renewable energy share in electricity sector between 2005 and 2011 happened with only 2.4% points increasing further in 2012 with only +0.1% points. The development of RES share in this sector was fast enough to exceed the expected NREAP shares in both years: 3.4% points over in 2011 and 3.5% points over in 2012.

Until 2020 Finland should revise the development of renewable energy share in heating/cooling sector. The main increase is expected in transport sector (from 11.7% to 19.5%) followed by electricity sector (from 29.5% to 33.0%).

26.4 Renewable electricity

26.4.1 Installed capacity

The renewable energy installed capacity in Finland increased from 5260 MW in 2005 to 5313 MW in 2011 and 5419 MW in 2012. Nevertheless these capacities are 0.1% (-7 MW) and 1.1% (-61 MW) under the respective NREAP planned capacities for these years.

Hydropower installed capacity covered 59% of total renewable energy capacity in Finland in year 2012. 36.1% of the total renewable energy installed capacity in this year was coming from biomass and the rest was wind power (4.75%) and solar (0.15%).

The main progress from year 2005 was made in wind technology with an increase in capacity by +119 MW in 2011 increasing further with +58 MW in 2012. Nevertheless this technology missed the expected NREAP capacities in both years: 29% (-81 MW) under in 2011 and 32% (-123 MW) under in 2012.

More than half of additional renewable electricity between 2011 and 2012 in Finland was provided wind power

Biomass capacity decreased during 2005-2011 by 11% (-230 MW) increasing further to 2012 with only 2% (+46 MW). This development was slower than what was expected according to NREAP in both years being under by 4% in each.

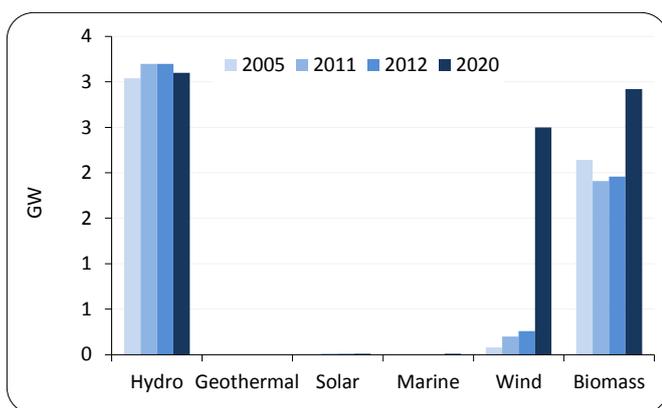


Figure 26-7. RES capacity deployment and progress until 2020 in Finland.

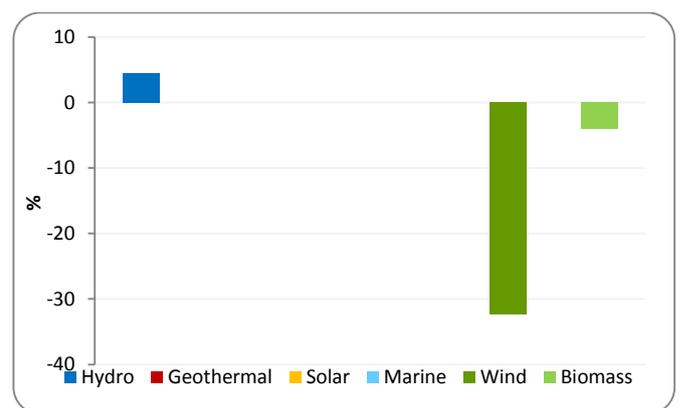


Figure 26-8. Deviation from NREAP in the RES installed capacity in Finland in 2012.

Finland has planned to introduce the photovoltaic technology for electricity production in 2017. Nevertheless it reported since in 2009 6 MW installed capacity in photovoltaic technology. Between 2009 and 2012 this capacity increased up to 8 MW.

In 2020 it is expected that hydropower will have a 36.3% contribution in total renewable energy capacity in Finland followed by biomass with 34.19%, wind power with 29.27%, solar and marine with 0.12% each.

26.4.2 Consumption

Renewable electricity consumed in Finland amounted to 23.4 TWh (84.1 PJ) in 2011 and 24.5 TWh (88.1 PJ) in 2012 from 23.7 TWh (85.4 PJ) in 2005. The renewable electricity in Finland was under the expected NREAP plan in 2011 by 1.5% (-352 GWh). Between 2011 and 2012 renewable electricity consumption in Finland increased by 4.7% (+1096 GWh) exceeding by 1% the expected NREAP plan of 24.2 TWh (87.2 PJ). In 2020 the renewable electricity consumption in Finland is expected to amount to 333.3 GWh (120 PJ).

In 2012 Finland got 53.71% of renewable electricity from the hydropower technology which was followed by biomass with 44.33%, wind with 1.94% and solar photovoltaic only 0.02%.

Biomass use for electricity purposes had between 2005 and 2012 the highest additional contribution with +1186 GWh (+4.3 PJ) even that a decrease by 1% (-107 GWh) took place during period 2011-12. Biomass had also the highest absolute deviations from the expected NREAP plans: +2043 GWh (+22.9%) over in 2011 and +1656 GWh (+18.0%) over in 2012. Even that an increase by +324 GWh (1.17 PJ) took place during period 2005-2012 in the renewable electricity coming from wind technology comparing with expected developments this technology was found under the plans in both years: 31.9% (-188 GWh) under in 2011 and 42.2% (-346 GWh) under in 2012.

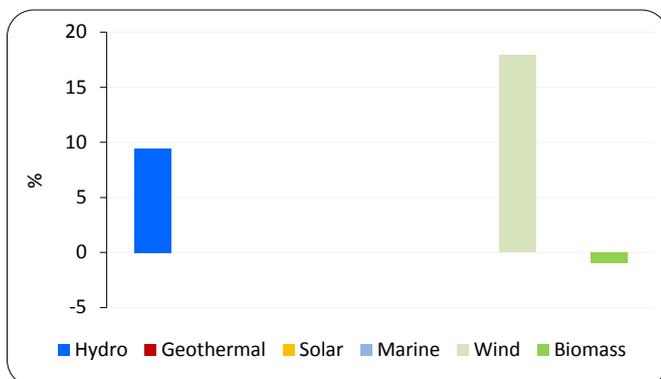


Figure 26-9. Relative increase/decrease of RES electricity sources in Finland, 2011-12

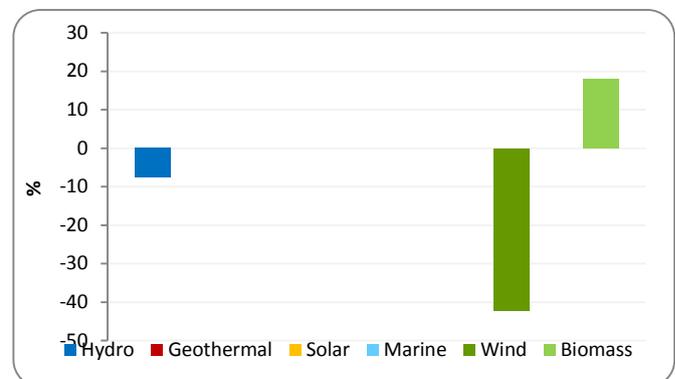


Figure 26-10. Deviation from NREAP in the RES electricity consumption in Finland in 2012.

15.8% of gross final electricity consumption in Finland in year 2012 was covered by hydropower

No change from year 2010 was reported during period 2011-12 on the use of solar technology for electricity production which remained at the level of 5 GWh (0.02 PJ).

In 2012 hydropower decreased its contribution in total renewable electricity with nearly 5pp being 771 GWh (2.8 PJ) under the baseline level of 13.9 TWh (50.1 PJ). This technology missed both 2011 and 2012 plans respectively with 15.6% (-2212 GWh) less and 7.6% (-1081 GWh) less.

In 2020 the contributions of hydropower and biomass are expected to decrease respectively to 43.26% and 38.73% while wind contribution is expected to be increased significantly to 18.0%.

26.5 Renewable energy in heating & cooling

The use of renewable energy in heating and cooling in Finland reached 6239 ktoe (261.2 PJ) in 2011 and 6681 ktoe (279.7 PJ) in 2012 over the 5530 ktoe (231.5 PJ) level of 2005. The development of renewable energy in this sector was fast enough to exceed the expected

Renewable heat share in Finland exceeded in 2012 by 1.2 pp the 2020 planned share of 48.2%

NREAP heat productions in both years: 11% (+609 ktoe) over in 2011 and 14% (+811 ktoe) over in 2012. In 2020 the heat production from renewable energy source in Finland is expected to reach 7270 ktoe (304.4 PJ).

Biomass was the main source of heat production in Finland in 2012 with a share equal to 95.27%. The rest was covered by heat pumps (4.71%) and solar thermal (0.01%).

The main progress from 2005 happened in biomass which increased by +472 ktoe (+8.6%) in 2011 and further more with +403 ktoe (+6.8%) in 2012. Comparing with expected NREAP levels biomass use for heat production was over in both years: 12% (+652 ktoe) over in 2011 and 16% (+895 ktoe) over in 2012.

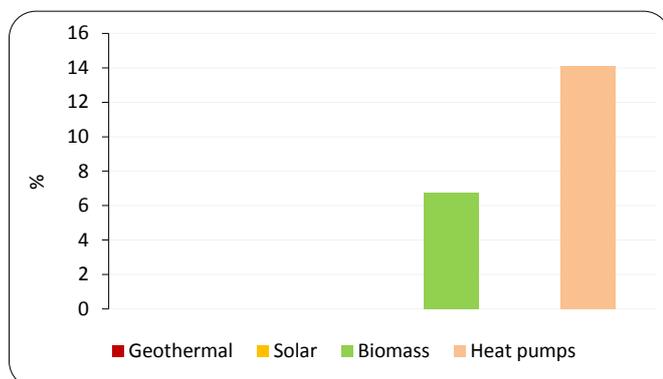


Figure 26-11. Relative increase/decrease of RES heating/cooling sources in Finland, 2011-12.

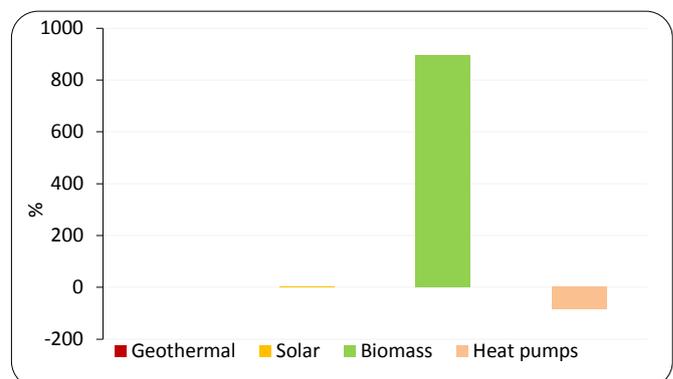


Figure 26-12. Deviation from NREAP in the RES heat consumption in Finland in 2012.

The heat coming from the use of heat pumps increased to 276 ktoe in 2011 over 2005 level of 40 ktoe increasing further between 2011 and 2012 by 14.1% (+39 ktoe). Nevertheless this development was slower than what was planned in the Finland NREAP in both years: 14% (-44 ktoe) under in 2011 and 21% (-85 ktoe) under in 2012.

The contribution of solar thermal in this sector was only 1 ktoe even than no heat was expected from this technology in Finland in both 2011 and 2012.

In 2020 the contribution of biomass in total renewable heat is expected to decrease to 90.92% while the heat pump will take the rest 9.08%.

26.6 Renewable energy in transport

The use of renewable energy in transport reached 213.1 ktoe (8.9 PJ) in 2011 and 216.3 ktoe (9.1 PJ) in 2012 being nevertheless 23.9% and 32.4% under the respective NREAP projected values of 280 ktoe (11.7 PJ) and 320 ktoe (13.4 PJ). The use of renewable energy in transport sector in 2020 is expected to be 600 ktoe (25.1 PJ).

In 2012 bioethanol/bio-ETBE covered almost half of renewable energy consumed in transport sector followed by biodiesel with 41.6%, renewable electricity with 8.3% and other biofuels with only 0.1%.

Biodiesel made the main progress in transport sector during 2005-2011 increasing with +108 ktoe keeping this level until 2012. In comparison with NREAP planned values the use of biodiesel in Finland was lower by 40% (-72 ktoe) in 2011 and 48.6% (-102 ktoe) in 2012.

Bioethanol/bio-ETBE use in transport sector in Finland reached 88 ktoe (3.7 PJ) in 2011 increasing further by only 2 ktoe in 2012 meeting the NREAP plane level for this year. In 2011 the use of bioethanol/bio-ETBE was over the expected use for this year by 10% (+8.0 ktoe).

While no use of other biofuels was expected in period 2011 – 2012, Finland reported an amount of 0.1 ktoe in 2011 and 0.3 ktoe in 2012.

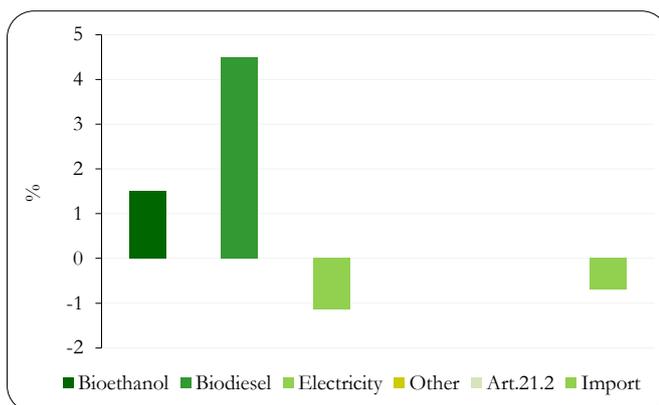


Figure 26-13. Relative increase/decrease of RES transport uses in Finland, 2011-12.

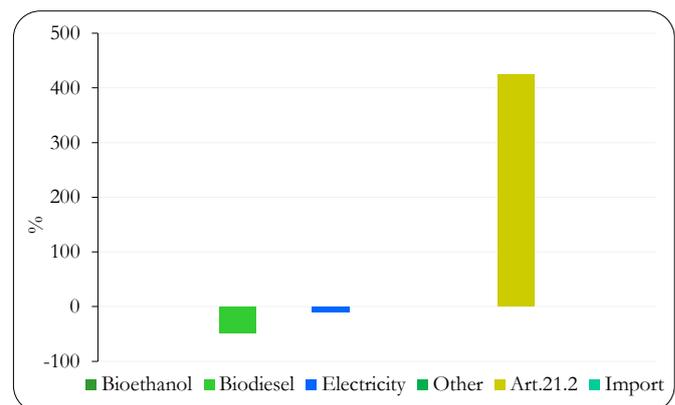


Figure 26-14. Deviation from NREAP in the RES use in transport in Finland in 2012.

The biofuels from wastes, residues, ligno-cellulosic material increased their use more than expected in both years: 420% (+42 ktoe) more in 2011 and 425% (+85 ktoe) more in 2012.

No imported biofuels were use in transport sector in Finland between 201 and 2012.

The use of renewable electricity in transport decreased in 2011 to 17 ktoe comparing with 2005 level of 20 ktoe. Between 2011 and 2012 the use of renewable electricity increased slightly with only 1.0 ktoe. Comparing with NREAP expectations Finland missed the use of renewable electricity in both years: 23.9% (-66.9 ktoe) less in 2011 and 32.4% (-103.7 ktoe) less in 2012.

In 2020 the use of bioethanol/bio-ETBE is expected to dominate in transport sector in Finland with a contribution of 71.7% while biodiesel and renewable electricity are expected to reach respectively 21.7% and 6.7%.

27. Renewable energy in Sweden

27.1 Deployment of renewable energy

The renewable energy consumed in Sweden increased from 14 Mtoe (585.6 PJ) in 2005 to 17 Mtoe (711.3 PJ) in 2011 and 18.8 Mtoe (789.2 PJ) in 2012. Renewable energy consumed in Sweden is expected to further increase to 19.9 Mtoe (833.8 PJ) until 2020 (Figure 27-1).

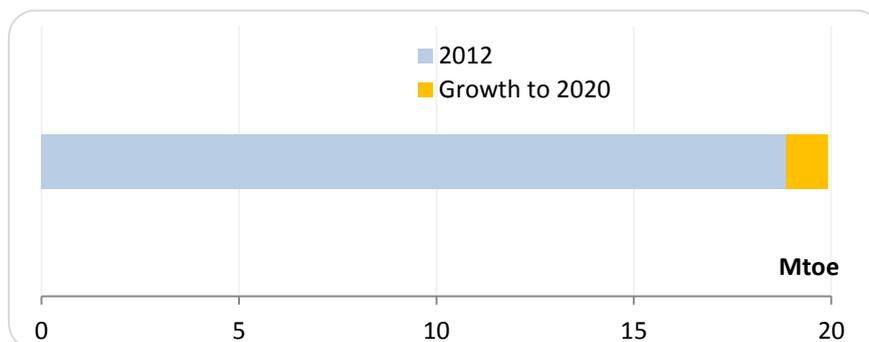


Figure 27-1. RES total in Sweden in 2012 and the expected growth to 2020 target

Renewable energy in heating/cooling sector²² made the main progress from the baseline year. In 2011 it counted for more than half of total renewable energy consumed in Sweden. It increased by nearly +2.1 Mtoe over the baseline year and further more with +506 ktoe (+5.5%). This development was enough to exceed the NREAP planned levels in both years: 8.1% (+688 ktoe) more in 2011 and 11.1% (+963 ktoe) more in 2012.

Renewable energy consumption in Sweden exceeded the NREAP expected values in both years: by 3.9% (+630.6 ktoe) in 2011 and by 12.5% (+2095.6 ktoe) in 2012.

In relative terms renewable energy consumed in transport sector increased faster between 2005 and 2011 with 18.4% per annum in average reaching 606 ktoe (25.4 PJ). It had also the highest relative increase between 2011 and 2012 with 21.5% (+130 ktoe). Comparing with expected NREAP levels renewable energy consumed in transport sector in Sweden was found to be over in both years: 5.2% (+30 ktoe) more in 2011 and 17.9% (+112 ktoe) more in 2012.

Renewable electricity sector²³ development was slower than what was planned between 2005 and 2011. It reached in 2011 the amount of 7227.8 ktoe (302.6 PJ) being 1.2% under the expected NREAP level. Nevertheless the renewable energy in this sector developed faster during period 2011-12 increasing by 16.9% (+1224.6 ktoe) exceeding by 1% the 2020 NREAP level of 8364 ktoe (350.2 PJ).

²² Sweden reported separately the contribution of waste in heating/cooling sector. For the consistency with the progress reports template this contribution is counted under the solid biomass category.

²³ Sweden reported separately the contribution of waste in electricity sector. For the consistency with the progress reports template this contribution is counted under the solid biomass category.

The main progress in 2020 is expected to happen in transport sector with an increase of 37% followed by heating/cooling with 9.2%.

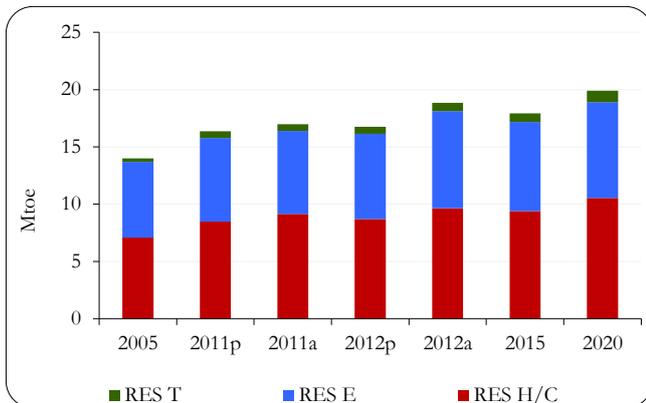


Figure 27-2. RES deployment in Sweden: projected growth and actual progress until 2020.

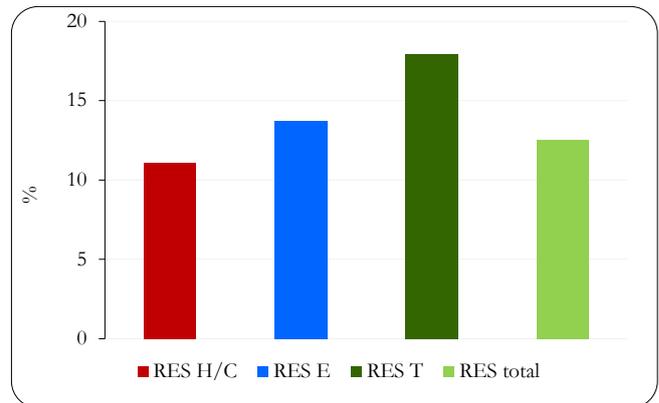


Figure 27-3. Deviation from NREAP in the RES production in Sweden in 2012.

27.2 Sources of renewable energy

In 2012 biomass was providing more than half of renewable energy mix in Sweden. The contribution of hydropower was set at 36.2% followed by heat pumps with 6.3%, wind with 3.3%, biofuels with 3.2% each and solar technology with only 0.1%.

Biomass use for electricity and heat in Sweden reached 8972.7 ktoe (375.7 PJ) in 2011 increasing with 16.1% between 2005 and 2011. The development of biomass used for electricity and heat in Sweden was not at the expected level in 2011 missing the NREAP plans by 0.4% (-37 ktoe). A further increase by 6.1% (+548.3 ktoe) happened during period 2011-12 bringing the biomass use in Sweden 3.2% (+297.4 ktoe) over the expected NREAP plan for 2012.

Solar use in electricity and heating/cooling sectors developed with an average growth rate of 15.8% (+6.6 ktoe) between 2005 and 2012 reaching 12.6 ktoe (0.5 PJ). This development

Energy produced by solar technology in Finland exceeded in 2012 by nearly two-times the expected 2020 planed value of 6.3 ktoe (0.3 PJ)

was significantly faster than the NREAP projected one surpassing the expected levels in both 2011 and 2012: 94.4% (+5.8 ktoe) more in 2011 and 105% (+6.5 ktoe) more in 2012.

Biofuels in Sweden increased their use in transport sector with 38% per annum in average (+441 ktoe) during period 2005-12 reaching 607 ktoe (25.4 PJ). Their use was found over the expected NREAP uses in both 2011 and 2012 respectively with 11.8% (+50 ktoe) and 30% (+140 ktoe).

In 2020, the share of biomass in renewable energy mix is expected to increase to 55%, followed by hydro with 30%, wind with 6%, heat pumps with 5% and biofuels with 4%. During period 2012-2020 more progress is expected in the biomass use (+1410.4 ktoe), followed by wind (+459.2 ktoe) and biofuels (+203 ktoe).

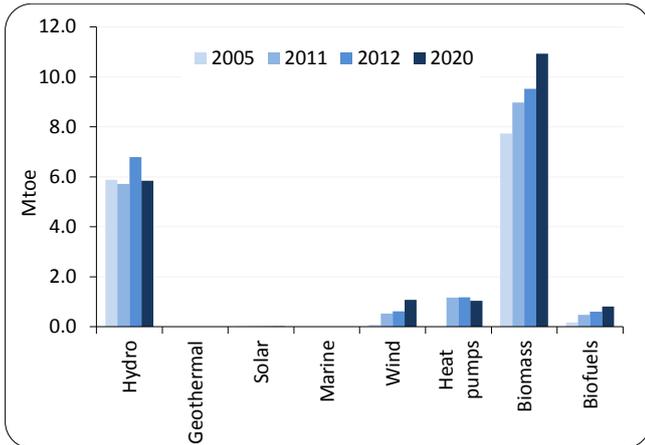


Figure 27-4. Contribution of renewable energy sources in Sweden: actual and projected in 2020

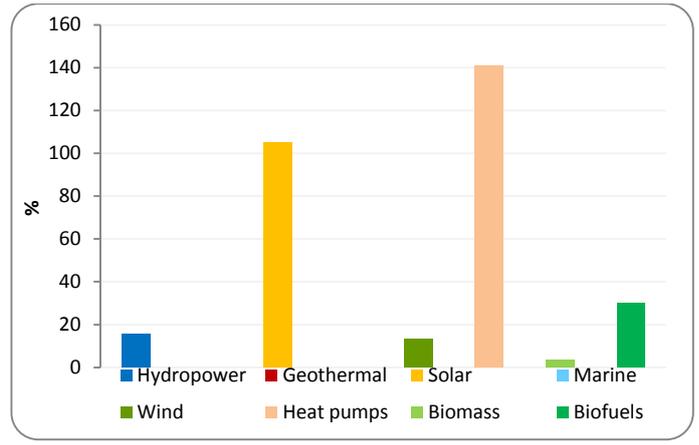


Figure 27-5. Deviation from NREAP in the contribution of renewable sources in Sweden in 2020

27.3 Renewable energy share

Sweden reached in 2011 an overall RES share equal to 48.8% of gross final energy consumption being 9.1% points over the 2005 overall RES share increasing then further to 51% in 2012. Comparing with 2011 and 2012 NREAP shares Sweden was over in both years: 4.6% points (+10.4%) over in 2011 and 6.1% points (+13.6%) over in 2012. The 2020 overall RES share in Sweden is set to 50.6%.

Sweden exceeded already in 2012 the expected overall RES share (50.6%) for 2020 as well as the indicative trajectory up to 2020 which in Sweden NREAP is set well under the NREAP trajectory.

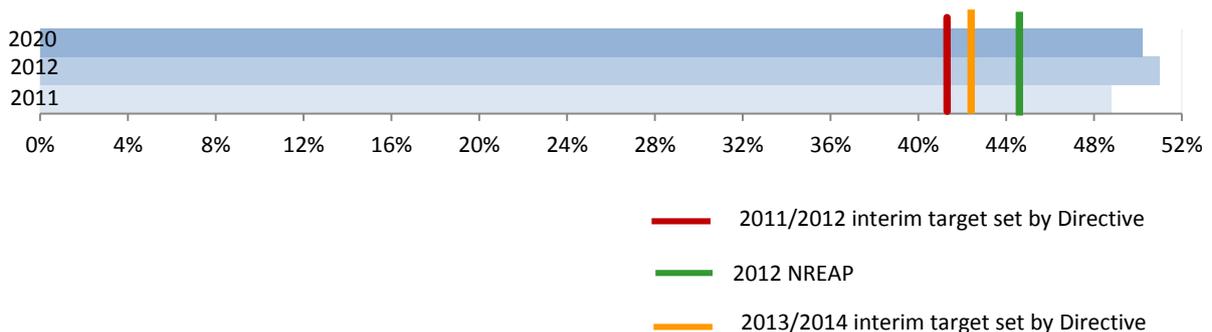


Figure 27-6. Overall RES share in Sweden, 2011-12

The development of renewable energy share in heating/cooling sector was determinant in the development of overall RES share in Sweden during period 2011-12. Sweden exceeded since in 2011 (+0.4% points) the expected 2020 plan share in this sector increasing further with 3.1% points between 2011 and 2012. Comparing with the expected shares Sweden was over in both years: 4.9% points over in 2011 and 7.4% points over in 2012.

Renewable energy development in transport sector happened also faster than what was planned in the Sweden NREAP reaching in 2012 a share of 15.7% which is 1.9% points over the 2020 planned share. The RES share in this sector increased by +6.9% points in 2011 over the level of 4.0% in 2005. Comparing with 2011 and 2012 expected shares Sweden was over in both years: 2.7% points (+33.3%) over in 2011 and 7.0% Points (+79.5%) over in 2012.

Renewable energy share in electricity sector reached 59.9% in 2011, 9% points over the 2005 share. Between 2011 and 2012 a very slightly change happened in this share. +0.1% points increase. Comparing with expected RES shares for 2011 and 2012 Sweden was well over: 4.1% points (+7.3%) over in 2011 and 3.4% points (+6.0%) over in 2012.

Based on Sweden NREAP only renewable electricity share is expected to be increased up to 2020 (from 60% to 62.9%). Concerning the share in heating/cooling and transport sectors Sweden needs to revise the respective shares in order to support the further development of renewable energy in these sectors.

27.4 Renewable electricity

27.4.1 Installed capacity

The renewable energy installed capacity in Sweden increased from 19.4 GW in 2005 to 22.7 GW in 2011 and 24.0 GW in 2012. The development of renewable energy installed capacity in Sweden between 2011 and 2012 happened with a higher growth rate than what was expected exceeding in 2012 the 2020 planned capacity of 23.8 GW. Comparing with NREAP planned capacities for 2011 and 2012 Sweden was well over in both years: 7.1% (+1498.4 MW) over in 2011 and 11.9% (+2547.1 MW) over in 2012.

In 2012 the hydropower presented 68% of renewable energy installed capacity in Sweden followed by biomass with 16.9%, wind with 15% and photovoltaic with only 0.1%

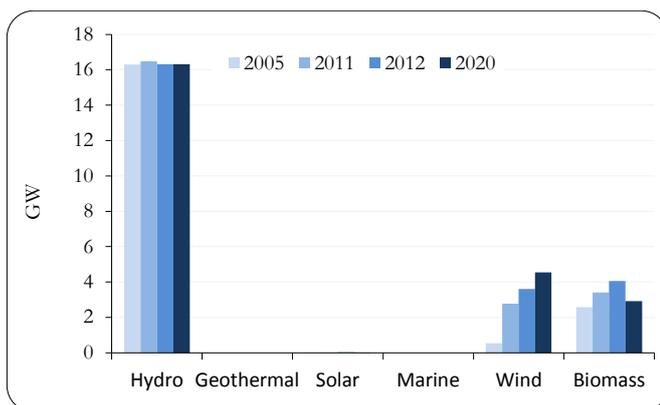


Figure 27-7. RES capacity deployment and progress until 2020 in Sweden.

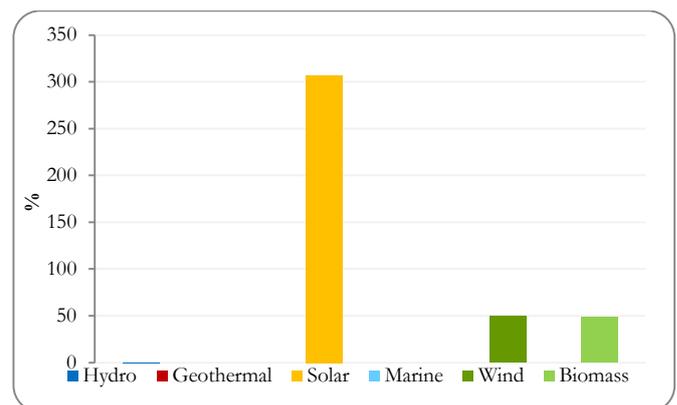


Figure 27-8. Deviation from NREAP in the RES installed capacity in Sweden in 2012.

All renewable sources increased their electricity installed capacity in Sweden during period 2005-2012. The fastest absolute development happened in biomass capacity which reached in 2012 the amount of 4055 MW being 39.2% over the 2020 planned level of 2914 MW. The biomass capacity was also over the expected 2011 and 2012 NREAP levels: 25.7% (+695 MW) over in 2011 and 48.5% (+1325 MW) in 2012.

The development of solar photovoltaic was also very fast tripling the capacity in 2011 over 4 MW of 2005 and then doubling it in 2012 over 12 MW of 2011. Sweden 2020 plan in photovoltaic installed capacity (8MW) was exceeded since in 2011. In regards to 2011 and 2012 NREAP plans Sweden was over in both years: 114.3% (+6 MW) over in 2011 and 306.8% (+18 MW) over in 2012.

Wind installed capacity had the highest relative increase during period 2005-2012 with an average growth rate of 81.8% amounting to 3606 MW. Comparing with NREAP expected levels Sweden was over in both years: 29.3% (+627 MW) more in 2011 and 49.8% (+1198 MW) more in 2012.

More than 60% of additional renewable electricity capacity in Sweden between 2011 and 2012 was provided by wind power

Even that Sweden had planned a slightly increase in hydropower capacity between 2005 and 2011 a higher increase happened exceeding by 1% the 2020 plan of 16137 MW. Nevertheless a decrease happened between 2011 and 2012 which set the hydropower installed capacity at almost 2020 level (16317 MW). Despite this decrease the hydropower installed capacity was over the NREAP plan in both years: 1.0% (+170 MW) over in 2011 and 0.04% (6.0MW) over in 2012.

In 2020 hydropower will still maintain the main contribution with 68.6% followed by wind with 19.12%, biomass with 12.25% and photovoltaic with 0.03%.

27.4.2 Consumption

Renewable electricity consumption in Sweden amounted to 84 TWh (302.6 PJ) in 2011 and 98.3 TWh (353.8 PJ) in 2012 from 77.0 TWh (276.9 PJ) in 2005. Nevertheless the renewable electricity consumed in Sweden during period 2005-11 was not at the expected level missing the NREAP plan for 2011 with 1.2% (-1017 GWh). The increase by 16.9% (+14239 GWh) that happened between 2011 and 2012 was enough to exceed the expected NREAP renewable electricity consumption for year 2012 by 13.7% (+11867 GWh). In 2020 the renewable electricity consumption in Sweden is expected to amount to 97.3 TWh (350 PJ).

In 2012 almost 81% of total renewable electricity in Sweden was coming from hydropower. The rest was covered by biomass (12.4%), wind (7.29%). Solar photovoltaic was a very marginal contributor in total renewable electricity consumed in Sweden in this year with only 0.02%.

In 2011 the renewable electricity coming from hydropower reached 66.4 TWh (239 PJ) which was 2.7% (-1833 GWh) lower than the expected NREAP level. Nevertheless an increase by 18.8% (+12.5 TWh) happened between 2011 and 2012 making possible the exceedance of NREAP plan for 2012 with 15.7% (+10.7 TWh). The development of renewable electricity from hydropower between 2011 and 2012 was very fast exceeding even the 2020 plan level of 68 TWh.

48% of gross final electricity consumption in Sweden in year 2012 was covered by hydropower

Biomass use of electricity purposes developed faster compared with what was planned in the NREAP: 2.6% (+290 GWh) over in 2011 and 2.8% (+333 GWh) over in 2012.

Solar photovoltaic was the technology with the highest relative increase between 2011 and 2012 with 72.7% but only 8 GWh in absolute terms. Comparing with expected developments according to the Sweden NREAP photovoltaic technology was over in both years: 547.1% (+9.3 GWh) over in 2011 and 900% (+17 GWh).

Renewable electricity from wind reached 7160 GWh in 2012 increasing by 95% per annum in average over the 2005 level of 939 GWh. Comparing with NREAP planned level wind technology was over the plans in both years: 9.3% (+517 GWh) over in 2011 and 13.0% (+826 GWh) over in 2012.

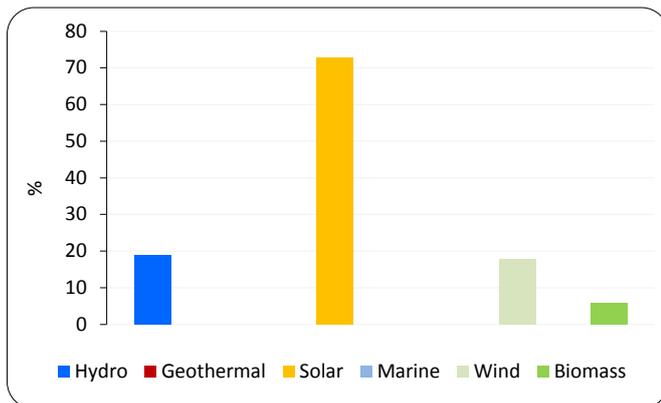


Figure 27-9. Relative increase/decrease of RES electricity sources in Sweden, 2011-12

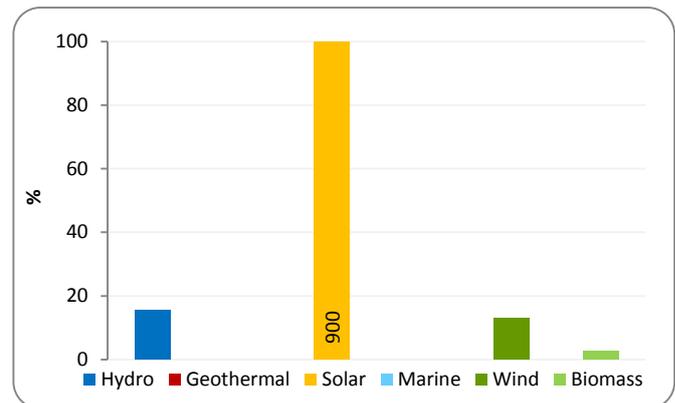


Figure 27-10. Deviation from NREAP in the RES electricity consumption in Sweden in 2012.

In 2020 the contribution of hydropower in total renewable electricity will decrease up to 69.9% while biomass and wind contribution will increase respectively to 17.2% and 12.9%.

27.5 Renewable energy in heating & cooling

The use of renewable energy in heating and cooling in Sweden amounted to 9155 ktoe (383.3 PJ) in 2011 and 9661 ktoe (404.5 PJ) in 2012 increasing over the 2005 level of 7084 ktoe (296.6 PJ). The development of renewable energy in this sector was faster than planned in both 2011 and 2012: 8.1% (+688 ktoe) over in 2011 and 11.1% (+962 ktoe) over in 2012. The heat production from renewable energy sources in Sweden is expected to reach 10542 ktoe (441.4 PJ) in 2020.

Heat production in Sweden in 2012 was dominated by biomass with a share of 87.7%. Heat pump contribution was 12.2% while solar thermal had a very marginal contribution with 0.1%.

Renewable heat share in Sweden exceeded in 2012 by 3.6 pp the 2020 planned share of 65.6%

The main progress from 2005 happened in heat pumps which reached 1163 ktoe (48.7 PJ) in 2011 exceeding the 2020 plan of 1045 ktoe (43.8 PJ). The heat production from this technology increased further in 2012 with

1.2% (+14 ktoe) reaching 1177 ktoe (49.3 PJ). Comparing with the expected heat productions from this technology Sweden was well over in both years: 178.2% (+745 ktoe) over in 2011 and 140.7% (688 ktoe) over in 2012.

No changes were planned in heat production from solar thermal in Sweden NREAP up to 2020. Nevertheless the heat production from this technology increased in 2011 to 11 ktoe (0.3 PJ) being almost 83% over the 2020 plan of 6 ktoe. The same deviation was found from expected NREAP heat productions for 2011 and 2020 since no change in heat production from solar happened in Sweden between 2011 and 2012.

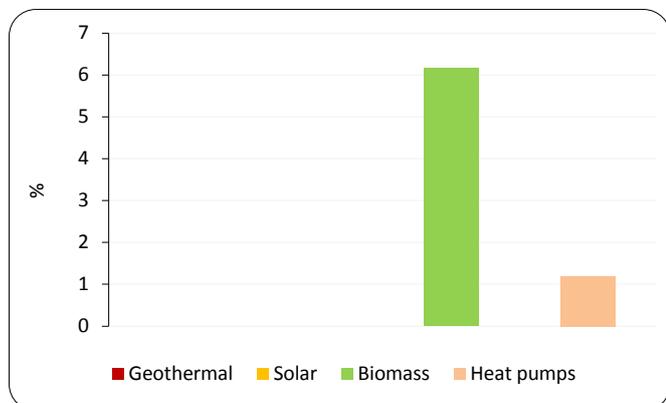


Figure 27-11. Relative increase/decrease of RES heating/cooling sources in Sweden, 2011-12.

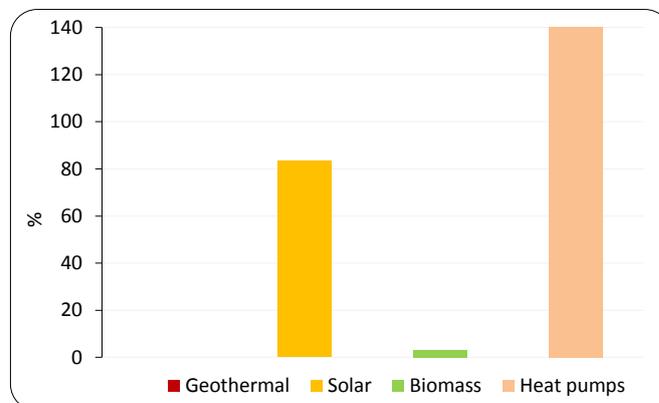


Figure 27-12. Deviation from NREAP in the RES heat consumption in Sweden in 2012.

In 2012 the use of biomass for heat production reached 7981 ktoe (334.1 PJ) increasing from 7078 ktoe (296.3 PJ) of year 2005. The increase between 2011 and 2012 happened with 6.2% (+492 ktoe). The use of biomass for heat production in 2011 was lower than what was expected from the Sweden NREAP by 0.8% (-61.9 ktoe) while in 2012 this use surpassed the plan by 3.3% (+269 ktoe).

In 2020 it is expected that the contribution of biomass will reach 90% while the heat pumps contribution will decrease to 9.9%. Solar thermal will have a very marginal contribution with only 0.1%.

27.6 Renewable energy in transport

The use of renewable energy in transport reached 606 ktoe (25.4 PJ) in 2011 and 736 ktoe (30.8 PJ) in 2012 increasing over 287 ktoe (12 PJ) in 2005. The use of renewable energy in this sector was found to be over the expected use in both years: 5.2% (+30 ktoe) over in 2011 and 17.9% (+112 ktoe) over in 2012. The use of renewable energy in transport sector in 2020 is expected to be 1008 ktoe (42.2 PJ).

In 2012 45% of renewable energy consumed in transport sector was covered by biodiesel.

Renewable energy share in transport sector in Sweden exceeded in 2012 by 2.2 pp the 2020 planned share of 15.72%

Bioethanol-bio/ETBE contribution reached 26.8% followed by 17.5% contribution of renewable electricity and 10.7% of other biofuels.

Biodiesel made the main progress in transport sector during 2005-2011 with an additional use of +206 ktoe (8.6 PJ) increasing further with 54% (+116 ktoe) between 2011 and 2012. In comparison with NREAP planned values the use

of biodiesel in Sweden was higher by 104.8% (+110 ktoe) in 2011 and 171.3% (+209 ktoe) in 2012.

Even that an increase was planned in the Sweden NREAP, bioethanol/bio-ETBE use in transport sector decreased in 2011 to 197 ktoe (8.2 PJ) which is under (-2.9%) even the 2010 use. No changes happened in the use of this biofuel category between 2011 and 2012. Comparing with expected NREAP plan the bioethanol/bio-ETBE use in Sweden was under in both years: 27.8% (-76 ktoe) less in 2011 and 33% (-97 ktoe) less in 2012.

Almost 30% of additional biofuels use in EU 28 between 2011 and 2012 was provided by Sweden

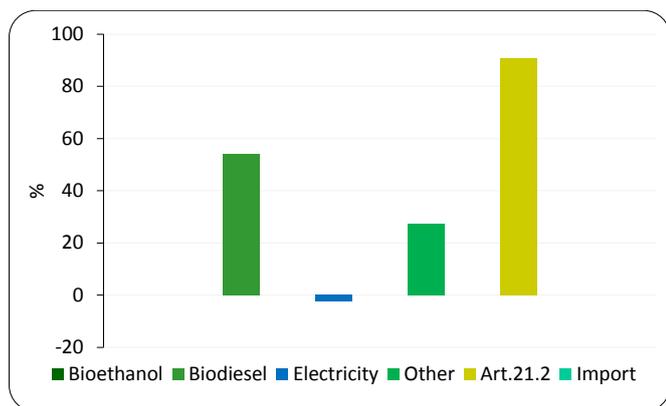


Figure 27-13. Relative increase/decrease of RES transport uses in Sweden, 2011-12.

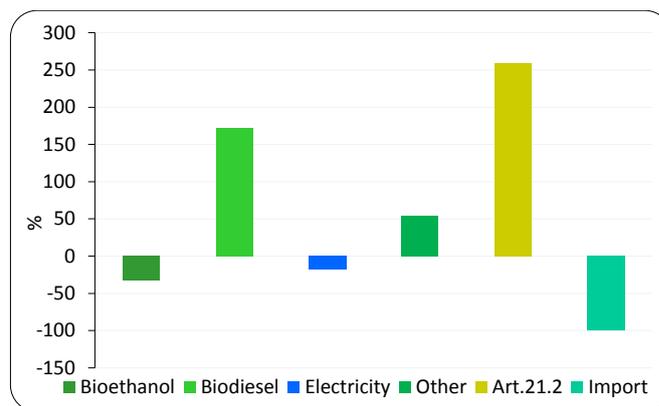


Figure 27-14. Deviation from NREAP in the RES use in transport in Sweden in 2012.

Other biofuels (biogas and vegetable oils) were used in Sweden in 2011 and 2012 in the respective amounts of 62 ktoe and 79 ktoe. These uses were over the expected NREAP plans in both years: 34.8% (+16 ktoe) over in 2011 and 54.9% (+28 ktoe) over in 2012.

The use of biofuels from wastes, residues, ligno-cellulosic material grew by a factor of 7 between 2005 and 2011 reaching the amount of 96 ktoe (4.0 PJ) increasing further in 2012 by 90.6% (+87 ktoe). Comparing with expected NREAP use Sweden was over in both years: 108.7% (+50.0 ktoe) over in 2011 and 258.8% (+132 ktoe) over in 2012.

Even that Sweden planned to use imported biofuels during period 2011 – 2012 no use of these biofuels took place in both years.

The use of renewable electricity in transport sector in Sweden reached 132 ktoe (5.5 PJ) in 2011 decreasing further by 2.3% (-3.3 ktoe) between 2011 and 2012. This development was not fast enough to meet the expected NREAP levels in both 2011 and 2012: 13.2% 8-20.0 ktoe) under in 2011 and 17.8% (-28 ktoe) under in 2012.

In 2020 the share of bioethanol/bio-ETBE is expected to overcome the share of biodiesel in total renewable energy expected to be used in this sector reaching 46.1%. Biodiesel share is expected to decrease to 24.9% and the rest will be renewable electricity (19.6%) and other biofuels (9.3%).

28. Renewable energy in United Kingdom

28.1 Deployment of renewable energy

The renewable energy consumed in United Kingdom increased from 2235 ktoe (93.6 PJ) in 2005 to 4995 ktoe (209 PJ) in 2011 and 5633 ktoe (235.8 PJ) in 2012. Renewable energy consumed in United Kingdom is expected to further increase to 20731 ktoe (868 PJ) until 2020 (Figure 28-1).

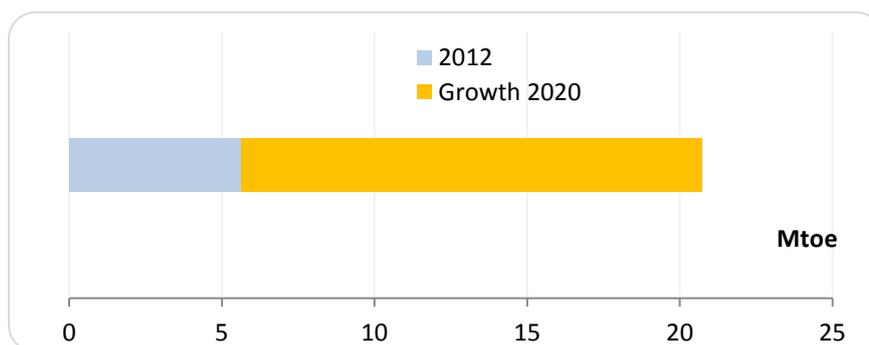


Figure 28-1 RES total in United Kingdom in 2012 and the expected growth to 2020 target

In relative terms the progress in transport sector during 2005-12 was faster than in other sectors increasing by 81.2% per annum in average. Nevertheless it experienced a decrease during period 2011-12 by 8.1% (-84 ktoe). Comparing with expected development renewable energy consumed in transport was under in both years: 29.1% under in 2011 and 45.6% under in 2012.

Heating/cooling sector was the only one to have a development faster than what was planned in the NREAP: 85.3% (+530 ktoe) over in 2011 and 61.5% (+465 ktoe) over in 2012. The average growth rate that this sector experienced during period 2005-2012 was 21.4% reaching 1221.1 ktoe in 2012.

Renewable energy consumed in the United Kingdom missed the expected NREAP targets in both 2011 and 2012 respectively by -5.4% (-282.5 ktoe) and -8.0% (-486.6 ktoe).

Renewable energy in electricity sector had the highest absolute increase in both years: +1352 ktoe in 2011 and +2004 ktoe in 2012. The renewable energy had also the fastest development during period 2011-12 by 23.2% (+651.6 ktoe). Nevertheless this development was not enough to meet the NREAP planned levels in both years: 12.1% (-387.3 ktoe) less in 2011 and 4.3% (-153.7 ktoe) less in 2012.

Electricity sector is expected to have the highest additional energy from renewable sources with +6.6 Mtoe (+190.7%) whereas the fastest increase is expected to take place in heating/cooling sector with +407.7% (+4978 ktoe).

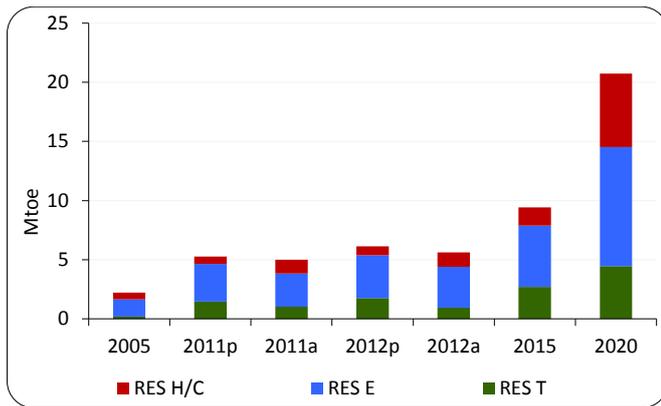


Figure 28-2. RES deployment in UK: projected growth and actual progress until 2020.



Figure 28-3. Deviation from NREAP in the RES production in United Kingdom in 2012.

28.2 Sources of renewable energy

Biomass was the main renewable energy source in United Kingdom with a 41% contribution in renewable energy mix in 2012, followed by wind with 29%, biofuels with 16%, hydropower with 8%, solar with 5% and heat pumps with 1%.

Biofuels use in transport sector had the fastest development during period 2005-12 increasing with an average growth rate of 153.7% (+807 ktoe) from 75 ktoe (3.1 PJ) in the baseline year. Nevertheless this development was slower than the NREAP projected one missing both 2011 and 2012 expected levels: 26.3% (-345 ktoe) less in 2011 and 44.6% (-711 ktoe) less in 2012.

Solar had the second highest growth rate with 108.5% per annum in average (225.5 ktoe) during 2005-2012 period reaching 255 ktoe (10.7 PJ) in 2012. This development was fast enough to exceed not only the 2011 and 2012 NREAP plans respectively with 222.6% (+98.7 ktoe) and 367% (+200.5 ktoe) but even the 2020 expected level with 12.6% (+28.5 ktoe).

While no developments were expected in geothermal²⁴ source United Kingdom introduced it since in 2009 with 0.8 ktoe (0.03 PJ) a level that didn't change till 2012.

Biomass use for energy production in United Kingdom increased with only 10.2% per annum in average (+963.3 ktoe) during period 2005-2012 reaching 2307 ktoe (96.6 PJ) in 2012. The development of this source was found over the expected NREAP projected one exceeding both 2011 and 2012 levels: 43.2% (+637.9 ktoe) more in 2011 and 43.2% (+695.8 ktoe) more in 2012.

In 2020, the share of biomass in renewable energy mix is expected to be dominated by wind technology (33%) followed by biomass (30%), biofuels (20%), heat pumps (11%), hydropower (3%), marine (2%) and solar (1%).

²⁴ This source in UK represent only geothermal thermal

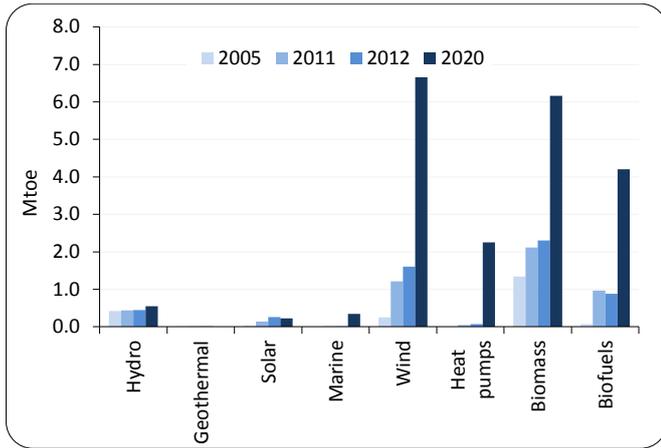


Figure 28-4. Contribution of renewable energy sources in United Kingdom: actual and projected in 2020

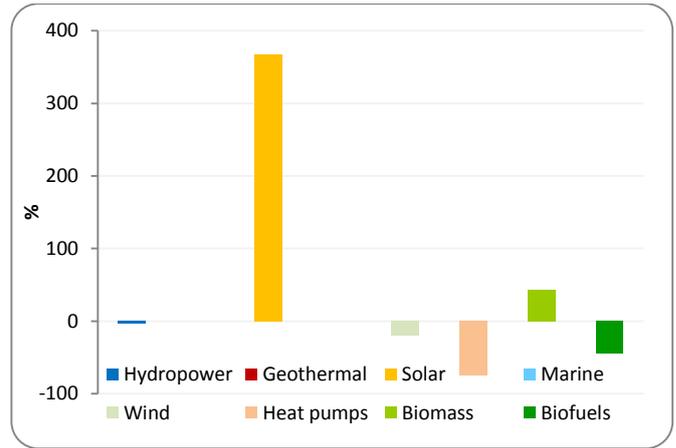


Figure 28-5. Deviation from NREAP in the contribution of renewable sources in United Kingdom in 2012

28.3 Renewable energy share

The overall renewable energy contribution in Gross Final Energy Consumption in United Kingdom reached 3.8% in 2011 and 4.2% in 2012 increasing from 1.4% in 2005. Comparing with the NREAP expected shares in 2011 United Kingdom was under by 0.2% points but managed to exceed it by 0.2% points in 2012. The overall RES share in 2012 was over the 2011/2012 interim target but remained far from 2013/2014 interim target. The 2020 target that United Kingdom has to reach for the overall RES share is 15%.

The overall RES share in the United Kingdom reached in 2012 the NREAP target and the very close indicative minimum trajectory for 2011/2012. Although RES share remains slightly above both the minimum trajectory and the NREAP targets, based on data reported in 2011 and 2012 the United Kingdom still has to achieve a significant increase in overall RES share in its Gross Final Energy Consumption in order to reach the 2020 targets

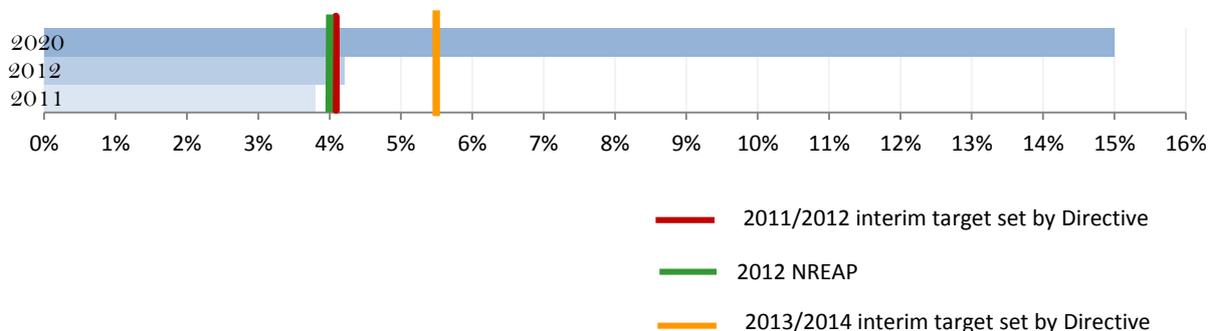


Figure 28-6. Overall RES share in United Kingdom, 2011-12

Renewable electricity share had the fastest development during period 2005-2012 with +6.1% points missing nevertheless the expected shares for both 2011 and 2012: 1.2% points under in 2011 and 0.2% points under in 2012.

The share of renewable energy in transport sector developed with +5.5% points between 2005 and 2012 missing nevertheless the expected share for year 2011 with 0.7% points but exceeding the planned one for 2012 with 0.2% points.

Renewable energy share in heating/cooling sector increased with +1.6% points in 2012 from the share of 0.7% in the baseline year. This development was faster than the NREAP projected one exceeding both 2011 and 2012 expected shares with 1.3% points each.

The main development up to 2020 is expected to take place in electricity sector where the renewable energy share is expected to have an increase with 20.2% points whereas in electricity sector the share of renewable energy will need 9.7% points to reach the plan of 12%.

28.4 Renewable electricity

28.4.1 Installed capacity

The renewable energy installed capacity in United Kingdom doubled during period 2005-2012 reaching 15538 MW over 7323 MW in the baseline year. Nevertheless in 2011 the installed capacity of renewable energy sources missed the expected capacity by 11.5% (-1586 MW). The increase by 26.7% during period 2011-12 was enough to exceed the NREAP planned capacity in 2012 by 0.1% (+18 MW). A capacity of 41020 MW is expected to be reached in 2020.

In 2012 wind capacity represent more than 57% of total RES installed capacity in United Kingdom followed by biomass with 21%, hydropower and solar with 11% each.

The fastest progress in year 2012 over 2005 capacity was made in solar technology which increased by a factor equal to 156 reaching 1706 MW in 2012. It exceeded both 2011 and 2012 expected NREAP capacities respectively with 609% (+853 MW) and 509% (+1426 MW).

Wind technology had the highest absolute increase during 2005-2012 period with +7323 MW (58.5% per annum in average). Wind technology missed in 2011 the planned capacity by 10.7% (-774 MW) but increased enough during 2011-12 (+37.2%) to exceed the planned capacity in 2012 by 3.1% (+268 MW). Biomass installed capacity doubled during this period reaching 3251 MW in 2012 or more

More than 70% of additional renewable electricity capacity in United Kingdom between 2011 and 2012 was provided by wind power

than 75% of 2020 target. The exceedances from 2011 and 2012 NREAP capacities were respectively 63.2% (+1207 MW) and 60.1% (+1221 MW).

Hydropower capacity reported by United Kingdom in its second progress report remained almost unchanged compared with 2009-2010 period. Due to the fact that United Kingdom compiled the Table 10a of its NREAP in a different way from the established template the installed capacity during period 2009-2012 compared with year 2005 resulted to be much lower in absolute level. Comparing with the planned capacities for years 2011 and 2012

United Kingdom was found to have 63.2% (-2875 MW) less in 2011 and 63.3% (-2904 MW) less in 2012.

While no marine installed capacity was planned in the NREAP in 2012 United Kingdom reported a capacity of 7 MW for this technology.

In 2020 it is expected that wind technology will cover more than two-third of total RES installed capacity in United Kingdom. Hydropower is expected to follow with 12% together with biomass (10%), solar (7%) and marine (3%).

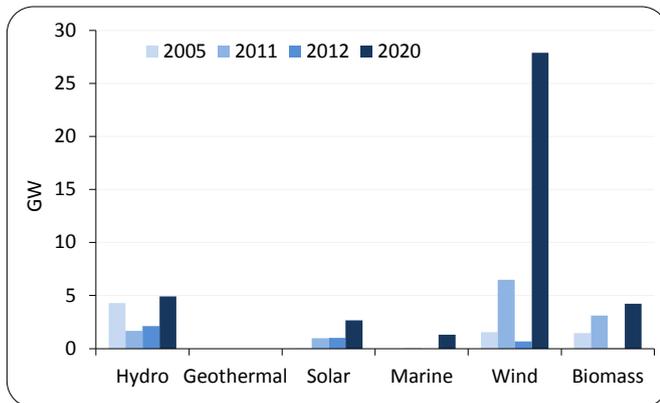


Figure 28-7. RES capacity deployment and progress until 2020 in United Kingdom.

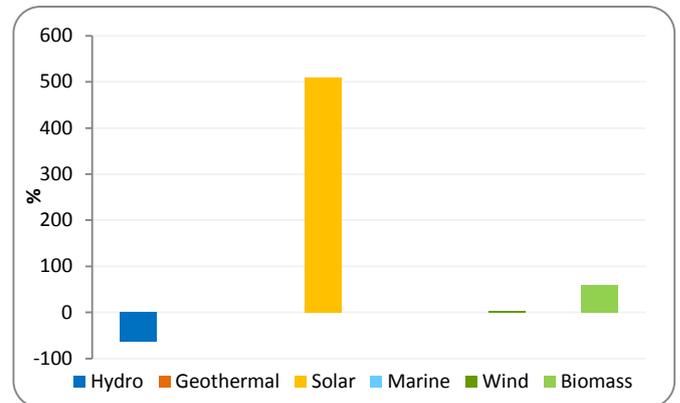


Figure 28-8. Deviation from NREAP in the RES installed capacity in United Kingdom in 2012.

28.4.2 Consumption

Renewable electricity consumption in United Kingdom amounted to 32.7 TWh (117.6 PJ) in 2011 and 40.2 TWh (145 PJ) in 2012 from 17 TWh (61) in 2005. Nevertheless the renewable electricity consumption in United Kingdom didn't reach the NREAP planned values missing the respective values by 12.1% (-4504 GWh) in 2011 and 4.3% (-1787 GWh) in 2012. In 2020 the renewable electricity consumption in United Kingdom is expected to triple over 2012 level amounting to 117 GWh (421 PJ).

In 2012 wind power and biomass provided 84.2% of total renewable electricity consumed (respectively with 46.4% and 37.8%) and the rest was coming from hydropower with 12% and solar with 3%.

Solar technology experienced the fastest increase during period 2005-2012 by a factor of 148 reaching 1188 GWh or more than half of 2020 target. It exceeded the NREAP planned levels in both years: 103% (+124 GWh) more in 2011 and 395% (+948 GWh) more in 2012.

Wind power contributed with more than two-third of additional renewable electricity in United Kingdom during 2005-2012 period, +15.8 GWh. Nevertheless this technology didn't

Wind and biomass covered almost 10% of 2012 gross final electricity consumption in United Kingdom

developed fast enough to meet the expected NREAP plans in both 2011 and 2012: 26.3% (-5025 GWh) less in 2011 and 19.4% (-4504 GWh) less in 2012.

The contribution of biomass in additional renewable electricity in United Kingdom during period 2005-2012 was with 6.2 TWh. The development of biomass in United Kingdom

during period 2011-12 compared with NREAP was faster than expected: 4% (+511 GWh) more in 2011 and 14.6% (+1939 GWh) more in 2012.

Renewable electricity coming from hydropower in United Kingdom developed with an average yearly rate of 0.8% (+265 GWh) between 2005 and 2012 over 4921 GWh (17.7 PJ) in the baseline year. This development was slower than what was planned in the NREAP missing both 2011 and 2012 expected contributions: 2.2% (-115 GWh) less in 2011 and 3.2% (-174 GWh) less in 2012.

A contribution of 4 GWh (0.004 PJ) in 2012 was found to come from marine technology even that no plans were in place for 2011 and 2012. The increase of renewable electricity from this source during 2011-12 period was with 300% (+3 GWh).

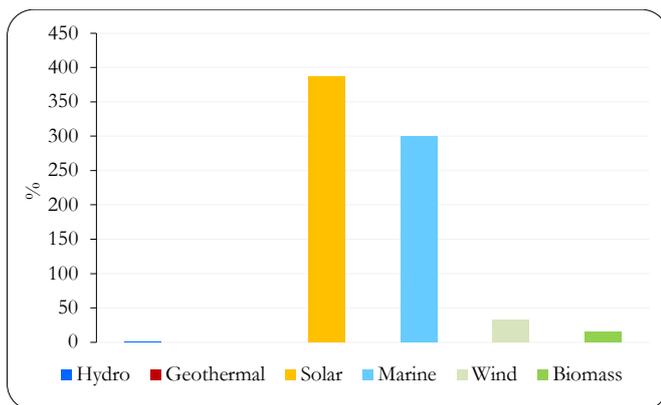


Figure 28-9. Relative increase/decrease of RES electricity sources in United Kingdom, 2011-12

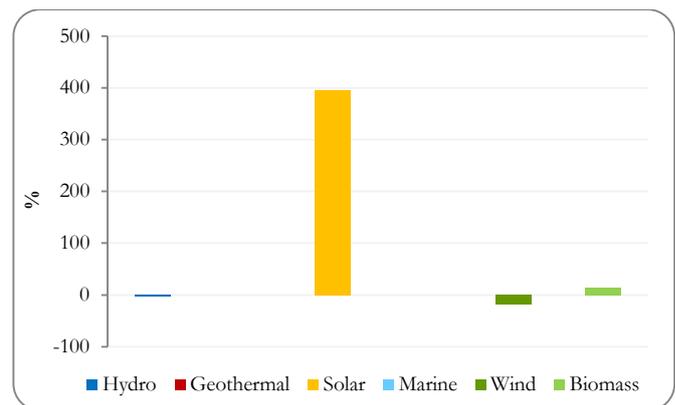


Figure 28-10. Deviation from NREAP in the RES electricity consumption in United Kingdom in 2012.

In 2020 wind power is expected to cover almost two-third of total renewable electricity expected to be consumed while the rest will come from biomass (22.4%), hydropower (5.4%), marine (3.4%) and solar (1.9%).

28.5 Renewable energy in heating & cooling

The use of renewable energy in heating and cooling²⁵ in United Kingdom increased by 561 ktoe (+13.6% per annum in average) during 2005-2011 reaching 1151 ktoe and the additional heat in period 2011-12 was only 70.3 ktoe (+6.1%). Renewable energy in this sector developed faster than what was planned in the United Kingdom NREAP: 79% (+508 ktoe) more in 2011 and 57.6% (+446 ktoe) more in 2012. The heat production from renewable energy sources is expected to reach 6202 ktoe in 2020.

In 2012 biomass contribution in total heat production was 81.9%, the rest solar thermal with 12.5%, heat pumps with 5.5% and geothermal²⁶ with 0.1%.

United Kingdom had projected a lower contribution of solar thermal for heat production. Nevertheless this technology developed fast exceeding the expected NREAP heat production in both 2011 and 2012 respectively by 259% (+88 ktoe) and 350% (+119 ktoe).

²⁵ Total value of Table 1c of UK 2013 progress report includes 42 ktoe in 2011 and 51 ktoe in 2012 as derived heat without specifying the source. These values are not included in the analysis of renewable energy consumed in UK in this sector during period 2011-2012.

²⁶ See Section 29.2 for the detailed analysis of this source

Solar thermal technology in United Kingdom developed fast exceeding since in 2020 (????) the 2020 plan of 34 ktoe (1.4 PJ). In 2012 the heat produced by solar thermal was found to be 4.5 times higher than its 2020 planned value.

Biomass had the highest additional heat production in 2012 over 2005 level increasing yearly by 9.8% (+440 ktoe). Comparing with expected NREAP heat production, biomass exceeded in both years the planned levels: 153.5% (+594 ktoe) more in 2011 and 112.3% (529 ktoe) more in 2012.

United Kingdom has set a very ambitious 2020 plan of 2254 ktoe (94.4 PJ) for heat pump use in heating/cooling sector. Despite of this the development of heat pump technology in United Kingdom during 2011-12 period was not fast enough to meet the respective NREAP planned levels: 78.8% (-175 ktoe) under in 2011 and 75% (-203 ktoe) under in 2012.

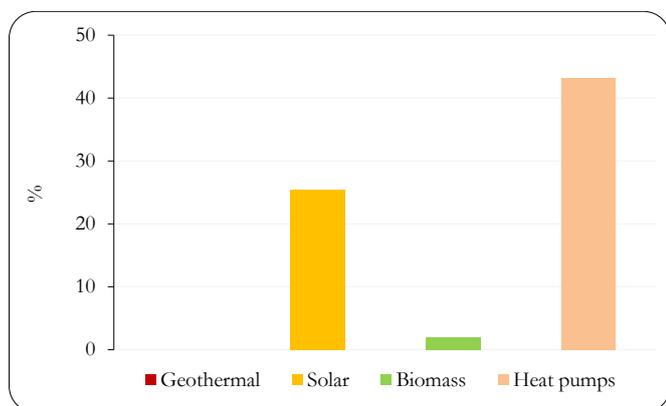


Figure 28-11. Relative increase/decrease of RES heating/cooling sources in United Kingdom, 2011-12.

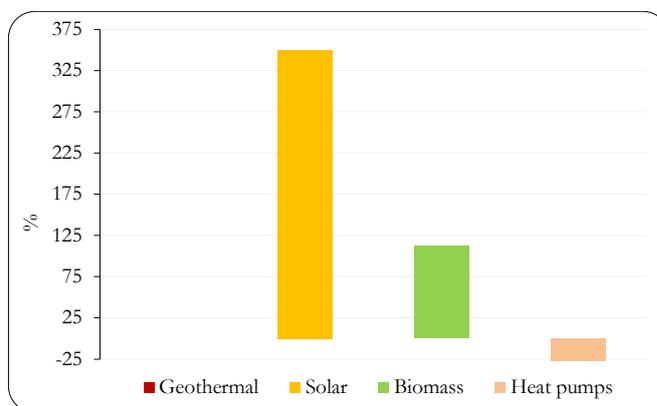


Figure 28-12. Deviation from NREAP in the RES heat consumption in United Kingdom in 2012.

The introduction of geothermal source might change the 2020 picture of renewable sources contributions in total renewable heat expected to be produce in United Kingdom. According to United Kingdom NREAP in 2020 biomass is expected to produce 63.1% of total renewable energy heat and the rest will be heat pumps (36.3%) and solar thermal (0.5%).

28.6 Renewable energy in transport

The use of renewable energy in transport reached 1035 ktoe in 2011 decreasing then by 8.1% (-84 ktoe) in 2012. Comparing with respective NREAP planned values the use of renewable energy in transport sector was lower by 29% (-425 ktoe) in 2011 and 45.6% (-798 ktoe) in 2012. The use of renewable energy in transport sector in 2020 is expected to be 4472 ktoe.

In 2012 almost half of renewable energy consumed in this sector was in the form of biodiesel while the contributions of other sources were: bioethanol/bio-ETBE 40.7%, renewable electricity 7.3% and other biofuels 2.5%.

Bioethanol/bio-ETBE had the fastest development in transport sector during 2005-2012 amounting to 387 ktoe by a yearly increase of 293%. It exceeded in both 2011 and 2012 the NREAP planned use respectively by 84.4% (+151 ktoe) and 78.3% (+170 ktoe).

Biodiesel had the highest absolute increase during 2005-2012 period by 414 ktoe (104% per annum in average). Nevertheless biodiesel in this sector didn't meet the expected use in both years: 44% (-500 ktoe) under the 2011 and 65.8% (-905 ktoe) under in 2012.

Even that not planned other biofuels recorded a use of 4 ktoe (0.17 PJ) in 2011 which increased in 2012 with 4.5% (+3 ktoe).

While no contribution was expected in both years for the use of biofuels from wastes, residues, ligno-cellulosic material, their use grew to 472 ktoe (19.8 PJ) in 2012. No uses of other biofuels (biogas and vegetable oils) were expected in United Kingdom in 2011 and 2012. Nevertheless it reported an amount of 4 ktoe in 2011 and 24 ktoe in 2012.

Imported biofuels decreased with 18% during 2011-12 time span being 32.8% (-387.4 ktoe) and 54.5% (-781 ktoe) under the respective NREAP planned values for these years.

The use of renewable electricity in transport almost halved during 2005-2011 period compared with 113 ktoe in 2005. It increased with only 3 ktoe during 2011-12 being nevertheless under the respective NREAP planned values: 54.8% (-80 ktoe) in 2011 and 55.8% (-87 ktoe) in 2012.

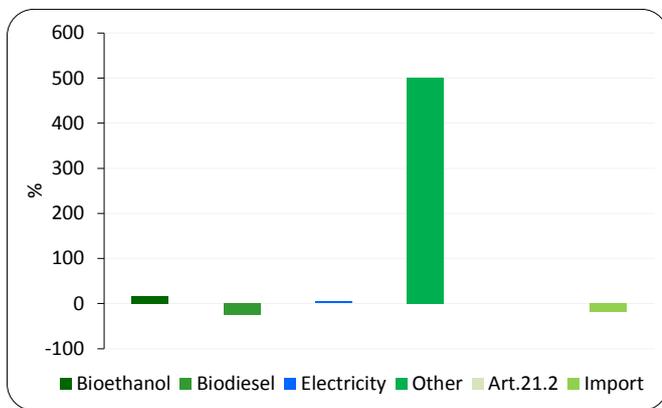


Figure 28-13. Relative increase/decrease of RES transport uses in United Kingdom, 2011-12.

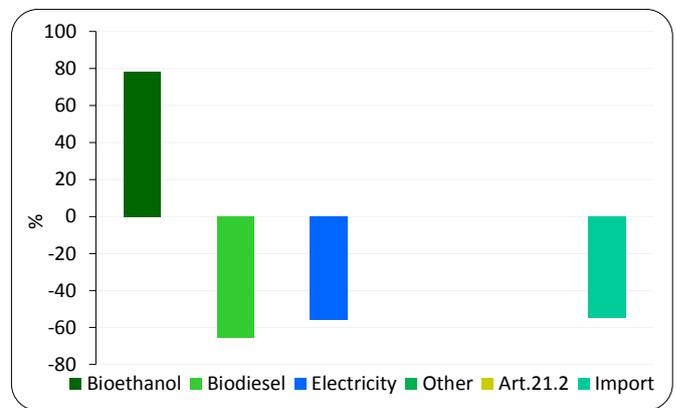


Figure 28-14. Deviation from NREAP in the RES use in transport in United Kingdom in 2012.

In 2020 biodiesel use in transport sector is expected to increase its share to 55.1% while bioethanol/bio-ETBE and renewable electricity will decrease their share slightly respectively to 39% and 6%.

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Abbreviations

ETBE – Ethyl Tertiary Butyl Ether
EU – European Union
GW – Gigawatt
GWh – Gigawatt-hour
H/C – Heating /cooling sector
ktoe – kilo-tonnes oil equivalent
Mtoe – Mega-tonnes oil equivalent
MS – Member States
NREAPs – National renewable energy action plans
PR – Renewable Energy Progress Reports
PV – Solar photovoltaic
PJ – Petajoule
RES – Renewable Energy Sources
RES-H/C- Renewable Energy Sources in Heating/Cooling sector
RES-E – Renewable Energy Sources in Electricity sector
RES-T – Renewable Energy Sources in Transport sector
TWh- Terrawatt-hour

Units

1 Mtoe = 41.868 PJ = 11.63 TWh
1 ktoe = 41.868 TJ = 11.63 GWh
1 PJ = 0.278 TWh = 0.024 Mtoe
1 TWh = 3.6 PJ = 0.086 Mtoe
1 TJ = 277.8 MWh

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ANNEX I
Data checking of EU-28 MS 2013 progress reports

Data from Member States' second progress reports are summarised using the approach applied in the previous JRC reports [1], [2], [3], [11] on renewable energy development. As the progress reports were of varying quality and completeness, a data-check procedure was used in order to fix possible miscalculations and misreporting.

Data checking methodology and discrepancy indicators

<i>RES_H/C</i>	= Diff. {Sum of RE sources in heating/cooling — total RES in H/C, as reported}
<i>RES_E</i>	= Diff. {Sum of RE sources in electricity — total RES in electricity, as reported}
<i>RES_T</i>	= Diff. {Sum of RE sources in transport — total RES in transport, as reported}
<i>Total RES*</i>	= Diff. {Sum of RE sources in total RES — total RES, as reported}
<i>Total RES**</i>	= Diff. {Sum of RE sources in total RES — sum of RES in each sector, as reported}
<i>Total RES***</i>	= Diff. {Total RES as reported — sum of RES in each sector, as reported}

Table 1 presents the discrepancies between calculated and reported total values for renewable energy consumption in each sector and in total for the EU-28.

Table 1. Discrepancies between calculated and reported RES in EU 28

	2011		2012	
	ktoe	%	ktoe	%
RES-H/C	-1339.4	-1.7	-1357.3	-1.6
RES-E	-2575.0	-4.3	-1415.7	-2.2
RES-T	74.8	0.6	74.5	0.6
Total RES*	-3342.5	-2.2	-2490.2	-1.5
Total RES**	-3839.6	-2.5	-2698.5	-1.7
Total RES***	-497.04	-0.3	-208.2	-0.13

For electricity and heating/cooling, the reported values were found to be generally lower than the calculated values, whereas for transport the reported values were higher. The higher reported values for transport in 2011 and 2012 can be explained by the fact that some Member States reported multiple counting values as total RES consumed in that sector, instead of final consumption values. The largest discrepancies in both 2011 and 2012 were nevertheless found for electricity sector.

The data check for each Member State raised some issues, which are described below. Nevertheless, this report does not attempt to correct the data provided by the Member States. All EU-28 totals discussed here, including sector totals, were calculated by adding together data from *single sources and subcategories*, ignoring intermediate and sector totals provided by the Member States. As a consequence, whenever there was a discrepancy between sources or subcategories and sectoral or intermediate totals in the data provided by the Member States, it was reproduced in the EU-28 total values in this report.

Discrepancies in EU-28 data reporting

10 Member States (CZ, EE, IE, LV, LT, LU, NL, PL, SK and UK) reported lower total values for electricity than the sum of renewable energy sources used in this sector in 2011.

12 Member States (CZ, EE, IE, EL, LV, LT, LU, HU, NL, PL, SE and UK) reported lower total values for electricity than the sum of renewable energy sources used in this sector in 2012.

12 Member States (BE, BG, DK, DE, IT, PL, PT, RO, SI, FI, SE and UK) reported higher values for heating/cooling than the sum of renewable energy sources used in this sector in 2011.

14 Member States (BE, BG, DK, DE, ES, IT, CY, LV, MT, PL, PT, SI, FI and UK) reported higher values for heating/cooling than the sum of renewable energy sources used in this sector in 2012.

10 Member States (BG, CZ, DE, LV, HR, HU, PL, RO, FI and UK) reported lower values for transport than the sum of renewable energy sources in this sector in 2011.

8 Member States (BG, LV, HR, HU, RO, SI, FI and UK) reported lower values for transport than the sum of renewable energy sources used in this sector in 2012.

Other findings on data reporting discrepancies

Italy reported the biodegradable fraction of waste separately in both biomass electricity (capacity and production) and biomass heat. In order to be consistent with the progress report template, this value has been added to the solid biomass subcategory.

For Sweden, the total value of hydropower with pumped storage differed from the sum of hydropower subcategories and pumped storage. The total value of renewable electricity from wind power differed from the sum of renewable electricity from wind subcategories (onshore and offshore). Sweden reported waste use in electricity and heating/cooling sectors separately. In order to be consistent with the progress report template, the contribution of renewable waste was included in the category of solid biomass.

For the United Kingdom, the total value of renewable energy consumed in heating/cooling, as reported in Table 1c of the UK's 2013 progress report, included an amount of derived heat for which the source was not specified. This value was reported in the snapshot for the UK but the sum of renewable energy sources in Table 1c was set as the total value of renewable energy consumed in this sector.

Other findings on data reporting discrepancies

Belgium did not divide wind in the electricity sector into subcategories, neither for capacity nor consumption.

The Czech Republic reported only the total biomass consumed in heating/cooling in 2011 (1737 ktoe) without dividing into subcategories.

Denmark did not divide biofuels consumed in transport into subcategories for 2011 and 2012.

Estonia did not provide any data on greenhouse gas (GHG) emission savings for 2011 and 2012.

Ireland did not provide any data on GHG emission savings from renewable energy consumed in 2011-12.

Greece reported the total RES consumed in transport improperly using multiple counting calculations.

For Spain, the total reported value of solar electricity differed from the sum of photovoltaics (PV) and concentrated solar power (CSP). The calculated value is used in this report.

France reported a value for renewable electricity consumption originated from hydropower without pumping that differs from the sum of the sub-categories.

Latvia's reported hydropower value, which included pumped storage, was found to be lower than the sum of the hydropower subcategories and pumped storage.

Croatia's reported value for hydropower with pumped storage differed from the sum of the hydropower subcategories and pumped storage.

Portugal's reported total value of hydropower with pumped storage differed from the sum of the hydropower subcategories and pumped storage.

Romania's total value of hydropower with pumped storage differed from the sum of the hydropower subcategories and pumped storage.

Slovakia's total value of hydropower with pumped storage differed from the sum of the hydropower subcategories and pumped storage.

Finland did not divide renewable electricity consumption coming from wind technology into subcategories in 2011 or 2012.

Table 2 presents a summary of the differences found for each Member State in the reporting of total values for renewable energy consumption in each sector.

Table 2. Discrepancies between calculated and reported RES in each EU 28 MS, 2011& 2012

	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
	RES_H/C		RES_E		RES_T		Total RES*		Total RES**	
	ktoe	ktoe	ktoe	ktoe	ktoe	ktoe	ktoe	ktoe	ktoe	ktoe
BE	-46.3	-24.5	-51.0	-38.4	-0.5	-0.2	-97.4	-62.1	-97.8	-63.1
BG	-10.0	-22.0	-31.1	-16.2	2.0	1.1	-39.3	-37.0	-39.1	-37.1
CZ	0.0	0.0	0.2	0.7	1.0	-1.0	0.2	-1.3	1.2	-0.3
DK	-389.6	-397.4	-82.0	-77.0	0.0	-0.2	-457.6	-455.6	-471.6	-474.6
DE	-759.0	-845.0	-291.7	-300.7	1.0	0.0	-1049.7	-1145.7	-1049.7	-1145.7
EE	0.0	0.0	0.2	0.1	-0.1	-0.1	1.1	1.0	0.1	0.0
IE	0.0	0.0	0.2	0.5	-0.3	-0.3	-0.1	1.1	-0.1	0.1
EL	18.8	0.2	-27.7	0.3	-22.7	-23.8	-31.6	-50.3	-31.6	-23.3
ES	0.0	-1.0	-183.6	-166.6	0.0	0.0	-183.6	-167.6	-183.6	-167.6
FR	0.0	0.0	-240.7	-196.1	0.0	0.0	313.3	47.9	-240.7	-196.1
IT	-1.0	-1.0	-746.4	-486.9	0.0	0.0	-747.6	-487.8	-747.4	-487.9
CY	0.0	-0.4	-0.1	-0.1	0.0	0.0	0.0	-0.5	0.0	-0.5
LV	0.2	-0.5	4.5	4.7	0.1	0.2	6.8	7.4	4.8	4.4
LT	1.0	0.0	0.8	0.8	-1.0	-1.0	0.8	-0.2	0.8	-0.2
LU	3.9	3.4	2.0	1.3	0.0	-1.0	6.3	4.5	5.9	3.7
HR	3.7	7.4	0.0	-5.1	9.9	11.1	13.5	12.9	13.6	13.4
HU	0.0	1.0	-0.2	0.2	18.0	17.0	17.8	18.2	17.8	18.2
MT	0.1	-0.7	0.0	-0.5	0.0	0.0	0.1	-1.2	0.1	-1.2
NL	1.0	1.0	28.7	30.8	0.0	-1.0	28.7	29.8	29.7	30.8
AT	0.0	133.0	-310.6	-330.6	0.0	0.0	-171.6	-194.6	-310.6	-197.6
PL	-32.2	-32.3	52.8	53.9	0.1	-0.2	-198.4	-12.2	20.8	21.4
PT	-0.2	-0.5	-0.3	-397.8	0.0	0.0	5.1	-397.5	-0.5	-398.3
RO	-0.1	0.0	-471.4	-376.8	1.9	2.4	-469.5	-374.4	-469.5	-374.4
SI	-0.5	-0.1	-46.0	-21.0	-0.2	0.4	-46.4	-21.1	-46.7	-20.7
SK	0.0	0.0	0.4	-0.2	-0.5	-0.1	-0.1	-0.3	-0.1	-0.3
FI	-86.0	-127.0	-178.4	-105.1	0.1	0.3	-264.3	-232.8	-264.3	-231.8
SE	-1.0	0.0	-4.2	1009.3	-1.0	0.0	-5.2	1009.3	-6.2	1009.3
UK	-42.2	-50.9	0.3	0.9	67.0	71.0	26.1	20.0	25.1	21.0
EU 28	-1339.4	-1357.3	-2575.0	-1415.7	74.8	74.6	-3342.5	-2490.2	-3839.6	-2698.5

ANNEX II

Shares of renewable energy in electricity, heating/cooling and transport sectors for period 2011-2012 and year 2013

Table All - 1. Overall RES share in the EU-28, the absolute deviations from NREAPs, 2011-2013

	PRs	PRs	SHARES	Absolute deviations from NREAPs		
	2011	2012	2013	2011	2012	2013
	%	%	%	percentage points	percentage points	percentage points
BE	5.17	6.81	7.85	0.77	1.61	2.05
BG	14.60	16.40	18.99	3.90	5.70	7.59
CZ	10.47	11.22	12.41	0.67	0.72	1.41
DK	23.99	25.97	27.19	0.59	1.77	-0.11
DE	11.60	12.40	12.37	0.80	1.00	0.37
EE	25.90	24.80	25.62	4.70	2.80	2.32
IE	6.50	7.10	7.80	-0.20	-0.50	-0.80
EL	11.03	13.83	14.99	2.23	4.33	5.09
ES	13.20	14.30	15.42	-1.20	-0.80	-0.18
FR	12.70	13.70	14.24	-0.80	-0.30	-0.76
IT	12.27	13.53	16.71	3.62	4.30	6.85
CY	6.51	7.70	8.12	-0.29	0.60	0.32
LV	33.55	35.78	37.07	-0.25	1.48	2.37
LT	20.23	21.72	22.95	3.23	3.72	3.95
LU	2.87	3.13	3.57	-0.03	0.23	-0.33
HR	14.20	15.10	17.96	0.00	0.00	2.16
HU	9.06	9.60	9.81	1.76	2.20	2.31
MT	1.33	2.70	3.83	-0.97	0.10	0.03
NL	4.30	4.50	4.52	-0.30	-1.10	-2.08
AT	30.70	32.20	32.55	-0.70	0.60	0.75
PL	10.42	11.04	11.28	0.26	0.30	0.07
PT	24.50	24.60	25.69	-0.70	-2.30	-1.41
RO	21.20	22.90	23.94	3.20	3.86	4.59
SI	19.42	20.23	21.52	1.22	1.53	2.02
SK	11.90	11.70	9.82	3.70	3.50	0.92
FI	33.50	35.10	36.81	3.40	4.10	5.21
SE	48.80	51.00	52.13	4.60	6.10	6.53
UK	3.80	4.20	5.13	-0.20	0.20	0.13
EU 28	13.14	14.15	14.95	0.82	1.24	1.31

Table AII - 2. RES-E share in the EU-28, the absolute deviations from NREAPs, 2011-2013

	PRs	PRs	SHARES	Absolute deviations from NREAPs		
	2011	2012	2013	2011	2012	2013
	%	%	%	percentage points	percentage points	percentage points
BE	8.83	11.12	12.29	2.63	3.32	2.79
BG	13.60	16.70	18.91	1.50	3.30	3.91
CZ	10.60	11.64	12.75	-0.10	0.14	0.75
DK	35.88	38.69	43.12	-1.22	0.69	-3.08
DE	20.90	23.60	25.59	1.60	2.70	2.89
EE	12.20	15.70	13.03	5.20	7.60	1.73
IE	17.60	19.60	20.89	-7.00	-5.70	-9.61
EL	13.82	16.48	21.24	-1.88	-2.32	-0.56
ES	31.60	33.50	36.39	0.60	1.50	3.69
FR	16.40	16.70	16.87	0.40	-0.30	-1.13
IT	23.55	27.42	31.30	3.98	7.22	9.61
CY	3.90	5.90	6.64	-0.50	1.50	0.64
LV	44.70	44.88	48.75	-1.60	-2.12	1.55
LT	9.00	10.90	13.14	-1.00	-0.10	0.14
LU	4.07	4.64	5.31	-0.33	-0.76	-1.19
HR	34.50	35.60	38.68	0.00	0.00	2.08
HU	6.35	6.10	6.60	-0.15	-0.80	-0.90
MT	0.64	0.99	1.62	-0.46	-0.51	-2.08
NL	9.80	10.50	10.07	0.70	-2.00	-5.23
AT	64.50	65.30	68.08	-9.20	-8.80	-6.12
PL	8.15	10.68	10.73	-0.70	0.49	-0.40
PT	45.90	47.60	49.16	1.70	-1.20	-0.14
RO	31.13	33.57	37.52	0.30	-0.27	0.86
SI	30.81	31.36	32.82	-1.49	-0.94	-0.88
SK	19.90	20.50	20.80	0.60	0.30	-0.20
FI	29.40	29.50	31.11	3.40	3.50	4.11
SE	59.90	60.00	61.81	4.10	3.40	4.41
UK	8.80	10.80	13.85	-1.20	-0.20	0.85
EU 28	21.51	23.51	25.37	0.56	1.30	1.63

Table All - 3. RES-H/C share in the EU-28, the absolute deviations from NREAPs, 2011-2013

	PRs		SHARES	Absolute deviations from NREAPs			
	2011	2012		2013	2011	2012	2013
	%	%		%	percentage points	percentage points	percentage points
BE	4.68	6.64	8.11	0.48	1.94	3.01	
BG	24.90	27.50	29.20	7.60	9.60	10.70	
CZ	12.65	13.64	15.33	1.25	1.44	2.63	
DK	31.77	33.32	34.78	-0.03	1.22	-0.42	
DE	10.80	11.10	10.57	1.40	1.10	0.07	
EE	48.40	41.40	43.14	8.90	1.60	3.44	
IE	4.70	5.20	5.70	-0.20	-0.90	-1.20	
EL	20.23	24.23	26.48	4.53	8.03	9.68	
ES	13.60	14.00	14.89	2.30	2.30	2.79	
FR	15.80	17.20	18.32	-2.20	-1.80	-2.18	
IT	12.49	12.81	18.03	5.40	5.10	9.62	
CY	18.90	21.50	21.66	2.00	3.70	3.16	
LV	44.83	47.39	49.71	-1.87	-0.21	1.51	
LT	33.68	35.41	37.72	4.68	5.41	5.72	
LU	4.80	4.99	5.65	2.50	2.29	2.25	
HR	12.80	13.50	18.12	0.00	0.00	3.82	
HU	12.28	13.54	13.46	3.48	4.94	4.96	
MT	5.76	12.47	23.67	-2.64	3.67	15.17	
NL	3.30	3.40	3.61	-0.70	-1.00	-1.19	
AT	45.50	45.00	33.51	15.20	14.60	2.91	
PL	13.38	13.66	13.94	0.84	0.88	0.89	
PT	35.90	33.00	34.55	4.20	0.30	2.15	
RO	24.31	25.74	26.20	6.80	7.59	8.57	
SI	28.68	30.57	31.74	5.38	6.17	6.34	
SK	10.70	10.50	7.49	2.70	2.00	-1.71	
FI	45.90	48.20	50.87	6.90	8.20	9.87	
SE	62.50	65.60	67.15	4.90	7.40	8.45	
UK	2.30	2.30	2.63	1.30	1.30	0.63	
EU 28	15.28	15.92	16.50	2.20	2.24	2.08	

Table AII - 4. RES-T share in the EU-28, the absolute deviations from NREAPs, 2011- 2013

	PRs	PRs	SHARES	Absolute deviations from NREAPs		
	2011	2012	2013	2011	2012	2013
	%	%	%	percentage points	percentage points	percentage points
BE	4.00	4.46	4.34	0.20	-0.34	-0.46
BG	0.40	0.30	5.63	-1.40	-2.20	2.33
CZ	5.90	5.59	5.69	1.30	0.39	-0.21
DK	3.56	5.49	5.70	0.06	-0.41	-0.30
DE	5.90	6.90	6.33	-1.60	-0.70	-0.67
EE	0.10	0.10	0.24	0.00	-2.30	-4.56
IE	3.70	3.80	5.02	-0.20	-0.80	-0.08
EL	0.74	1.06	1.06	-2.56	-3.04	-3.74
ES	0.40	0.40	0.44	-6.70	-7.20	-7.36
FR	6.90	7.10	7.22	0.00	-0.10	-0.28
IT	4.69	5.84	4.97	0.57	1.12	-0.38
CY	2.10	2.40	1.13	-0.30	-0.10	-1.67
LV	3.24	3.10	3.08	-0.86	-1.10	-1.32
LT	3.70	4.80	4.65	-0.30	-0.20	-1.35
LU	2.05	2.22	3.88	0.75	0.42	1.48
HR	1.40	2.20	2.15	0.00	0.00	-0.85
HU	5.05	4.49	5.35	0.45	-0.51	0.35
MT	1.07	3.84	3.26	-1.93	0.54	-0.34
NL	4.60	5.00	5.05	0.40	0.40	-0.05
AT	6.70	7.00	7.45	-0.20	-0.10	0.15
PL	6.51	6.09	6.03	-0.05	-1.18	-1.76
PT	0.40	0.40	0.66	-4.70	-4.90	-5.04
RO	2.05	4.15	4.65	-4.32	-2.75	-2.67
SI	2.11	2.88	3.40	-0.69	-0.22	-0.10
SK	5.60	4.50	5.30	1.40	0.20	0.90
FI	6.40	7.90	9.87	-0.60	-0.10	-0.13
SE	9.40	12.60	16.65	1.20	3.80	7.25
UK	2.70	3.70	4.42	-0.70	-0.30	-0.08
EU 28	4.53	5.17	5.35	-1.05	-0.89	-0.98

ANNEX III

Summary of renewable energy development in the EU MS, progress towards, and the deviation from their targets in NREAPs, 2011-12

1. European Union

Table 1- 1. RES use in EU28, progress and deviation from NREAPs

	2011		2012		Deviation from NREAP				growth 2012-2020		2020
	PR		PR		2011		2012				NREAPs
	[Mtoe]	[Mtoe]	[Mtoe]	[Mtoe]	[%]	[Mtoe]	[%]	[Mtoe]	[%]	[Mtoe]	
RES-H/C	77.3	82.0	5.8	8.1	7.5	10.0	29.8	36.3	111.8		
RES-E	57.9	64.2	-2.6	-4.2	-0.3	-0.4	39.9	62.1	104.1		
RES-T-20	12.8	13.3	-4.3	-25.3	-5.0	-27.4	19.0	143.4	32.3		
RES	147.9	159.5	-1.1	-0.7	2.2	1.4	88.7	55.6	248.2		

Table 1- 2. The contribution of different sources of renewable energy in EU28²⁷

	2011		2012		Deviation from NREAP				2020
	PR		PR		2011		2012		NREAP
	[ktoe]	[ktoe]	[ktoe]	[ktoe]	%	[ktoe]	%	[ktoe]	
Hydropower	27247.3	28241.0	-2573.4	-8.6	-1748.2	-5.8	31792.6		
Geothermal	1081.1	1091.5	-239.9	-18.2	-360.9	-24.9	3588.8		
<i>Geothermal-el</i>	510.8	500.1	-17.8	-3.4	-47.2	-8.6	942.9		
<i>Geothermal-th</i>	570.3	591.4	-222.1	-28.0	-313.7	-34.7	2645.9		
Solar	5849.9	8037.9	1428.4	32.3	2686.9	50.2	15150.3		
<i>Solar-el</i>	4091.3	6141.9	1358.4	49.7	2712.8	79.1	8696.5		
<i>Solar-th</i>	1758.6	1896.0	70.1	4.1	-25.9	-1.3	6455.3		
Marine	41.1	39.7	-2.1	-4.8	-9.7	-19.7	559.5		
Wind	15140.4	17073.6	-1361.5	-8.3	-1670.9	-8.9	42050.7		
<i>Onshore</i>	13916.4	15515.1	-1478.3	-9.6	-1532.5	-9.0	30308.7		
<i>Offshore</i>	648.1	880.2	-408.3	-38.7	-746.1	-45.9	11742.0		
Heat pumps	6105.8	6762.1	1390.7	29.5	1340.8	24.7	12286.3		
Biomass	79645.2	84965.5	4579.6	6.1	6930.0	8.9	110465.9		
<i>Solid biomass</i>	72049.0	78231.1	6139.1	9.3	10001.0	14.7	94319.0		
<i>Biogas</i>	5355.8	6228.4	938.8	21.3	1355.2	27.8	10022.9		
<i>Bioliquids</i>	504.5	504.9	-4207.9	-89.3	-4399.4	-89.7	6094.2		
Biofuels	11479.2	11936.1	-4194.6	-26.8	-4770.7	-28.6	29053.7		
<i>Bioethanol</i>	2546.4	2575.1	-1258.4	-33.1	-1495.1	-36.7	7323.6		
<i>Biodiesel</i>	8698.9	8937.5	-2945.3	-25.3	-3459.7	-27.9	20983.2		
Renewable electricity-T	1294.3	1332.0	-141.2	-9.8	-242.2	-15.4	3244.9		

Table 1- 3. Current growth in RES share in EU28 and progress until 2020

	2005		2011		2012		Deviation from NREAP				2020
	NREAPs		PR		PR		2011		2012		NREAPs
	%	%	%	%	% points	%	% points	%	%	%	
RES-H/C	9.32	15.28	15.92	2.20	16.79	2.24	16.36	21.39			
RES-E	14.75	21.51	23.51	0.56	2.65	1.30	5.85	33.89			
RES-T-10	1.32	5.00	6.03	-0.57	-10.26	0.06	0.96	11.43			
Overall RES	8.17	13.14	14.15	0.82	6.62	1.24	9.62	20.62			

²⁷ BE reported for both 2011 & 2012 only the total wind w/o subdividing in subcategories; CZ reported for 2011 only the total biomass consumed in H/C sector w/o dividing in subcategories; DK reported for 2011 & 2012 only the total biofuels w/o dividing in subcategories; FI reported for both 2011 & 2012 the total wind w/o dividing in subcategories. Due to these facts the total values of wind and biomass for 2011 & 2012 doesn't match with the sum of respectively subcategories. The total value of biofuels includes also the contribution of other biofuels which is not reported in this table. The total value of solar includes also the contribution of CSP technology which is not reported in this table.

2. Belgium

Table 2- 1. RES use in Belgium, progress and deviation from NREAPs

	2011	2012	Deviation from NREAP				growth	2012-202	2020
	PR	PR	2011		2012				NREAPs
	[ktoe]	[ktoe]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]
RES-H/C	901.7	1285.5	-8.5	-0.9	270.4	26.6	1302.9	101.4	2588.4
RES-E	617.0	809.6	90.3	17.1	142.3	21.3	1178.8	145.6	1988.4
RES-T-20	364.5	372.8	8.4	2.3	-69.1	-15.6	513.5	137.7	886.33
RES	1883.2	2467.9	90.2	5.0	343.5	16.2	2995.2	121.4	5463

Table 2- 2. The contribution of different sources of renewable energy in Belgium

	2011	2012	Deviation from NREAP				2020
	PR	PR	2011		2012		NREAP
	[ktoe]	[ktoe]	[ktoe]	%	[ktoe]	%	[ktoe]
Hydropower	25.5	27.1	-6.2	-19.5	-5.0	-15.6	37.8
Geothermal	2.6	2.8	-0.8	-23.5	-0.7	-20.0	8.2
<i>Geothermal-el</i>	n.r	n.r	n/a	n/a	n/a	n/a	2.5
<i>Geothermal-th</i>	2.6	2.8	-0.8	-23.5	-0.7	-20.0	5.7
Solar	115.0	200.1	40.8	54.9	111.9	127.0	296.6
<i>Solar-el</i>	100.6	184.8	68.8	216.2	148.8	414.1	98.0
<i>Solar-th</i>	14.4	15.3	-28.0	-66.0	-36.9	-70.7	198.7
Marine	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Wind	176.8	223.8	26.6	17.7	-22.7	-9.2	900.8
<i>Onshore</i>	n.r	n.r	n/a	n/a	n/a	n/a	367.6
<i>Offshore</i>	n.r	n.r	n/a	n/a	n/a	n/a	533.2
Heat pumps	19.0	23.4	-56.7	-74.9	-69.4	-74.8	350.0
Biomass	1179.8	1617.9	78.1	7.1	245.6	32.7	2983.4
<i>Solid biomass</i>	1088.8	1496.7	49.7	4.8	349.3	30.4	2770.4
<i>Biogas</i>	91.0	121.3	37.6	70.4	60.0	97.8	178.8
<i>Bioliquids</i>	n.r	n.r	-9.2	-100	-10.8	-100	34.1
Biofuels	338.1	346.0	8.7	2.6	-66.1	-16.0	789.1
<i>Bioethanol</i>	48.0	48.0	12.1	33.9	4.5	10.4	91.2
<i>Biodiesel</i>	290.1	298.0	-3.4	-1.2	-70.6	-19.2	697.9
Renewable electricity-T	26.4	26.8	-0.4	-1.3	-3.1	-10.2	97.2

Table 2- 3. Current growth in RES share in Belgium and progress until 2020

	2005	2011	2012	Deviation from NREAP				2020
	NREAPs	PR	PR	2011		2012		NREAPs
	%	%	%	% points	%	% points	%	%
RES-H/C	2.3	4.68	6.64	0.5	11.4	1.9	41.3	11.9
RES-E	2.7	8.83	11.12	2.6	42.4	3.3	42.6	20.9
RES-T-10	0.19	4.0	4.5	0.2	4.5	-0.3	-6.1	11.6
Overall RES	2.2	5.17	6.81	0.8	17.5	1.6	31.0	13

3. Bulgaria

Table 3- 1. RES use in Bulgaria, progress and deviation from NREAPs

	2011		2012		Deviation from NREAP		growth		2012-2020	2020
	PR	PR	2011	2012					NREAPs	
	[ktoe]	[ktoe]	[ktoe]	[ktoe]	[%]	[%]	[ktoe]	[%]	[ktoe]	
RES-H/C	1033.0	1100.0	268.0	35.0	301.0	37.7	3.0	0.3	1103.0	
RES-E	424.9	529.8	43.5	11.4	104.2	24.5	124.2	23.4	653.9	
RES-T-20	8.0	6.1	-43.0	-84.3	-64.9	-91.4	295.9	4850.8	302	
RES	1465.9	1635.9	268.5	22.4	340.3	26.3	423.1	25.9	2059	

Table 3- 2. The contribution of different sources of renewable energy in Bulgaria

	2011		2012		Deviation from NREAP				2020
	PR	PR	2011	2012					NREAP
	[ktoe]	[ktoe]	[ktoe]	[ktoe]	%	%	[ktoe]	%	[ktoe]
Hydropower	342.5	364.7	56.8	19.9	76.9	26.7			319.2
Geothermal	33	33	31	1550	30.6	1275			9.0
<i>Geothermal-el</i>	n.r	n.r	n/a	n/a	n/a	n/a			n.r
<i>Geothermal-th</i>	33.0	33.0	31.0	1550	30.6	1275			9.0
Solar	22.7	85.0	12.0	112	70.5	485.2			58.4
<i>Solar-el</i>	8.7	70.0	4.4	102	62.2	794.5			37.4
<i>Solar-th</i>	14.0	15.0	7.6	118.8	8.3	123.9			21.0
Marine	n.r	n.r	n/a	n/a	n/a	n/a			n.r
Wind	69	89.4	-17.7	-20.4	-30.2	-25.3			222.9
<i>Onshore</i>	69	89.4	-17.7	-20.4	-30.2	-25.3			222.9
<i>Offshore</i>	n.r	n.r	n/a	n/a	n/a	n/a			n.r
Heat pumps	42.0	47.0	42.0		47.0				0.0
Biomass	948.8	1010.7	188.1	24.7	210.4	26.3			1147.4
<i>Solid biomass</i>	946.2	1010.6	185.9	24.4	214.0	26.9			1097.2
<i>Biogas</i>	2.6	0.1	2.2	512.6	-3.7	-97.7			50.2
<i>Bioliquids</i>	n.r	n.r	n/a	n/a	n/a	n/a			n.r
Biofuels	n.r	n.r	-47.0	-100	-67.0	-100			287.0
<i>Bioethanol</i>	n.r	n.r	-1.0	-100	-3.0	-100			60.0
<i>Biodiesel</i>	n.r	n.r	-46.0	-100	-64.0	-100			220.0
Renewable electricity-T	8.0	6.1	4.0	100	2.1	52.5			15.0

Table 3- 3. Current growth in RES share in Bulgaria and progress until 2020

	2005	2011	2012	Deviation from NREAP				2020
	NREAPs	PR	PR	2011	2012			NREAPs
	%	%	%	% points	%	% points	%	%
RES-H/C	15.9	24.9	27.5	7.6	43.9	9.6	53.6	23.8
RES-E	8.4	13.6	16.7	1.5	12.4	3.3	24.6	20.8
RES-T-10	0.11	0.7	0.4	-1.1	-63.4	-2.0	-82.8	10.8
Overall RES	9.6	14.6	16.4	3.9	36.4	5.7	53.3	16

4. Czech Republic

Table 4- 1. RES use in Czech Republic, progress and deviation from NREAPs

	2011		2012		Deviation from NREAP		growth	2012-202	2020
	PR	PR	2011	2012					
	[ktoe]	[ktoe]	[ktoe]	[ktoe]	[%]	[%]	[ktoe]	[%]	[ktoe]
RES-H/C	1800.0	1904.0	-176.0	-8.9	-193.0	-9.2	661.0	34.7	2565.0
RES-E	623.2	693.7	-5.7	-0.9	6.9	1.0	220.2	31.7	913.8
RES-T-20	308.0	289.0	23.0	8.1	-38.0	-11.6	405.0	140.1	694
RES	2731.2	2886.7	-158.7	-5.5	-224.1	-7.2	1286.2	44.6	4173

Table 4- 2. The contribution of different sources of renewable energy in Czech Republic

	2011		2012		Deviation from NREAP		2020
	PR	PR	2011	2012		NREAP	
	[ktoe]	[ktoe]	[ktoe]	[ktoe]	%	%	[ktoe]
Hydropower	168.9	183.1	-15.3	-8.3	-7.4	-3.9	232.7
Geothermal	n.r	n.r	n/a	n/a	n/a	n/a	16.5
<i>Geothermal-el</i>	n.r	n.r	n/a	n/a	n/a	n/a	1.5
<i>Geothermal-th</i>	n.r	n.r	n/a	n/a	n/a	n/a	15.0
Solar	198.7	197.8	0.0	0.0	-3.6	-1.8	238.7
<i>Solar-el</i>	187.7	184.8	0.0	0.0	-3.6	-1.9	206.7
<i>Solar-th</i>	11.0	13.0	0.0	0.0	0.0	0.0	32.0
Marine	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Wind	34.1	35.8	2.2	7.0	0.2	0.5	87.2
<i>Onshore</i>	34.1	35.8	2.2	7.0	0.2	0.5	87.2
<i>Offshore</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Heat pumps	52.0	62.0	0.0	0.0	2.0	3.3	157.0
Biomass	1969.5	2119.0	-168.6	-7.9	-177.3	-7.7	2746.6
<i>Solid biomass</i>	152.7	1884.7	-1815.1	-92.2	-172.2	-8.4	2317.5
<i>Biogas</i>	79.9	234.2	-90.5	-53.1	-5.0	-2.1	429.1
<i>Bioliquids</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Biofuels	300.0	280.0	25.0	9.1	-36.0	-11.4	672.0
<i>Bioethanol</i>	59.0	59.0	5.0	9.3	-6.0	-9.2	128.0
<i>Biodiesel</i>	241.0	221.0	20.0	9.0	-30.0	-12.0	495.0
Renewable electricity-T	8.0	9.0	-2.0	-20.0	-2.0	-18.2	22.0

Table 4- 3. Current growth in RES share in Czech Republic and progress until 2020

	2005		2011		2012		Deviation from NREAP		2020	
	NREAPs	PR	PR	2011	2012			NREAPs		
	%	%	%	% points	%	% points	%	%	%	
RES-H/C	8.3	12.65	13.64	1.3	11.0	1.4	11.8	15.5		
RES-E	3.4	10.6	11.64	-0.1	-0.9	0.1	1.2	13.5		
RES-T-10	0.15	5.9	5.6	1.3	27.1	0.4	6.9	15.5		
Overall RES	6.1	10.47	11.22	0.7	6.8	0.7	6.9	14		

5. Denmark²⁸

Table 5- 1. RES use in Denmark, progress and deviation from NREAPs

	2011	2012	Deviation from NREAP				growth	2012-202	2020
	PR	PR	2011		2012				NREAPs
	[ktoe]	[ktoe]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]
RES-H/C	2139.4	2251.6	-395.6	-15.6	-309.4	-12.1	776.4	34.5	3028.0
RES-E	1046.0	1119.0	-115.0	-9.9	-79.7	-6.6	652.1	58.3	1771.1
RES-T-20	147.0	221.8	-4.0	-2.6	-35.2	-13.7	69.2	31.2	291
RES	3332.4	3592.4	-514.6	-13.4	-424.3	-10.6	1497.7	41.7	5090

Table 5- 2. The contribution of different sources of renewable energy in Denmark

	2011	2012	Deviation from NREAP				2020
	PR	PR	2011		2012		NREAP
	[ktoe]	[ktoe]	[ktoe]	%	[ktoe]	%	[ktoe]
Hydropower	2.0	1.9	-0.7	-26.8	-0.8	-30.5	2.7
Geothermal	2.0	3.4	2.0	n/a	3.4	n/a	0.0
<i>Geothermal-el</i>	n.r	n.r	n.r	n.r	n.r	n.r	n.r
<i>Geothermal-th</i>	2.0	3.4	2.0	n/a	3.4	n/a	n.r
Solar	20.1	38.8	7.9	65.0	26.7	219.0	16.3
<i>Solar-el</i>	1.3	8.9	1.1	650.0	8.8	5095.0	0.3
<i>Solar-th</i>	18.8	29.9	6.8	56.7	17.9	149.2	16.0
Marine	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wind	748.1	802.6	-54.7	-6.8	-31.1	-3.7	1007.3
<i>Onshore</i>	580.2	625.2	25.5	4.6	74.8	13.6	549.6
<i>Offshore</i>	167.9	177.3	-80.2	-32.3	-106.0	-37.4	457.7
Heat pumps	115.4	116.6	-109.6	-48.7	-129.4	-52.6	369.0
Biomass	2297.8	2407.3	-355.5	-13.4	-257.8	-9.7	3403.8
<i>Solid biomass</i>	294.6	305.6	-60.7	-17.1	-56.5	-15.6	760.8
<i>Biogas</i>	264.7	273.1	-71.0	-21.1	-64.5	-19.1	545.7
<i>Bioliquids</i>	30.0	32.5	10.3	52.1	8.1	33.2	214.4
Biofuels	0.0	0.0	0.0	0.0	-0.1	0.0	0.7
<i>Bioethanol</i>	2003.2	2101.7	-294.8	-12.8	-201.3	-8.7	2643.0
<i>Biodiesel</i>	1941.4	2029.7	-286.6	-12.9	-200.3	-9.0	2470.0
Renewable electricity-T	45.8	50.0	-16.2	-26.1	-16.0	-24.2	165.0

Table 5- 3. Current growth in RES share in Denmark and progress until 2020

	2005	2011	2012	Deviation from NREAP				2020
	NREAPs	PR	PR	2011		2012		NREAPs
	%	%	%	% points	%	% points	%	%
RES-H/C	23.2	31.77	33.32	0.0	-0.1	1.2	3.8	39.8
RES-E	26.8	35.88	38.69	-1.2	-3.3	0.7	1.8	51.9
RES-T-10	0.22	3.8	5.8	0.2	6.3	-0.1	-1.6	10.2
Overall RES	17	23.53	25.97	0.1	0.6	1.8	7.3	30.4

²⁸ The updated 2013 progress report of Denmark submitted to the European Commission on 20.03.2014 reported different shares and figures on renewable energy development compared with the first submission of this report on 09.01.2014

6. Germany

Table 6- 1. RES use in Germany, progress and deviation from NREAPs

	2011		2012		Deviation from NREAP		growth 2012-202		2020
	PR	PR	2011	2012					NREAPs
	[ktoe]	[ktoe]	[ktoe]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]	[%]
RES-H/C	10686.0	11320.0	229.0	436.0	2.2	4.0	3111.0	27.5	14431.0
RES-E	10354.3	11734.3	367.9	962.0	3.7	8.9	6922.1	59.0	18656.4
RES-T-20	2987.0	3131.0	-850.0	-719.0	-22.2	-18.7	3009.0	96.1	6140
RES	24027.3	26185.3	-253.1	679.0	-1.0	2.7	13042.1	49.8	39227

Table 6- 2. The contribution of different sources of renewable energy in Germany

	2011		2012		Deviation from NREAP		2020
	PR	PR	2011	2012			NREAP
	[ktoe]	[ktoe]	[ktoe]	[ktoe]	%	%	[ktoe]
Hydropower	1822.9	1816.8	274.9	17.8	268.8	17.4	1720
Geothermal	61.6	68.2	-16.9	-21.5	-54.2	-44.3	828.2
<i>Geothermal-el</i>	1.6	2.2	-2.9	-64.2	-6.2	-74.2	142.2
<i>Geothermal-th</i>	60.0	66.0	-14	-18.9	-48.0	-42.1	686
Solar	2239.5	2844.7	538.4	31.6	788.5	38.3	4803.8
<i>Solar-el</i>	1685.5	2268.7	484.4	40.3	772.5	51.6	3559.5
<i>Solar-th</i>	554.0	576.0	54	10.8	16.0	2.9	1245
Marine	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Wind	4020.2	4242.8	-230	-5.4	-319.9	-7.0	8981.4
<i>Onshore</i>	4020.2	4242.8	-147.5	-3.5	-156.3	-3.6	6249.1
<i>Offshore</i>	n.r	n.r	-82.5	-100	-163.7	-100	2732.3
Heat pumps	612.0	681.0	81	15.3	82.0	13.7	1145
Biomass	12284.2	13400.8	-49.4	-0.4	633.7	5.0	15608.3
<i>Solid biomass</i>	9240.5	9781.8	-24.2	-0.3	257.5	2.7	11064.9
<i>Biogas</i>	2842.3	3427.5	566	24.9	982.4	40.2	3707.7
<i>Bioliquids</i>	201.4	191.5	-591.3	-74.6	-606.2	-76.0	835.7
Biofuels	2805.0	2943.0	-787	-21.9	-635.0	-11.9	5473
<i>Bioethanol</i>	782.0	792.0	-405	-34.1	-353.0	-30.8	857
<i>Biodiesel</i>	1989.0	2034.0	-311	-13.5	-52.0	-2.5	4443
Renewable electricity-T	182.0	188.0	-63	-25.7	-84.0	-30.9	667

Table 6- 3. Current growth in RES share in Germany and progress until 2020

	2005	2011	2012	Deviation from NREAP				2020
	NREAPs	PR	PR	2011	2012		NREAPs	
	%	%	%	% points	% points	%	%	
RES-H/C	6.6	10.8	11.1	1.4	14.9	1.1	11.0	15.5
RES-E	10.2	20.9	23.6	1.6	8.3	2.7	12.9	38.6
RES-T-10	3.89	6.0	7.8	-1.6	-20.6	0.1	1.9	13.7
Overall RES	6.5	11.6	12.4	0.8	7.4	1.0	8.8	19.6

7. Estonia

Table 7- 1. RES use in Estonia, progress and deviation from NREAPs

	2011	2012	Deviation from NREAP				growth	2012-202	2020
	PR	PR	2011		2012				NREAPs
	[ktoe]	[ktoe]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]
RES-H/C	667.0	655.0	45.0	7.2	29.0	4.6	-48.0	-7.3	607.0
RES-E	98.2	131.1	38.7	65.0	70.2	115.3	33.5	25.5	164.5
RES-T-20	0.9	0.9	-6.1	-87.1	-13.1	-93.6	89.1	9900.0	90
RES	766.1	787.0	77.6	11.3	86.1	12.3	74.6	9.5	862

Table 7- 2. The contribution of different sources of renewable energy in Estonia

	2011	2012	Deviation from NREAP				2020
	PR	PR	2011		2012		NREAP
	[ktoe]	[ktoe]	[ktoe]	%	[ktoe]	%	[ktoe]
Hydropower	1.1	2.0	-1.5	-56.7	-0.6	-23.3	2.6
Geothermal	n.r	n.r	n/a	n/a	n/a	n/a	n.r
<i>Geothermal-el</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
<i>Geothermal-th</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Solar	n.r	n.r	n/a	n/a	n/a	n/a	n.r
<i>Solar-el</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
<i>Solar-th</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Marine	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Wind	29.9	43.0	-0.6	-2.0	13.6	46.2	132.2
<i>Onshore</i>	29.9	43.0	-0.6	-2.0	13.6	46.2	83.8
<i>Offshore</i>	n.r	n.r	n/a	n/a	n/a	n/a	48.4
Heat pumps	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Biomass	734.2	741.1	85.8	13.2	86.2	13.2	636.8
<i>Solid biomass</i>	731.9	738.7	109.9	17.7	112.7	18.0	607.0
<i>Biogas</i>	2.3	2.4	2.3		2.4		0.0
<i>Bioliquids</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Biofuels	n.r	n.r	-6.9	-100.0	-13.9	-100.0	89.4
<i>Bioethanol</i>	n.r	n.r	n/a	n/a	-5.6	-100.0	38.0
<i>Biodiesel</i>	n.r	n.r	-6.9	-100.0	-8.2	-100.0	51.1
Renewable electricity-T	0.9	0.9	0.8	800.0	0.8	800.0	0.6

Table 7- 3. Current growth in RES share in Estonia and progress until 2020

	2005	2011	2012	Deviation from NREAP				2020
	NREAPs	PR	PR	2011		2012		NREAPs
	%	%	%	% points	%	% points	%	%
RES-H/C	31.3	48.4	41.4	8.9	22.5	1.6	4.0	38.4
RES-E	1.2	12.2	15.7	5.2	74.3	7.6	93.8	17.6
RES-T-10	0.00	0.2	0.2	-0.7	-80.8	-1.5	-90.2	9.6
Overall RES	16.6	25.9	24.8	4.7	22.2	2.8	12.7	25

8. Ireland

Table 8- 1. RES use in Ireland, progress and deviation from NREAPs

	2011	2012	Deviation from NREAP				growth	2012-202	2020
	PR	PR	2011		2012			NREAPs	
	[ktoe]	[ktoe]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]
RES-H/C	218.0	232.0	-35.0	-13.8	-79.0	-25.4	359.0	154.7	591.0
RES-E	423.2	468.5	-183.9	-30.3	-165.3	-26.1	727.5	155.3	1196.0
RES-T-20	97.7	85.7	-71.3	-42.2	-116.2	-57.6	433.2	505.8	518.9
RES	738.9	786.1	-290.2	-28.2	-360.6	-31.4	1519.8	193.3	2306

Table 8- 2. The contribution of different sources of renewable energy in Ireland

	2011	2012	Deviation from NREAP				2020
	PR	PR	2011		2012		NREAP
	[ktoe]	[ktoe]	[ktoe]	%	[ktoe]	%	[ktoe]
Hydropower	64.7	65.3	4.2	7.0	5.0	8.3	60.3
Geothermal	n.r	n.r	n/a	n/a	n/a	n/a	n.r
<i>Geothermal-el</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
<i>Geothermal-th</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Solar	8.14	10.24	3.14	62.8	3.24	46.3	20.0
<i>Solar-el</i>	0.04	0.04	0.04	n/a	0.04	n/a	n.r
<i>Solar-th</i>	8.1	10.2	3.1	62.0	3.2	45.7	20.0
Marine	n.r	n.r	n/a	n/a	n/a	n/a	19.8
Wind	329.4	365.2	-183.5	-35.8	-167.1	-31.4	1029.4
<i>Onshore</i>	n.r	n.r	-502.9	-100.0	-522.3	-100.0	879.6
<i>Offshore</i>	n.r	n.r	-10.0	-100.0	-10.1	-100.0	149.8
Heat pumps	18.0	18.0	-7.0	-28.0	-13.0	-41.9	84.0
Biomass	221.7	241.8	-35.1	-13.7	-72.4	-23.0	572.5
<i>Solid biomass</i>	194.8	215.8	-23.5	-10.8	-56.8	-20.8	512.1
<i>Biogas</i>	26.9	26.0	-11.6	-30.2	-15.6	-37.5	60.4
<i>Bioliquids</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Biofuels	97.1	85.1	-70.8	-42.2	-115.8	-57.7	481.9
<i>Bioethanol</i>	29.0	29.0	-21.0	-42.0	-31.0	-51.7	139.0
<i>Biodiesel</i>	68.0	56.0	-49.0	-41.9	-84.0	-60.0	342.0
Renewable electricity-T	0.5	0.6	-0.5	-47.0	-0.4	-42.0	37.0

Table 8- 3. Current growth in RES share in Ireland and progress until 2020

	2005	2011	2012	Deviation from NREAP				2020
	NREAPs	PR	PR	2011		2012		NREAPs
	%	%	%	% points	%	% points	%	%
RES-H/C	3.5	4.7	5.2	-0.2	-4.1	-0.9	-14.8	12
RES-E	6.9	17.6	19.6	-7.0	-28.5	-5.7	-22.5	42.5
RES-T-10	0.07	7.4	7.6	3.5	89.4	3.0	67.4	9.9
Overall RES	3.1	6.5	7.1	-0.2	-3.0	-0.5	-6.6	16

9. Greece

Table 9- 1. RES use in Greece, progress and deviation from NREAPs

	2011	2012	Deviation from NREAP				growth	2012-202	2020
	PR	PR	2011		2012				NREAPs
	[ktoe]	[ktoe]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]
RES-H/C	1373.8	1492.2	61.8	4.7	134.2	9.9	415.8	27.9	1908.0
RES-E	711.3	850.3	-173.5	-19.6	-194.8	-18.6	1641.4	193.0	2491.7
RES-T-20	23.3	27.2	-191.0	-89.1	-230.8	-89.5	606.8	2230.9	634
RES	2108.4	2369.7	-302.7	-12.6	-291.4	-11.0	2664.0	112.4	5034

Table 9- 2. The contribution of different sources of renewable energy in Greece

	2011	2012	Deviation from NREAP				2020
	PR	PR	2011		2012		NREAP
	[ktoe]	[ktoe]	[ktoe]	%	[ktoe]	%	[ktoe]
Hydropower	353.1	354.8	-82.3	-18.9	-106.1	-23.0	565.5
Geothermal	16.0	13.0	-5.0	-23.8	-8.0	-38.1	114.3
<i>Geothermal-el</i>	n.r	n.r	n/a	n/a	n/a	n/a	63.3
<i>Geothermal-th</i>	16.0	13.0	-5.0	-23.8	-8.0	-38.1	51.0
Solar	235.5	329.7	-31.0	-11.6	39.7	13.7	665.0
<i>Solar-el</i>	52.5	145.7	12.0	29.8	85.7	142.7	310.0
<i>Solar-th</i>	183.0	184.0	-43.0	-19.0	-46.0	-20.0	355.0
Marine	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Wind	288.6	332.8	-98.5	-25.4	-169.2	-33.7	1444.5
<i>Onshore</i>	288.6	332.8	-98.5	-25.4	-169.2	-33.7	1386.8
<i>Offshore</i>	n.r	n.r	n/a	n/a	n/a	n/a	57.8
Heat pumps	82.0	102.0	53.0	182.8	54.0	112.5	279.0
Biomass	1109.9	1210.1	53.0	5.0	130.1	12.0	1330.3
<i>Solid biomass</i>	1078.0	1178.0	36.7	3.5	113.7	10.7	1253.3
<i>Biogas</i>	31.9	32.1	16.3	103.9	16.4	104.2	77.0
<i>Bioliquids</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Biofuels	20.0	24.0	-191.0	-90.5	-230.0	-90.6	617.5
<i>Bioethanol</i>	n.r	n.r	-142.0	-100.0	-171.0	-100.0	414.0
<i>Biodiesel</i>	20.0	24.0	-49.0	-71.0	-59.0	-71.1	203.0
Renewable electricity-T	3.3	3.2	0.0	0.0	-0.8	-20.0	16.5

Table 9- 3. Current growth in RES share in Greece and progress until 2020

	2005	2011	2012	Deviation from NREAP				2020
	NREAPs	PR	PR	2011		2012		NREAPs
	%	%	%	% points	%	% points	%	%
RES-H/C	12.76	20.23	24.23	4.5	28.9	8.0	49.6	19.7
RES-E	8.03	13.82	16.48	-1.9	-12.0	-2.3	-12.3	39.8
RES-T-10	0.02	1.5	2.1	-1.9	-55.9	-2.0	-48.2	10.1
Overall RES	6.96	11.03	13.83	2.2	25.3	4.3	45.6	18

10. Spain

Table 10- 1. RES use in Spain, progress and deviation from NREAPs

	2011	2012	Deviation from NREAP				growth	2012-2020	2020
	PR	PR	2011		2012				NREAPs
	[ktoe]	[ktoe]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]
RES-H/C	4093.0	4144.0	101.0	2.5	110.0	2.7	1213.0	29.3	5357.0
RES-E	7455.4	7856.4	-404.8	-5.2	-483.2	-5.8	4598.5	58.5	12455.0
RES-T-20	108.0	114.0	-2066.4	-95.0	-2217.1	-95.1	3102.0	2721.1	3216
RES	11656.4	12114.4	-2370.2	-16.9	-2590.3	-17.6	8913.5	73.6	21028

Table 10- 2. The contribution of different sources of renewable energy in Spain

	2011	2012	Deviation from NREAP				2020
	PR	PR	2011		2012		NREAP
	[ktoe]	[ktoe]	[ktoe]	%	[ktoe]	%	[ktoe]
Hydropower	2479.6	2373.1	-222.7	-8.2	-295.8	-11.1	2822.0
Geothermal	17.0	18.0	13.2	347.4	14.2	373.7	35.3
<i>Geothermal-el</i>	n.r	n.r	n/a	n/a	n/a	n/a	25.8
<i>Geothermal-th</i>	17.0	18.0	13.2	347.4	14.2	373.7	9.5
Solar	1013.4	1246.7	0.8	0.1	-15.8	-1.3	2942.8
<i>Solar-el</i>	808.4	1026.7	-14.2	-1.7	-37.8	-3.6	2299.2
<i>Solar-th</i>	205.0	220.0	15.0	7.9	22.0	11.1	644.0
Marine	n.r	n.r	n/a	n/a	n/a	n/a	18.9
Wind	3839.4	4090.2	-20.6	-0.5	-2.2	-0.1	6239.8
<i>Onshore</i>	3839.4	4090.2	-20.6	-0.5	-2.2	-0.1	6083.1
<i>Offshore</i>	n.r	n.r	n/a	n/a	n/a	n/a	156.7
Heat pumps	n.r	n.r	-19.7	-100.0	-22.2	-100.0	50.8
Biomass	4199.0	4272.5	-55.4	-1.3	-51.5	-1.2	5702.2
<i>Solid biomass</i>	4074.9	4143.1	-64.4	-1.6	-51.9	-1.2	5378.6
<i>Biogas</i>	124.1	129.5	8.9	7.8	0.4	0.3	323.6
<i>Bioliquids</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Biofuels	n.r	n.r	-2048.0	-100.0	-2159.0	-100.0	2713.4
<i>Bioethanol</i>	n.r	n.r	-232.0	-100.0	-281.0	-100.0	400.0
<i>Biodiesel</i>	n.r	n.r	-1816.0	-100.0	-1878.0	-100.0	2313.0
Renewable electricity-T	108.0	114.0	-18.4	-14.6	-58.1	-33.8	502.6

Table 10- 3. Current growth in RES share in Spain and progress until 2020

	2005	2011	2012	Deviation from NREAP				2020
	NREAPs	PR	PR	2011		2012		NREAPs
	%	%	%	% points	%	% points	%	%
RES-H/C	8.9	13.6	14	2.3	20.4	2.3	19.7	17.3
RES-E	18.4	31.6	33.5	0.6	1.9	1.5	4.7	39
RES-T-10	0.76	0.4	0.4	-6.7	-94.3	-7.2	-94.7	11.3
Overall RES	8.2	13.2	14.3	-1.2	8.3	-0.8	5.3	20.8

11. France

Table 11- 1. RES use in France, progress and deviation from NREAPs

	2011		2012		Deviation from NREAP		growth 2012-2020		2020
	PR	PR	2011	2012					NREAPs
	[ktoe]	[ktoe]	[ktoe]	[ktoe]	[%]	[%]	[ktoe]	[%]	[ktoe]
RES-H/C	10173	11763	-1497	-12.8	-459	-3.8	7969	67.7	19732
RES-E	6959.3	7254.9	-886.7	-11.3	-1013.7	-12.3	6099.5	84.1	13354
RES-T-20	2981	3051	-11	-0.4	-61	-2	1011	33.1	4062
RES	20113.3	22068.9	-2394.7	-10.6	-1533.7	-6.5	15079.5	68.3	37148

Table 11- 2. The contribution of different sources of renewable energy in France

	2011		2012		Deviation from NREAP		2020	
	PR	PR	2011	2012				NREAP
	[ktoe]	[ktoe]	[ktoe]	[ktoe]	%	%	[ktoe]	[ktoe]
Hydropower	5158.9	5117.9	-800.1	-13.4	-864.2	-14.4	6166.4	
Geothermal	93.8	98.4	-97.1	-50.9	-115.4	-54.0	540.9	
<i>Geothermal-el</i>	4.8	4.4	-11.1	-69.7	-14.4	-76.6	40.9	
<i>Geothermal-th</i>	89.0	94.0	-86.0	-49.1	-101.0	-51.8	500.0	
Solar	323.8	515.4	87.3	36.9	214.3	71.1	1519.0	
<i>Solar-el</i>	202.8	382.4	121.3	149.0	266.3	229.3	592.1	
<i>Solar-th</i>	121.0	133.0	-34.0	-21.9	-52.0	-28.1	927.0	
Marine	41.0	39.4	-2.0	-4.6	-9.8	-19.9	98.9	
Wind	1077.7	1220.0	-155.9	-12.6	-324.2	-21.0	4979.4	
<i>Onshore</i>	1077.7	1220.0	-155.9	-12.6	-152.2	-11.1	3431.4	
<i>Offshore</i>	n.r	n.r	n/a	n/a	-172.0	-100.0	1548.0	
Heat pumps	945.0	1227.0	-145.0	-13.3	-73.0	-5.6	1850.0	
Biomass	9491.1	10799.9	-1272.0	-11.8	-300.3	-2.7	17931.7	
<i>Solid biomass</i>	9251.3	10538.5	-1335.5	-12.6	-373.7	-3.4	17058.4	
<i>Biogas</i>	239.8	261.4	63.6	36.1	73.3	39.0	873.3	
<i>Bioliquids</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r	
Biofuels	2785.0	2842.0	-15.0	-0.5	-58.0	-2.0	3660.0	
<i>Bioethanol</i>	392.0	418.0	-158.0	-28.7	-132.0	-24.0	650.0	
<i>Biodiesel</i>	2393.0	2424.0	143.0	6.4	74.0	3.1	2850.0	
Renewable electricity-T	196.0	209.0	4.0	2.1	-3.0	-1.4	402.0	

Table 11- 3. Current growth in RES share in France and progress until 2020

	2005		2011		2012		Deviation from NREAP		2020	
	NREAPs	PR	PR	2011	2012			NREAPs		
	%	%	%	% points	%	% points	%	%	%	
RES-H/C	13.6	15.8	17.2	-2.2	-12.2	-1.8	-9.5	33		
RES-E	13.5	16.4	16.7	0.4	2.5	-0.3	-1.8	27		
RES-T-10	1.21	7.7	7.4	1.1	17.0	0.4	6.4	10.2		
Overall RES	9.6	12.7	13.7	-0.8	-5.9	-0.3	-2.1	23		

12. Italy

Table 12 1. RES use in Italy, progress and deviation from NREAPs

	2011	2012	Deviation from NREAP				growth	2012-202	2020
	PR	PR	2011		2012			NREAPs	
	[ktoe]	[ktoe]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]
RES-H/C	7217.0	7387.0	3021.0	72.0	2804.0	61.2	3069.0	41.5	10456.0
RES-E	6091.6	7353.1	53.3	0.9	1074.6	17.1	1151.0	15.7	8504.1
RES-T-20	1575.0	1551.0	209.0	15.3	20.0	1.3	1348.0	86.9	2899
RES	14883.6	16291.1	3283.3	28.3	3898.6	31.5	5568.0	34.2	21859

Table 12 2. The contribution of different sources of renewable energy in Italy

	2011	2012	Deviation from NREAP				2020
	PR	PR	2011		2012		NREAP
	[ktoe]	[ktoe]	[ktoe]	%	[ktoe]	%	[ktoe]
Hydropower	2862.4	3122.1	-760.4	-21.0	-499.6	-13.8	3612.0
Geothermal	625.2	614.9	-100.7	-13.9	-127.7	-17.2	880.5
<i>Geothermal-el</i>	486.2	480.9	-7.7	-1.6	-22.7	-4.5	580.5
<i>Geothermal-th</i>	139.0	134.0	-93.0	-40.1	-105.0	-43.9	300.0
Solar	1068.5	1777.1	634.3	146.1	1236.9	229.0	2561.9
<i>Solar-el</i>	928.5	1622.1	642.3	224.5	1273.9	365.8	976.1
<i>Solar-th</i>	140.0	155.0	-8.0	-5.4	-37.0	-19.3	1586.0
Marine	n.r.	n.r.	n/a	n/a	n/a	n/a	0.4
Wind	882.9	1066.6	78.1	9.7	179.2	20.2	1720.0
<i>Onshore</i>	882.9	1066.6	78.1	9.7	179.2	20.2	1548.0
<i>Offshore</i>	n.r.	n.r.	n/a	n/a	n/a	n/a	172.0
Heat pumps	2457.0	2613.0	1089.0	79.6	1141.0	77.5	2900.0
Biomass	5412.6	5546.4	2133.1	65.0	1949.7	54.2	7285.1
<i>Solid biomass</i>	4536.8	4689.1	1694.6	59.6	1601.9	51.9	5933.4
<i>Biogas</i>	622.8	580.3	373.3	149.6	289.3	99.4	783.7
<i>Bioliquids</i>	254.0	277.0	66.2	35.2	58.5	26.8	568.0
Biofuels	1400.0	1365.0	229.0	19.6	43.0	3.3	2530.0
<i>Bioethanol</i>	114.0	103.0	-79.0	-40.9	-135.0	-56.7	600.0
<i>Biodiesel</i>	1286.0	1262.0	317.0	32.7	192.0	17.9	1880.0
Renewable electricity-T	175.0	186.0	-20.0	-10.3	-23.0	-11.0	369.0

Table 12 3. Current growth in RES share in Italy and progress until 2020

	2005	2011	2012	Deviation from NREAP				2020
	NREAPs	PR	PR	2011		2012		NREAPs
	%	%	%	% points	%	% points	%	%
RES-H/C	2.8	12.49	12.81	5.4	76.2	5.1	66.1	17.09
RES-E	16.29	23.55	27.42	4.0	20.3	7.2	35.7	26.39
RES-T-10	0.87	4.9	7.2	0.8	19.2	2.4	51.7	10.1
Overall RES	4.91	12.27	13.53	3.6	41.8	4.3	46.6	17

13. Cyprus

Table 13- 1. RES use in Cyprus, progress and deviation from NREAPs

	2011	2012	Deviation from NREAP				growth	2012-2020	2020
	PR	PR	2011		2012			NREAPs	
	[ktoe]	[ktoe]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]
RES-H/C	83.6	81.5	2.3	2.8	-4.3	-5.0	42.1	51.6	123.6
RES-E	15.2	22.0	-6.4	-29.7	-0.1	-0.7	79.0	358.5	101.1
RES-T-20	16.0	17.0	-0.8	-5.0	-1.2	-6.6	21.4	125.9	38.4
RES	114.8	120.6	-5.0	-4.2	-5.6	-4.4	142.5	118.2	263

Table 13- 2. The contribution of different sources of renewable energy in Cyprus

	2011	2012	Deviation from NREAP				2020
	PR	PR	2011		2012		NREAP
	[ktoe]	[ktoe]	[ktoe]	%	[ktoe]	%	[ktoe]
Hydropower	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Geothermal	n.r	n.r	n/a	n/a	n/a	n/a	n.r
<i>Geothermal-el</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
<i>Geothermal-th</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Solar	64.0	66.3	1.4	2.2	0.1	0.2	136.3
<i>Solar-el</i>	1.0	1.8	-0.1	-8.5	0.2	12.8	45.8
<i>Solar-th</i>	63.0	64.5	1.5	2.4	-0.1	-0.1	90.5
Marine	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Wind	9.8	15.9	-6.5	-39.8	-0.4	-2.3	42.9
<i>Onshore</i>	9.8	15.9	-6.5	-39.8	-0.4	-2.3	42.9
<i>Offshore</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Heat pumps	1.1	1.1	0.5	81.0	0.2	28.0	3.0
Biomass	24.0	20.3	0.4	1.9	-4.3	-17.6	42.5
<i>Solid biomass</i>	15.3	11.7	-1.5	-8.8	-5.7	-32.7	24.2
<i>Biogas</i>	8.6	8.6	1.8	26.8	1.3	18.1	18.3
<i>Bioliquids</i>	0.1	0.02	0.1	n/a	0.02	n/a	n.r
Biofuels	16.0	17.0	-0.8	-4.7	-1.1	-6.1	37.8
<i>Bioethanol</i>	n.r	n.r	n/a	n/a	n/a	n/a	14.7
<i>Biodiesel</i>	16.0	17.0	-0.8	-4.7	-1.1	-6.1	23.2
Renewable electricity-T	n.r	n.r	-0.1	-100.0	-0.1	-100.0	0.6

Table 13- 3. Current growth in RES share in Cyprus and progress until 2020

	2005	2011	2012	Deviation from NREAP				2020
	NREAPs	PR	PR	2011		2012		NREAPs
	%	%	%	% points	%	% points	%	%
RES-H/C	9.1	18.9	21.5	2.0	11.8	3.7	20.8	23.5
RES-E	n/a	3.9	5.9	-0.5	-11.4	1.5	34.1	16
RES-T-10	n/a	2.1	2.4	-0.3	-12.2	-0.2	-7.3	10.0
Overall RES	2.9	6.51	7.7	-0.3	-4.3	0.6	8.5	13

14. Latvia

Table 14- 1. RES use in Latvia, progress and deviation from NREAPs

	2011	2012	Deviation from NREAP				growth	2012-202	2020
	PR	PR	2011		2012				NREAPs
	[ktoe]	[ktoe]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]
RES-H/C	1059.2	1187.5	-7.8	-0.7	64.5	5.7	208.5	17.6	1396.0
RES-E	282.5	303.7	6.3	2.3	17.6	6.1	142.8	47.0	446.4
RES-T-20	29.1	26.2	-14.9	-33.9	-19.8	-43.0	56.8	216.8	83
RES	1370.8	1517.4	-16.4	-1.2	62.3	4.3	408.1	26.9	1925

Table 14- 2. The contribution of different sources of renewable energy in Latvia

	2011	2012	Deviation from NREAP				2020
	PR	PR	2011		2012		NREAP
	[ktoe]	[ktoe]	[ktoe]	%	[ktoe]	%	[ktoe]
Hydropower	266.7	270.4	10.0	3.9	13.2	5.1	262.4
Geothermal	n.r	n.r	n/a	n/a	n/a	n/a	n.r
<i>Geothermal-el</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
<i>Geothermal-th</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Solar	n.r	n.r	n/a	n/a	-0.1	-100.0	2.3
<i>Solar-el</i>	n.r	n.r	n/a	n/a	-0.1	-100.0	0.3
<i>Solar-th</i>	n.r	n.r	n/a	n/a	n/a	n/a	2.0
Marine	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Wind	5.6	8.5	-0.7	-11.5	-0.1	-1.6	78.3
<i>Onshore</i>	5.6	8.5	-0.7	-11.5	-0.1	-1.6	44.6
<i>Offshore</i>	n.r	n.r	n/a	n/a	n/a	n/a	33.6
Heat pumps	n.r	n.r	n/a	n/a	n/a	n/a	4.0
Biomass	1069.5	1212.3	-10.8	-1.0	69.1	6.0	1497.4
<i>Solid biomass</i>	1049.8	1172.9	-5.3	-0.5	65.7	5.9	1398.2
<i>Biogas</i>	16.8	37.0	-8.4	-33.4	1.0	2.8	99.2
<i>Bioliquids</i>	2.9	2.4	2.9	n/a	2.4	n/a	n.r
Biofuels	24.6	21.5	-16.4	-40.0	-21.5	-50.0	77.0
<i>Bioethanol</i>	7.7	6.4	-8.3	-51.9	-10.6	-62.4	18.0
<i>Biodiesel</i>	16.9	15.1	-8.1	-32.4	-9.9	-39.6	28.0
Renewable electricity-T	4.5	4.7	1.5	50.0	1.7	56.7	6.0

Table 14- 3. Current growth in RES share in Latvia and progress until 2020

	2005	2011	2012	Deviation from NREAP				2020
	NREAPs	PR	PR	2011		2012		NREAPs
	%	%	%	% points	%	% points	%	%
RES-H/C	42.7	44.83	47.39	-1.9	-4.0	-0.2	-0.4	53.4
RES-E	44.9	44.7	44.88	-1.6	-3.5	-2.1	-4.5	59.8
RES-T-10	0.87	3.6	3.5	-0.5	-11.1	-0.7	-15.7	10.0
Overall RES	32.6	33.55	35.78	-0.3	-0.7	1.5	4.3	40

15. Lithuania

Table 15- 1. RES use in Lithuania, progress and deviation from NREAPs

	2011	2012	Deviation from NREAP				growth	2012-2020	2020
	PR	PR	2011		2012				NREAPs
	[ktoe]	[ktoe]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]
RES-H/C	873.0	937.0	159.0	22.3	189.0	25.3	114.0	12.2	1051.0
RES-E	84.8	103.8	-10.6	-11.1	-5.2	-4.8	150.6	145.1	254.4
RES-T-20	45.0	61.0	-12.8	-22.1	-14.8	-19.5	108.5	177.9	169.5
RES	1002.8	1101.8	135.6	15.6	169.0	18.1	373.1	33.9	1475

Table 15- 2. The contribution of different sources of renewable energy in Lithuania

	2011	2012	Deviation from NREAP				2020
	PR	PR	2011		2012		NREAP
	[ktoe]	[ktoe]	[ktoe]	%	[ktoe]	%	[ktoe]
Hydropower	36.0	36.6	-1.1	-3.0	-0.7	-1.8	40.4
Geothermal	2.0	2.0	-1.0	n/a	-1.0	n/a	5.0
<i>Geothermal-el</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
<i>Geothermal-th</i>	2.0	2.0	-1.0	n/a	-1.0	n/a	5.0
Solar	n.r	0.2	-1.2	n/a	-2.1	-92.4	10.3
<i>Solar-el</i>	n.r	0.2	-0.2	-100.0	-0.1	-33.3	1.3
<i>Solar-th</i>	n.r	n.r	-1.0	n/a	-2.0		9.0
Marine	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Wind	35.2	48.3	-5.5	-13.5	-0.1	-0.2	107.5
<i>Onshore</i>	n.r	n.r	-40.7	-100.0	-48.4	-100.0	107.5
<i>Offshore</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Heat pumps	n.r	n.r	-3.0		-4.0		14.0
Biomass	884.6	953.7	160.2	22.1	191.6	25.1	1128.2
<i>Solid biomass</i>	877.4	946.1	171.5	24.3	206.3	27.9	1042.7
<i>Biogas</i>	7.2	7.6	-11.3	-61.1	-14.7	-65.8	85.5
<i>Bioliquids</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Biofuels	45.0	61.0	-12.0	-21.1	-14.0	-18.7	167.0
<i>Bioethanol</i>	10.0	9.0	-4.0	-28.6	-13.0	-59.1	36.0
<i>Biodiesel</i>	35.0	52.0	-8.0	-18.6	-1.0	-1.9	131.0
Renewable electricity-T	n.r	n.r	-0.8	-100.0	-0.8	-100.0	2.5

Table 15- 3. Current growth in RES share in Lithuania and progress until 2020

	2005	2011	2012	Deviation from NREAP				2020
	NREAPs	PR	PR	2011		2012		NREAPs
	%	%	%	% points	%	% points	%	%
RES-H/C	27	33.68	35.41	4.7	16.1	5.4	18.0	39
RES-E	4	9	10.9	-1.0	-10.0	-0.1	-0.9	21
RES-T-10	0.32	7.4	9.6	3.2	75.1	4.2	77.9	9.8
Overall RES	15	20.23	21.72	3.2	19.0	3.7	20.7	24

16. Luxembourg

Table 16- 1. RES use in Luxembourg, progress and deviation from NREAPs

	2011		2012		Deviation from NREAP				growth 2012-2020		2020
	PR	PR	2011	2012					NREAPs		
	[ktoe]	[ktoe]	[ktoe]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]	
RES-H/C	53.9	57.4	26.1	93.9	23.8	70.8	50.4	87.8	107.8		
RES-E	25.0	26.3	0.8	3.2	-3.4	-11.3	40.9	155.2	67.2		
RES-T-20	48.0	49.0	21.6	81.8	10.8	28.3	177.1	361.4	226.1		
RES	126.9	132.7	48.5	61.8	31.2	30.8	268.4	202.2	401		

Table 16- 2. The contribution of different sources of renewable energy in Luxembourg

	2011		2012		Deviation from NREAP				2020
	PR	PR	2011	2012					NREAP
	[ktoe]	[ktoe]	[ktoe]	[ktoe]	%	[ktoe]	%	[ktoe]	
Hydropower	8.8	8.9	-0.3	-3.8	-0.3	-2.8	10.7		
Geothermal	n.r	n.r	n/a	n/a	n/a	n/a	n.r		
<i>Geothermal-el</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r		
<i>Geothermal-th</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r		
Solar	3.2	5.0	0.6	23.5	1.4	38.2	15.3		
<i>Solar-el</i>	2.2	3.3	0.5	30.0	0.8	31.0	7.2		
<i>Solar-th</i>	1.0	1.7	0.1	11.1	0.6	54.5	8.1		
Marine	n.r	n.r	n/a	n/a	n/a	n/a	n.r		
Wind	5.8	6.4	-0.3	-5.6	-2.1	-24.5	20.6		
<i>Onshore</i>	5.8	6.4	-0.3	-5.6	-2.1	-24.5	20.6		
<i>Offshore</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r		
Heat pumps	1.2	1.2	-0.5	-29.4	-0.9	-42.9	16.9		
Biomass	60.0	62.3	27.4	84.4	22.2	55.3	111.6		
<i>Solid biomass</i>	49.0	50.6	25.6	109.3	22.7	81.5	85.8		
<i>Biogas</i>	11.0	11.7	1.9	20.6	-0.5	-4.3	25.8		
<i>Bioliquids</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r		
Biofuels	46.0	47.0	21.8	90.1	11.3	31.7	215.7		
<i>Bioethanol</i>	7.0	1.0	4.3	159.3	-3.0	-75.0	23.1		
<i>Biodiesel</i>	39.0	46.0	17.5	81.4	14.3	45.1	192.7		
Renewable electricity-T	2.0	2.0	-0.2	-9.1	-0.5	-20.0	10.4		

Table 16- 3. Current growth in RES share in Luxembourg and progress until 2020

	2005		2011		2012		Deviation from NREAP				2020
	NREAPs	PR	PR	2011	2012					NREAPs	
	%	%	%	% points	%	% points	%	%	%		
RES-H/C	1.7	4.8	4.99	2.5	108.7	2.3	84.8	8.5			
RES-E	3.2	4.07	4.64	-0.3	-7.5	-0.8	-14.1	11.8			
RES-T-10	0.16	2.1	2.2	0.8	63.0	0.4	23.6	10.0			
Overall RES	0.9	2.87	3.13	0.0	-1.0	0.2	7.9	11			

17. Croatia

Table 17- 1. RES use in Croatia, progress and deviation from NREAPs

	2011	2012	growth	2012-2020	2020
	PR	PR			NREAPs
	[ktoe]	[ktoe]	[ktoe]	[%]	[ktoe]
RES-H/C	371.6	392.9	212.5	54.1	605.4
RES-E	542.0	547.9	173.5	31.7	721.4
RES-T-20	26.9	42.1	119.5	283.8	161.6
RES	940.5	982.9	505.5	51.4	1488

Table 17- 2. The contribution of different sources of renewable energy in Croatia

	2011	2012	2020
	PR	PR	NREAP
	[ktoe]	[ktoe]	[ktoe]
Hydropower	513.4	512.8	574.4
Geothermal	6.2	7.4	21.9
<i>Geothermal-el</i>	n.r	n.r	6.2
<i>Geothermal-th</i>	6.2	7.4	15.7
Solar	7.7	10.2	102.4
<i>Solar-el</i>	1.0	0.6	5.1
<i>Solar-th</i>	6.7	9.6	97.3
Marine	n.r	n.r	n.r
Wind	24.7	29.9	75.7
<i>Onshore</i>	24.7	29.9	75.7
<i>Offshore</i>	n.r	n.r	n.r
Heat pumps	21.4	26.4	95.6
Biomass	340.1	354.0	456.8
<i>Solid biomass</i>	336.6	348.4	428.4
<i>Biogas</i>	3.5	5.6	28.4
<i>Bioliquids</i>	n.r	n.r	n.r
Biofuels	17.4	32.1	143.0
<i>Bioethanol</i>	n.r	n.r	16.3
<i>Biodiesel</i>	17.4	32.1	121.6
Renewable electricity-T	9.5	10.0	18.6

Table 17- 3. Current growth in RES share in Croatia and progress until 2020

	2005	2011	2012	2020	Deviation from NREAP			
	NREAPs	PR	PR	NREAPs	2011	2012		
	%	%	%	%	% points	%	% points	%
RES-H/C	11	12.8	13.5	19.6	0.0	0.0	0.0	0.0
RES-E	33.3	34.5	35.6	39	0.0	0.0	0.0	0.0
RES-T-10	0.47	1.4	2.2	12.5	-0.1	-6.1	-0.1	-5.7
Overall RES	12.8	14.2	15.1	20.1	0.0	0.0	0.0	0.0

18. Hungary

Table 18- 1. RES use in Hungary, progress and deviation from NREAPs

	2011	2012	Deviation from NREAP				growth 2012-2020		2020
	PR	PR	2011		2012				NREAPs
	[ktoe]	[ktoe]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]
RES-H/C	1133.0	1116.0	192.0	20.4	172.0	18.2	747.0	66.9	1863.0
RES-E	232.8	222.2	-13.2	-5.4	-46.6	-17.3	259.1	116.6	481.3
RES-T-20	180.0	154.0	-20.0	-10.0	-72.0	-31.9	381.0	247.4	535
RES	1545.8	1492.2	158.8	11.4	53.4	3.7	1387.1	93.0	2879

Table 18- 2. The contribution of different sources of renewable energy in Hungary

	2011	2012	Deviation from NREAP				2020
	PR	PR	2011		2012		NREAP
	[ktoe]	[ktoe]	[ktoe]	%	[ktoe]	%	[ktoe]
Hydropower	18.6	18.8	2.0	11.9	2.2	13.5	20.4
Geothermal	104.0	107.0	-4.0	-3.7	-13.0	-10.8	392.3
<i>Geothermal-el</i>	n.r	n.r	n/a	n/a	n/a	n/a	35.3
<i>Geothermal-th</i>	104.0	107.0	-4.0	-3.7	-13.0	-10.8	357.0
Solar	6.2	6.7	-3.3	-34.5	-8.1	-54.7	89.0
<i>Solar-el</i>	0.2	0.7	-0.3	-60.0	-0.1	-11.1	7.0
<i>Solar-th</i>	6.0	6.0	-3.0	-33.3	-8.0	-57.1	82.0
Marine	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Wind	55.5	60.3	-4.0	-6.8	-19.6	-24.5	132.9
<i>Onshore</i>	55.5	60.3	-4.0	-6.8	-19.6	-24.5	132.9
<i>Offshore</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Heat pumps	n.r	n.r	-6.0	-100.0	-8.0	-100.0	143.0
Biomass	1181.6	1145.4	195.1	19.8	171.8	17.7	1566.9
<i>Solid biomass</i>	1153.4	1107.2	199.6	20.9	168.4	17.9	1456.2
<i>Biogas</i>	28.2	38.2	-4.5	-13.8	3.5	10.0	110.7
<i>Bioliquids</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Biofuels	162.0	137.0	-31.0	-16.1	-80.0	-36.9	511.0
<i>Bioethanol</i>	46.0	34.0	-25.0	-35.2	-48.0	-58.5	304.0
<i>Biodiesel</i>	116.0	103.0	-6.0	-4.9	-32.0	-23.7	202.0
Renewable electricity-T	18.0	17.0	11.0	157.1	8.0	88.9	24.0

Table 18- 3. Current growth in RES share in Hungary and progress until 2020

	2005	2011	2012	Deviation from NREAP				2020
	NREAPs	PR	PR	2011		2012		NREAPs
	%	%	%	% points	%	% points	%	%
RES-H/C	5.4	12.28	13.54	3.5	39.5	4.9	57.4	18.9
RES-E	4.3	6.35	6.1	-0.2	-2.3	-0.8	-11.6	10.9
RES-T-10	0.13	5.6	5.0	0.6	11.3	-0.4	-7.2	10.6
Overall RES	4.2	9.06	9.6	1.8	24.1	2.2	29.7	14.65

19. Malta

Table 19- 1. RES use in Malta, progress and deviation from NREAPs

	2011	2012	Deviation from NREAP				growth 2012-2020		2020
	PR	PR	2011		2012				NREAPs
	[ktoe]	[ktoe]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]
RES-H/C	3.8	6.7	-0.7	-16.2	1.8	35.9	-0.5	-7.5	6.2
RES-E	1.2	1.4	0.4	49.3	-0.2	-11.0	38.9	2719.3	40.3
RES-T-20	1.3	3.0	-2.1	-61.1	-0.8	-20.5	10.5	346.2	13.52
RES	6.4	11.2	-2.4	-27.5	0.8	7.9	48.9	438.0	60

Table 19- 2. The contribution of different sources of renewable energy in Malta

	2011	2012	Deviation from NREAP				2020
	PR	PR	2011		2012		NREAP
	[ktoe]	[ktoe]	[ktoe]	%	[ktoe]	%	[ktoe]
Hydropower	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Geothermal	n.r	n.r	n/a	n/a	n/a	n/a	n.r
<i>Geothermal-el</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
<i>Geothermal-th</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Solar	3.9	5.0	0.7	22.4	0.9	22.4	6.4
<i>Solar-el</i>	1.1	1.2	0.5	76.5	-0.2	-16.8	3.7
<i>Solar-th</i>	2.9	3.9	0.3	9.9	1.2	42.6	2.8
Marine	n.r	n.r	n/a	n/a	n/a	n/a	0.0
Wind	n.r	n.r	-0.01	-100.0	-0.01	-100.0	21.9
<i>Onshore</i>	n.r	n.r	n/a	-100.0	0.0	-100.0	3.3
<i>Offshore</i>	n.r	n.r	n/a	n/a	n/a	n/a	18.6
Heat pumps	n.r	1.8	n/a	n/a	1.8	n/a	n.r
Biomass	1.1	1.3	-1.1	-49.3	-1.1	-45.1	16.5
<i>Solid biomass</i>	0.7	0.7	0.6	655.8	0.6	655.8	7.4
<i>Biogas</i>	0.4	0.7	-1.6	-78.6	-1.6	-71.1	9.1
<i>Bioliquids</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Biofuels	1.3	3.0	-2.1	-61.1	-0.8	-20.3	12.8
<i>Bioethanol</i>	n.r	n.r	-2.1	-100.0	-2.5	-100.0	5.8
<i>Biodiesel</i>	1.3	3.0	0.1	5.6	1.8	138.6	7.0
Renewable electricity-T	n.r	n.r	n/a	n/a	n/a	n/a	0.7

Table 19- 3. Current growth in RES share in Malta and progress until 2020

	2005	2011	2012	Deviation from NREAP				2020
	NREAPs	PR	PR	2011		2012		NREAPs
	%	%	%	% points	%	% points	%	%
RES-H/C	0	5.76	12.47	-2.6	-31.4	3.7	41.7	6.2
RES-E	0	0.64	0.99	-0.5	-41.8	-0.5	-34.0	13.8
RES-T-10	0.00	2.1	7.7	-0.9	-29.2	4.4	133.4	10.7
Overall RES	0	1.33	2.7	-1.0	-42.2	0.1	3.8	10.2

20. The Netherlands

Table 20- 1. RES use in the Netherlands, progress and deviation from NREAPs

	2011		2012		Deviation from NREAP		growth 2012-2020		2020
	PR	PR	2011	2012					NREAPs
	[ktoe]	[ktoe]	[ktoe]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]	[%]
RES-H/C	876.0	940.0	-111.0	-11.2	-136.0	-12.6	1239.0	131.8	2179.0
RES-E	1031.7	1077.8	50.7	5.2	-278.6	-20.5	3249.3	301.5	4327.1
RES-T-20	349.0	348.0	-81.0	-18.8	-110.0	-24.0	557.0	160.1	905
RES	2256.7	2365.8	-141.3	-5.9	-524.6	-18.1	5045.3	213.3	7411

Table 20- 2. The contribution of different sources of renewable energy in the Netherlands

	2011		2012		Deviation from NREAP		2020	
	PR	PR	2011	2012				NREAP
	[ktoe]	[ktoe]	[ktoe]	[ktoe]	%	%	[ktoe]	[ktoe]
Hydropower	8.6	8.6	-4.4	-33.8	-7.0	-44.8	15.8	
Geothermal	8.0	12.0	-49.0	-86.0	-63.0	-84.0	259.0	
<i>Geothermal-el</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r	
<i>Geothermal-th</i>	8.0	12.0	-49.0	-86.0	-63.0	-84.0	259.0	
Solar	33.6	47.8	5.7	20.2	17.5	57.6	72.0	
<i>Solar-el</i>	8.6	21.8	-0.3	-3.8	10.5	92.4	49.0	
<i>Solar-th</i>	25.0	26.0	6.0	31.6	7.0	36.8	23.0	
Marine	n.r	n.r	n/a	n/a	n/a	n/a	44.2	
Wind	406.4	424.8	21.8	5.7	-140.8	-24.9	2787.1	
<i>Onshore</i>	342.5	357.4	26.9	8.5	-139.1	-28.0	1150.0	
<i>Offshore</i>	63.9	67.3	-5.2	-7.5	-1.8	-2.6	1637.1	
Heat pumps	115.0	131.0	-41.0	-26.3	-49.0	-27.2	377.0	
Biomass	1336.1	1393.6	7.6	0.6	-171.3	-10.9	2951.0	
<i>Solid biomass</i>	1128.9	1173.8	66.6	6.3	-68.0	-5.5	1679.9	
<i>Biogas</i>	207.2	218.7	-8.0	-3.7	-24.4	-10.0	689.1	
<i>Bioliquids</i>	n.r	n.r	-51.0	-100.0	-80.0	-100.0	582.0	
Biofuels	321.0	318.0	-95.0	-22.8	-124.0	-28.1	834.0	
<i>Bioethanol</i>	149.0	124.0	-57.0	-27.7	-78.0	-38.6	282.0	
<i>Biodiesel</i>	172.0	194.0	-38.0	-18.1	-46.0	-19.2	552.0	
Renewable electricity-T	28.0	30.0	14.0	100.0	14.0	87.5	71.0	

Table 20- 3. Current growth in RES share in the Netherlands and progress until 2020

	2005		2011		2012		Deviation from NREAP		2020	
	NREAPs	PR	PR	2011	2012			NREAPs		
	%	%	%	% points	%	% points	%	%	%	
RES-H/C	2.5	3.3	3.4	-0.7	-17.5	-1.0	-22.7	8.7		
RES-E	6	9.8	10.5	0.7	7.7	-2.0	-16.0	37		
RES-T-10	0.07	6.8	7.8	2.6	60.3	3.2	71.1	10.3		
Overall RES	2.5	4.3	4.5	-0.3	-6.5	-1.1	-19.6	14.5		

21. Austria

Table 21- 1. RES use in Austria, progress and deviation from NREAPs

	2011		2012		Deviation from NREAP		growth		2012-202	2020
	PR	PR	2011		2012				NREAPs	
	[ktoe]	[ktoe]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]	
RES-H/C	4208.0	4434.0	531.0	14.4	731.0	19.7	-256.0	-5.8	4178.0	
RES-E	3597.4	3685.4	-353.8	-9.0	-313.0	-7.8	819.1	22.2	4504.5	
RES-T-20	574.0	588.0	0.0	0.0	6.0	1.0	268.0	45.6	856	
RES	8379.4	8707.4	177.2	2.2	424.0	5.1	831.1	9.5	9539	

Table 21- 2. The contribution of different sources of renewable energy in Austria

	2011		2012		Deviation from NREAP		2020	
	PR	PR	2011		2012		NREAP	
	[ktoe]	[ktoe]	[ktoe]	%	[ktoe]	%	[ktoe]	
Hydropower	3013.7	3049.7	-310.1	-9.3	-285.6	-8.6	3621.6	
Geothermal	20.1	22.1	-0.1	-0.4	-0.1	-0.4	40.2	
<i>Geothermal-el</i>	0.1	0.1	-0.1	-50.0	-0.1	-50.0	0.2	
<i>Geothermal-th</i>	20.0	22.0	0.0	0.0	0.0	0.0	40.0	
Solar	182.0	202.0	37.5	25.9	47.2	30.5	295.3	
<i>Solar-el</i>	15.0	29.0	6.5	75.8	19.2	195.6	26.3	
<i>Solar-th</i>	167.0	173.0	31.0	22.8	28.0	19.3	269.0	
Marine	n.r	n.r	n/a	n/a	n/a	n/a	n.r	
Wind	179.7	207.4	-31.9	-15.1	-37.2	-15.2	413.7	
<i>Onshore</i>	179.7	207.4	-31.9	-15.1	-37.2	-15.2	413.7	
<i>Offshore</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r	
Heat pumps	133.0	145.0	33.0	33.0	38.0	35.5	262.0	
Biomass	4277.0	4493.2	448.9	11.7	655.7	17.1	4049.6	
<i>Solid biomass</i>	4191.2	4392.3	429.0	11.4	621.9	16.5	3980.6	
<i>Biogas</i>	85.8	101.0	22.9	36.5	36.9	57.6	66.0	
<i>Bioliquids</i>	n.r	n.r	-3.1	-100.0	-3.1	-100.0	3.1	
Biofuels	399.0	415.0	0.0	0.0	9.0	2.2	584.0	
<i>Bioethanol</i>	66.0	67.0	11.0	20.0	11.0	19.6	80.0	
<i>Biodiesel</i>	333.0	348.0	53.0	18.9	63.0	22.1	410.0	
Renewable electricity-T	175.0	173.0	0.0	0.0	-3.0	-1.7	272.0	

Table 21- 3. Current growth in RES share in Austria and progress until 2020

	2005		2011		2012		Deviation from NREAP		2020	
	NREAPs	PR	PR	2011		2012		NREAPs		
	%	%	%	% points	%	% points	%	%		
RES-H/C	20.2	45.5	45	15.2	50.2	14.6	48.0	32.6		
RES-E	59.8	64.5	65.3	-9.2	-12.5	-8.8	-11.9	70.6		
RES-T-10	2.29	6.7	7.0	-0.2	-2.9	0.0	0.1	11.4		
Overall RES	23.3	30.7	32.2	-0.7	-2.2	0.6	1.9	34.2		

22. Poland

Table 22- 1. RES use in Poland, progress and deviation from NREAPs

	2011		2012		Deviation from NREAP		growth		2012-2020	2020
	PR	PR	2011	2012					NREAPs	
	[ktoe]	[ktoe]	[ktoe]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]
RES-H/C	4888.8	5033.7	815.8	20.0	858.7	20.6	887.3	17.6	5921.0	
RES-E	1105.8	1457.9	15.5	1.4	181.9	14.3	1281.2	87.9	2739.1	
RES-T-20	768.1	843.8	-302.9	-28.3	-318.2	-27.4	1162.2	137.7	2006	
RES	6762.8	7335.4	528.4	8.5	722.4	10.9	3330.7	45.4	10666	

Table 22- 2. The contribution of different sources of renewable energy in Poland

	2011		2012		Deviation from NREAP		2020	
	PR	PR	2011	2012			NREAP	
	[ktoe]	[ktoe]	[ktoe]	[ktoe]	%	%	[ktoe]	
Hydropower	201.0	201.8	2.2	1.1	0.3	0.2	255.3	
Geothermal	12.7	15.8	-11.3	-47.1	-13.2	-45.5	178.0	
<i>Geothermal-el</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r	
<i>Geothermal-th</i>	12.7	15.8	-11.3	-47.1	-13.2	-45.5	178.0	
Solar	10.4	13.1	-34.8	-76.9	-70.1	-84.3	506.3	
<i>Solar-el</i>	0.02	0.1	-0.2	-90.0	-0.1	-45.0	0.3	
<i>Solar-th</i>	10.4	13.0	-34.6	-76.9	-70.0	-84.3	506.0	
Marine	n.r	n.r	n/a	n/a	n/a	n/a	n.r	
Wind	251.3	387.9	-28.6	-10.2	18.1	4.9	1260.8	
<i>Onshore</i>	251.3	387.9	-28.6	-10.2	18.1	4.9	1131.8	
<i>Offshore</i>	n.r	n.r	n/a	n/a	n/a	n/a	129.0	
Heat pumps	5.7	6.4	-29.3	-83.7	-35.6	-84.8	148.0	
Biomass	5513.6	5866.6	933.1	20.4	1141.1	24.1	6311.7	
<i>Solid biomass</i>	5401.9	5732.7	954.7	21.5	1180.5	25.9	5513.2	
<i>Biogas</i>	111.7	133.9	-21.6	-16.2	-39.4	-22.7	798.5	
<i>Bioliquids</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r	
Biofuels	714.4	789.5	-339.6	-32.2	-353.5	-30.9	1968.0	
<i>Bioethanol</i>	178.8	153.9	-120.2	-40.2	-154.1	-50.0	451.0	
<i>Biodiesel</i>	535.6	635.6	-219.4	-29.1	-199.4	-23.9	1451.0	
Renewable electricity-T	53.7	54.2	36.7	216.1	35.2	185.4	38.0	

Table 22- 3. Current growth in RES share in Poland and progress until 2020

	2005		2011		2012		Deviation from NREAP		2020	
	NREAPs	PR	PR	2011	2012			NREAPs		
	%	%	%	% points	%	% points	%	%		
RES-H/C	0	13.38	13.66	0.8	6.7	0.9	6.9	17.05		
RES-E	0	8.15	10.68	-0.7	-7.9	0.5	4.8	19.13		
RES-T-10	0.44	8.9	7.0	2.3	35.6	-0.2	-3.4	11.4		
Overall RES	0	10.42	11.04	0.3	2.6	0.3	2.8	15.85		

23. Portugal

Table 23- 1. RES use in Portugal, progress and deviation from NREAPs

	2011	2012	Deviation from NREAP				growth	2012-202	2020
	PR	PR	2011		2012				NREAPs
	[ktoe]	[ktoe]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]
RES-H/C	2209.8	1905.5	-128.2	-5.5	-532.5	-21.8	601.5	31.6	2507.0
RES-E	2148.7	1776.2	50.2	2.4	-557.2	-23.9	1284.1	72.3	3060.3
RES-T-20	17.6	18.8	-288.4	-94.2	-290.2	-93.9	516.2	2745.7	535
RES	4376.1	3700.5	-366.4	-7.7	-1379.9	-27.2	2401.8	64.9	6102

Table 23- 2. The contribution of different sources of renewable energy in Portugal

	2011	2012	Deviation from NREAP				2020
	PR	PR	2011		2012		NREAP
	[ktoe]	[ktoe]	[ktoe]	%	[ktoe]	%	[ktoe]
Hydropower	1041.8	572.8	195.9	23.2	-360.6	-38.6	1210.3
Geothermal	19.7	14.2	-6.4	-24.4	-13.9	-49.5	67.0
<i>Geothermal-el</i>	18.1	12.6	4.0		-1.5		42.0
<i>Geothermal-th</i>	1.6	1.6	-10.4	-86.7	-12.4	-88.6	25.0
Solar	83.6	101.2	-11.5	-12.1	-15.8	-13.5	372.8
<i>Solar-el</i>	24.1	33.8	-10.0	-29.3	-11.2	-24.9	212.9
<i>Solar-th</i>	59.5	67.4	-1.5	-2.5	-4.6	-6.4	160.0
Marine	n.r	0.0003	-0.2	-100.0	-0.3	-99.9	37.6
Wind	787.9	882.4	-186.8	-19.2	-201.2	-18.6	1255.3
<i>Onshore</i>	787.9	882.4	-186.8	-19.2	-201.2	-18.6	1239.8
<i>Offshore</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Heat pumps	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Biomass	2425.5	2111.3	-69.1	-2.8	-498.0	-19.1	2624.4
<i>Solid biomass</i>	2411.7	2093.3	790.6	48.8	458.1	28.0	1610.2
<i>Biogas</i>	13.8	18.0	-16.0	-53.6	-24.1	-57.3	82.2
<i>Bioliquids</i>	n.r	n.r	-843.8	-100.0	-932.0	-100.0	932.0
Biofuels	4.1	4.2	-278.9	-98.6	-278.8	-98.5	477.0
<i>Bioethanol</i>	n.r	n.r	n/a	n/a	n/a	n/a	27.0
<i>Biodiesel</i>	4.1	4.2	-278.9	-98.6	-278.8	-98.5	450.0
Renewable electricity-T	13.5	14.6	-9.5	-41.3	-11.4	-43.8	58.0

Table 23- 3. Current growth in RES share in Portugal and progress until 2020

	2005	2011	2012	Deviation from NREAP				2020
	NREAPs	PR	PR	2011		2012		NREAPs
	%	%	%	% points	%	% points	%	%
RES-H/C	31.9	35.9	33	4.2	13.2	0.3	0.9	30.6
RES-E	29.3	45.9	47.6	1.7	3.8	-1.2	-2.5	55.3
RES-T-10	0.19	0.5	0.5	-4.6	-90.1	-4.7	-90.3	10.0
Overall RES	19.8	24.5	24.6	-0.7	-2.8	-2.3	-8.6	31

24. Romania

Table 24- 1. RES use in Romania, progress and deviation from NREAPs

	2011		2012		Deviation from NREAP		growth 2012-2020		2020
	PR	PR	2011	2012					NREAPs
	[ktoe]	[ktoe]	[ktoe]	[ktoe]	[%]	[%]	[ktoe]	[%]	[ktoe]
RES-H/C	3504.1	3687.7	670.1	687.7	23.6	22.9	350.3	9.5	4038.0
RES-E	1099.4	1294.8	-560.4	-543.6	-33.8	-29.6	1404.7	108.5	2699.5
RES-T-20	102.8	212.8	-187.6	-105.8	-64.6	-33.2	337.8	158.7	550.6
RES	4706.2	5195.3	-78.0	38.4	-1.6	0.7	2092.7	40.3	7288

Table 24- 2. The contribution of different sources of renewable energy in Romania

	2011		2012		Deviation from NREAP		2020	
	PR	PR	2011	2012				NREAP
	[ktoe]	[ktoe]	[ktoe]	[ktoe]	%	%	[ktoe]	[ktoe]
Hydropower	970.6	1048.4	-479.2	-432.1	-33.1	-29.2	1700.1	
Geothermal	22.2	21.6	-7.8	-13.4	-26.0	-38.3	80.0	
<i>Geothermal-el</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r	
<i>Geothermal-th</i>	22.2	21.6	-7.8	-13.4	-26.0	-38.3	80.0	
Solar	0.1	0.8	-1.7	-6.5	-93.5	-89.2	97.5	
<i>Solar-el</i>	0.1	0.7	-0.7	-3.6	-86.0	-84.0	27.5	
<i>Solar-th</i>	n.r	0.1	-1.0	-2.9	-100.0	-96.7	70.0	
Marine	n.r	n.r	n/a	n/a	n/a	n/a	n.r	
Wind	111.8	227.5	-60.0	-57.7	-34.9	-20.2	722.4	
<i>Onshore</i>	111.8	227.5	-60.0	-57.7	-34.9	-20.2	722.4	
<i>Offshore</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r	
Heat pumps	n.r	n.r	-1.0	-1.0	-100.0	-100.0	12.0	
Biomass	3498.8	3684.2	659.4	654.8	23.2	21.6	4125.4	
<i>Solid biomass</i>	3486.1	3674.3	652.0	657.1	23.0	21.8	4012.7	
<i>Biogas</i>	12.7	9.9	7.4	-1.3	140.4	-11.7	101.7	
<i>Bioliqids</i>	n.r	n.r	n/a	-1.0	n/a	-100.0	11.0	
Biofuels	63.0	178.3	-191.0	-104.7	-75.2	-37.0	495.5	
<i>Bioethanol</i>	24.6	37.0	-60.4	-57.0	-71.1	-60.6	163.0	
<i>Biodiesel</i>	38.4	141.3	-130.6	-47.7	-77.3	-25.2	326.0	
Renewable electricity-T	39.8	34.5	3.4	-1.1	9.2	-3.1	52.7	

Table 24- 3. Current growth in RES share in Romania and progress until 2020

	2005	2011	2012	Deviation from NREAP		2020	
	NREAPs	PR	PR	2011	2012		NREAPs
	%	%	%	% points	%	% points	%
RES-H/C	18.72	24.31	25.74	6.8	38.8	7.6	41.8
RES-E	30.08	31.13	33.57	0.3	1.0	-0.3	-0.8
RES-T-10	1.39	2.1	4.3	-4.1	-65.8	-2.4	-36.1
Overall RES	17.9	21.2	22.9	3.2	17.8	3.9	24

25. Slovenia

Table 25- 1. RES use in Slovenia, progress and deviation from NREAPs

	2011	2012	Deviation from NREAP				growth 2012-2020		2020
	PR	PR	2011	2012				NREAPs	
	[ktoe]	[ktoe]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]
RES-H/C	583.5	588.9	114.5	24.4	96.9	19.7	36.1	6.1	625.0
RES-E	337.0	369.0	-55.4	-14.1	-30.0	-7.5	157.9	42.8	526.9
RES-T-20	39.8	55.4	-9.1	-18.6	1.3	2.4	147.3	265.9	202.7
RES	960.3	1013.3	50.0	5.5	68.2	7.2	341.3	33.7	1355

Table 25- 2. The contribution of different sources of renewable energy in Slovenia

	2011	2012	Deviation from NREAP				2020
	PR	PR	2011	2012		NREAP	
	[ktoe]	[ktoe]	[ktoe]	%	[ktoe]	%	[ktoe]
Hydropower	309.7	332.0	-51.3	-14.2	-29.0	-8.0	440.4
Geothermal	28.2	31.0	10.2	56.7	13.0	72.2	20.0
<i>Geothermal-el</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
<i>Geothermal-th</i>	28.2	31.0	10.2	56.7	13.0	72.2	20.0
Solar	14.5	23.4	7.0	93.6	14.5	163.1	33.0
<i>Solar-el</i>	5.7	14.0	4.2	286.5	12.1	640.0	12.0
<i>Solar-th</i>	8.8	9.4	2.8	46.7	2.4	34.3	21.0
Marine	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Wind	n.r	n.r	-0.3	-100.0	-0.3	-100.0	16.4
<i>Onshore</i>	0.0	0.0	-0.3	-100.0	-0.3	-100.0	16.4
<i>Offshore</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Heat pumps	n.r	n.r	-14.0	-100.0	-19.0	-100.0	57.0
Biomass	568.1	571.5	107.6	23.4	88.8	18.4	583.1
<i>Solid biomass</i>	549.4	546.6	107.3	24.3	91.2	20.0	523.6
<i>Biogas</i>	18.8	24.9	2.3	13.8	2.6	11.6	31.6
<i>Bioliquids</i>	n.r	n.r	-2.0	-100.0	-5.0	-100.0	28.0
Biofuels	35.0	51.0	-7.9	-18.4	3.1	6.5	192.2
<i>Bioethanol</i>	3.7	5.3	-0.4	-9.8	0.7	15.2	18.5
<i>Biodiesel</i>	31.3	45.7	-7.5	-19.3	2.4	5.5	173.7
Renewable electricity-T	4.8	4.4	-1.2	-20.0	-1.8	-29.0	10.5

Table 25- 3. Current growth in RES share in Slovenia and progress until 2020

	2005	2011	2012	Deviation from NREAP				2020
	NREAPs	PR	PR	2011	2012		NREAPs	
	%	%	%	% points	%	% points	%	%
RES-H/C	20	28.68	30.57	5.4	23.1	6.2	25.3	30.8
RES-E	28.5	30.81	31.36	-1.5	-4.6	-0.9	-2.9	39.3
RES-T-10	0.26	4.0	5.5	1.2	42.4	2.5	81.7	10.5
Overall RES	16.2	19.42	20.23	1.2	6.7	1.5	8.2	25.3

26. Slovakia

Table 26- 1. RES use in Slovakia, progress and deviation from NREAPs

	2011	2012	Deviation from NREAP				growth	2012-202	2020
	PR	PR	2011	2012				NREAPs	
	[ktoe]	[ktoe]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]
RES-H/C	564.0	532.0	90.0	19.0	30.0	6.0	288.0	54.1	820.0
RES-E	497.4	506.8	4.6	0.9	-14.8	-2.8	181.2	35.8	688.0
RES-T-20	121.5	95.9	27.5	29.3	-2.1	-2.1	111.1	115.8	207
RES	1182.9	1134.7	122.1	11.5	13.1	1.2	580.3	51.1	1715

Table 26- 2. The contribution of different sources of renewable energy in Slovakia

	2011	2012	Deviation from NREAP				2020
	PR	PR	2011	2012			NREAP
	[ktoe]	[ktoe]	[ktoe]	%	[ktoe]	%	[ktoe]
Hydropower	392.3	388.9	-25.9	-6.2	-31.4	-7.5	464.4
Geothermal	6.0	6.0	3.0	100.0	0.6	11.0	92.6
<i>Geothermal-el</i>	n.r	n.r	n/a	n/a	-2.4	-100.0	2.6
<i>Geothermal-th</i>	6.0	6.0	3.0	100.0	3.0	100.0	90.0
Solar	39.1	41.5	28.4	264.4	27.3	192.4	55.8
<i>Solar-el</i>	34.1	36.5	26.4	341.1	25.3	226.2	25.8
<i>Solar-th</i>	5.0	5.0	2.0	66.7	2.0	66.7	30.0
Marine	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Wind	0.5	0.5	-0.2	-25.0	-9.8	-95.0	48.2
<i>Onshore</i>	0.5	0.5	-0.2	-25.0	-9.8	-95.0	48.2
<i>Offshore</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Heat pumps	n.r	n.r	-1.0	-100.0	-1.0	-100.0	10.0
Biomass	623.4	601.9	90.2	16.9	29.5	5.2	837.1
<i>Solid biomass</i>	590.7	563.6	81.7	16.0	32.0	6.0	703.1
<i>Biogas</i>	32.7	38.3	8.5	35.2	-2.5	-6.0	134.0
<i>Bioliquids</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r
Biofuels	112.3	86.0	26.3	30.6	-3.0	-3.4	190.0
<i>Bioethanol</i>	14.6	14.5	-1.4	-8.8	-2.5	-14.7	75.0
<i>Biodiesel</i>	97.7	71.5	27.7	39.6	-0.5	-0.7	110.0
Renewable electricity-T	9.2	9.9	1.2	15.0	0.9	10.0	17.0

Table 26- 3. Current growth in RES share in Slovakia and progress until 2020

	2005	2011	2012	Deviation from NREAP				2020
	NREAPs	PR	PR	2011	2012			NREAPs
	%	%	%	% points	%	% points	%	%
RES-H/C	6.1	10.7	10.5	2.7	33.8	2.0	23.5	14.6
RES-E	16.7	19.9	20.5	0.6	3.1	0.3	1.5	24
RES-T-10	0.46	5.6	4.5	1.4	33.7	0.2	5.3	10.0
Overall RES	6.7	11.9	11.7	3.7	45.1	3.5	42.7	14

27. Finland

Table 27- 1. RES use in Finland, progress and deviation from NREAPs

	2011		2012		Deviation from NREAP		growth 2012-2020		2020
	PR	PR	2011	2012					NREAPs
	[ktoe]	[ktoe]	[ktoe]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]	[%]
RES-H/C	6239.0	6681.0	609.0	10.8	811.0	13.8	589.0	8.8	7270.0
RES-E	2009.6	2103.9	-30.3	-1.5	20.1	1.0	762.5	36.2	2866.4
RES-T-20	213.1	216.3	-66.9	-23.9	-103.7	-32.4	383.7	177.4	600
RES	8461.7	9001.2	511.8	6.4	727.4	8.8	1735.2	19.3	10736

Table 27- 2. The contribution of different sources of renewable energy in Finland

	2011		2012		Deviation from NREAP		2020	
	PR	PR	2011	2012				NREAP
	[ktoe]	[ktoe]	[ktoe]	[ktoe]	%	%	[ktoe]	[ktoe]
Hydropower	1032.7	1130.0	-190.2	-15.6	-93.0	-7.6	1240	
Geothermal	n.r	n.r	n/a	n/a	n/a	n/a	n.r	
<i>Geothermal-el</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r	
<i>Geothermal-th</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r	
Solar	1.4	1.4	1.4	n/a	1.4	n/a	n.r	
<i>Solar-el</i>	0.4	0.4	0.4	n/a	0.4	n/a	n.r	
<i>Solar-th</i>	1.0	1.0	1.0	n/a	1.0	n/a	n.r	
Marine	n.r	n.r	n.r	n/a	n/a	n/a	n.r	
Wind	34.6	40.8	-16.2	-31.9	-29.8	-42.2	516	
<i>Onshore</i>	n.r	n.r	n/a	n/a	n/a	n/a	301	
<i>Offshore</i>	n.r	n.r	n/a	n/a	n/a	n/a	215	
Heat pumps	276.0	315.0	-44.0	-13.8	-85.0	-21.3	660	
Biomass	6904.0	7297.8	827.7	13.6	1037.4	16.6	7720	
<i>Solid biomass</i>	6834.4	7236.7	3535.7	107.2	3787.4	109.8	4616	
<i>Biogas</i>	39.5	49.0	6.1	18.2	15.6	46.7	83	
<i>Bioliquids</i>	30.0	12.0	-2714.1	-98.9	-2765.5	-99.6	3021	
Biofuels	196.1	198.3	-63.9	-24.6	-101.7	-33.9	560	
<i>Bioethanol</i>	88.0	90.0	8.0	10.0	0.0	0.0	130	
<i>Biodiesel</i>	108.0	108.0	-72.0	-40.0	-102.0	-48.6	430	
Renewable electricity-T	17.0	18.0	-3.0	-15.0	-2.0	-10.0	40	

Table 27- 3. Current growth in RES share in Finland and progress until 2020

	2005		2011		2012		Deviation from NREAP		2020	
	NREAPs	PR	PR	2011	2012				NREAPs	
	%	%	%	% points	%	% points	%	%	%	
RES-H/C	40	45.9	48.2	6.9	17.7	8.2	20.5	47		
RES-E	27	29.4	29.5	3.4	13.1	3.5	13.5	33		
RES-T-10	0.47	8.0	11.7	0.8	11.5	3.4	40.1	19.5		
Overall RES	28.8	33.5	35.1	3.4	11.3	4.1	13.2	38		

28. Sweden

Table 28- 1. RES use in Sweden, progress and deviation from NREAPs

	2011		2012		Deviation from NREAP		growth 2012-2020		2020
	PR	PR	2011	2012	2011	2012			NREAPs
	[ktoe]	[ktoe]	[ktoe]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]	[%]
RES-H/C	9155.0	9661.0	688.0	8.1	963.0	11.1	882.0	9.1	10543.0
RES-E	7227.8	8452.3	-87.4	-1.2	1020.6	13.7	-88.2	-1.0	8364.1
RES-T-20	606.0	736.0	30.0	5.2	112.0	17.9	272.0	37.0	1008
RES	16988.8	18849.3	630.6	3.9	2095.6	12.5	1065.8	5.7	19915

Table 28- 2. The contribution of different sources of renewable energy in Sweden

	2011		2012		Deviation from NREAP		2020	
	PR	PR	2011	2012	2011	2012		NREAP
	[ktoe]	[ktoe]	[ktoe]	[ktoe]	%	%	[ktoe]	[ktoe]
Hydropower	5712.0	6786.7	-157.6	-2.7	919.4	15.7	5848.0	
Geothermal	n.r	n.r	n/a	n/a	n/a	n/a	n.r	
<i>Geothermal-el</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r	
<i>Geothermal-th</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r	
Solar	11.9	12.6	5.8	94.4	6.5	105.0	6.3	
<i>Solar-el</i>	0.9	1.6	0.8	547.1	1.5	900.0	0.3	
<i>Solar-th</i>	11.0	11.0	5.0	83.3	5.0	83.3	6.0	
Marine	n.r	n.r	n/a	n/a	n/a	n/a	n.r	
Wind	522.9	615.8	44.5	9.3	71.0	13.0	1075.0	
<i>Onshore</i>	480.7	576.2	22.7	5.0	54.4	10.4	1032.0	
<i>Offshore</i>	42.1	39.6	21.8	106.8	16.7	72.9	43.0	
Heat pumps	1163.0	1177.0	745.0	178.2	688.0	140.7	1045.0	
Biomass	8972.9	9521.3	-37.0	-0.4	297.4	3.2	10931.8	
<i>Solid biomass</i>	8930.1	9476.5	12.3	0.1	344.1	3.8	10845.6	
<i>Biogas</i>	42.8	44.7	21.4	99.6	24.0	115.4	15.6	
<i>Bioliquids</i>	0.0	0.0	-70.6	-100.0	-70.6	-100.0	70.6	
Biofuels	474.0	607.0	50.0	11.8	140.0	30.0	810.0	
<i>Bioethanol</i>	197.0	197.0	-76.0	-27.8	-97.0	-33.0	465.0	
<i>Biodiesel</i>	215.0	331.0	110.0	104.8	209.0	171.3	251.0	
Renewable electricity-T	132.0	129.0	-20.0	-13.2	-28.0	-17.8	198.0	

Table 28- 3. Current growth in RES share in Sweden and progress until 2020

	2005		2011		2012		Deviation from NREAP		2020	
	NREAPs	PR	PR	2011	2012	2011	2012	NREAPs		
	%	%	%	% points	%	% points	%	%	%	
RES-H/C	53.7	62.5	65.6	4.9	8.5	7.4	12.7	62.1		
RES-E	50.9	59.9	60	4.1	7.3	3.4	6.0	62.9		
RES-T-10	4.03	10.9	15.7	2.8	34.0	7.0	79.5	13.8		
Overall RES	39.7	48.8	51	4.6	10.4	6.1	13.6	50.2		

29. United Kingdom

Table 29- 1. RES use in United Kingdom, progress and deviation from NREAPs

	2011		2012		Deviation from NREAP		growth 2012-2020		2020
	PR	PR	2011	2012					NREAPs
	[ktoe]	[ktoe]	[ktoe]	[ktoe]	[%]	[ktoe]	[%]	[ktoe]	[%]
RES-H/C	1150.8	1221.1	529.8	85.3	465.1	61.5	4977.9	407.7	6199.0
RES-E	2809.3	3460.9	-387.3	-12.1	-153.7	-4.3	6599.4	190.7	10060.3
RES-T-20	1035.0	951.0	-425.0	-29.1	-798.0	-45.6	3521.0	370.2	4472
RES	4995.1	5633.0	-282.5	-5.4	-486.6	-8.0	15098.3	268.0	20731

Table 29- 2. The contribution of different sources of renewable energy in United Kingdom

	2011		2012		Deviation from NREAP		2020	
	PR	PR	2011	2012				NREAP
	[ktoe]	[ktoe]	[ktoe]	[ktoe]	%	%	[ktoe]	[ktoe]
Hydropower	439.9	446.0	-9.9	-2.2	-15.0	-3.2	547.0	
Geothermal	0.8	0.8	0.8	0.0	0.8	0.0	0.0	
<i>Geothermal-el</i>	n.r	n.r	n/a	n/a	n/a	n/a	n.r	
<i>Geothermal-th</i>	0.8	0.8	0.8	0.0	0.8	0.0	n.r	
Solar	143.0	255.2	98.7	222.6	200.5	367.0	226.6	
<i>Solar-el</i>	21.0	102.2	10.7	103.3	81.5	395.0	192.6	
<i>Solar-th</i>	122.0	153.0	88.0	258.8	119.0	350.0	34.0	
Marine	0.1	0.3	0.1	n/a	0.3	n/a	339.7	
Wind	1213.0	1605.3	-432.2	-26.3	-387.3	-19.4	6731.2	
<i>Onshore</i>	838.8	1009.2	-234.4	-21.8	-212.0	-17.4	2936.9	
<i>Offshore</i>	374.2	596.1	-197.7	-34.6	-175.4	-22.7	3794.3	
Heat pumps	47.0	67.3	-175.0	-78.8	-202.7	-75.1	2254.0	
Biomass	2116.3	2307.1	637.9	43.2	695.8	43.2	6163.8	
<i>Solid biomass</i>	1540.6	1724.0	662.2	75.4	708.9	69.8	5382.7	
<i>Biogas</i>	575.7	583.2	-24.2	-4.0	-13.2	-2.2	781.0	
<i>Bioliqids</i>	n.r	n.r	0.0	n/a	0.0	n/a	0.0	
Biofuels	969.0	882.0	-345.0	-26.3	-711.0	-44.6	4205.0	
<i>Bioethanol</i>	330.0	387.0	151.0	84.4	170.0	78.3	1743.0	
<i>Biodiesel</i>	635.0	471.0	-500.0	-44.1	-905.0	-65.8	2462.0	
Renewable electricity-T	66.0	69.0	-80.0	-54.8	-87.0	-55.8	267.0	

Table 29- 3. Current growth in RES share in United Kingdom and progress until 2020

	2005	2011	2012	Deviation from NREAP				2020
	NREAPs	PR	PR	2011	2012			NREAPs
	%	%	%	% points	%	% points	%	%
RES-H/C	0.7	2.3	2.3	1.3	130.0	1.3	130.0	12
RES-E	4.7	8.8	10.8	-1.2	-12.0	-0.2	-1.8	31
RES-T-10	0.45	2.7	5.5	-0.9	-24.3	1.3	31.1	10.8
Overall RES	1.4	3.8	4.2	-0.2	-5.0	0.2	5.0	15

ANNEX IV

**Contribution of renewable energy sources/technologies
in the EU MS renewable energy mix, 2012-20**

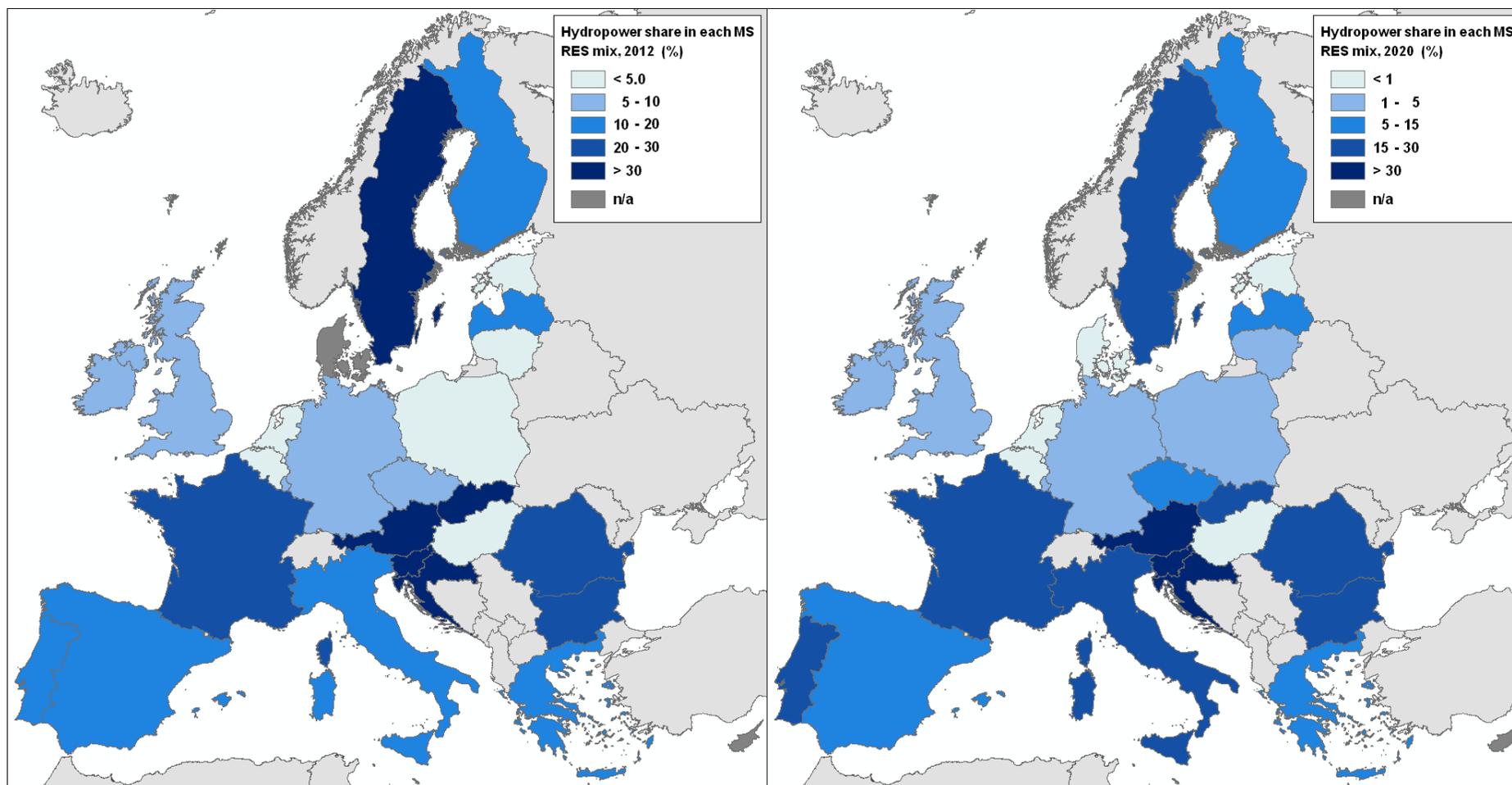


Figure A IV-1. Hydropower contribution in EU-28 MS renewable energy mix, 2012 (left) – 2020 (right)

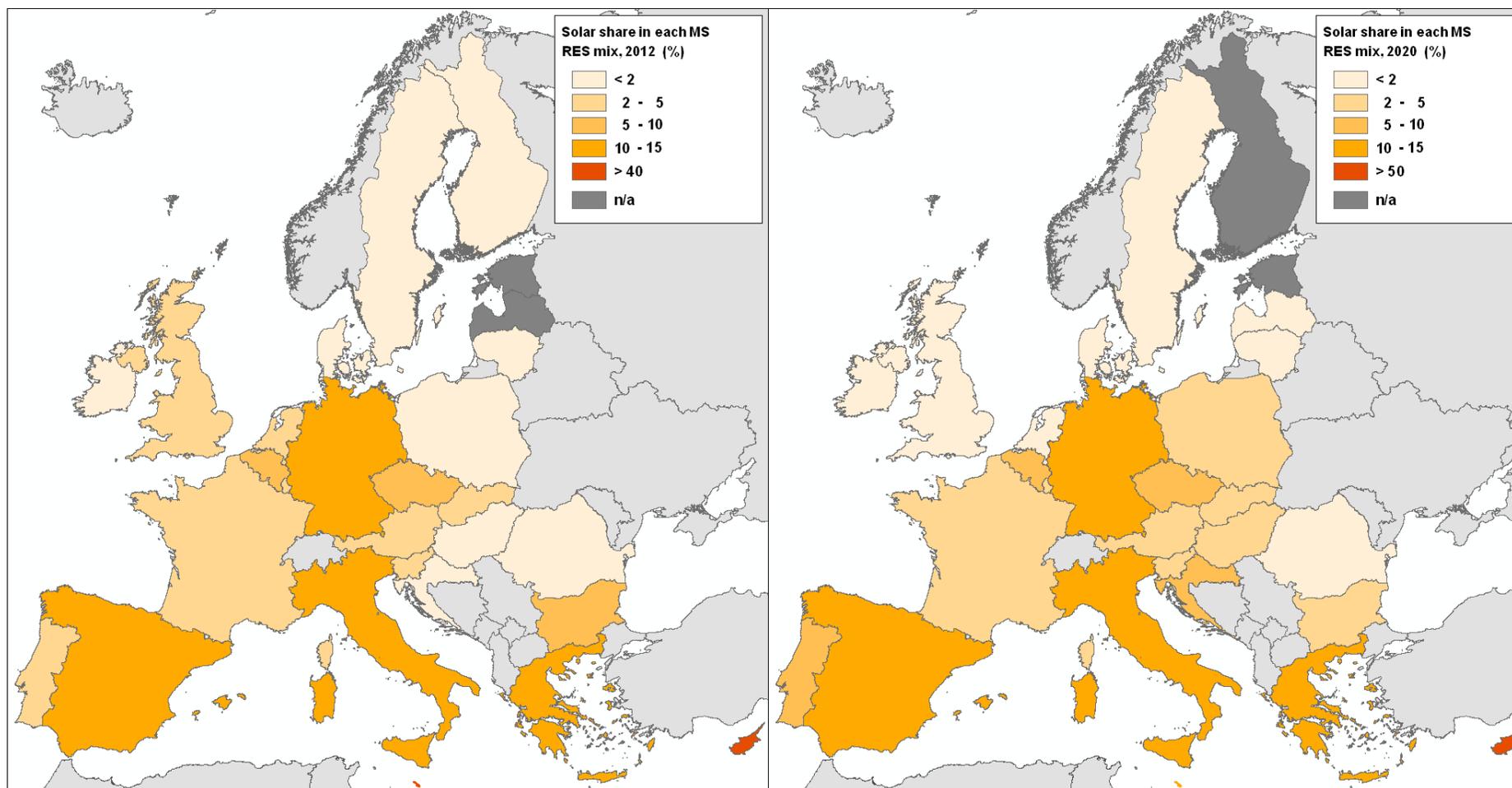


Figure A IV- 2. Solar contribution in EU-28 MS renewable energy mix, 2012 (left) – 2020 (right)

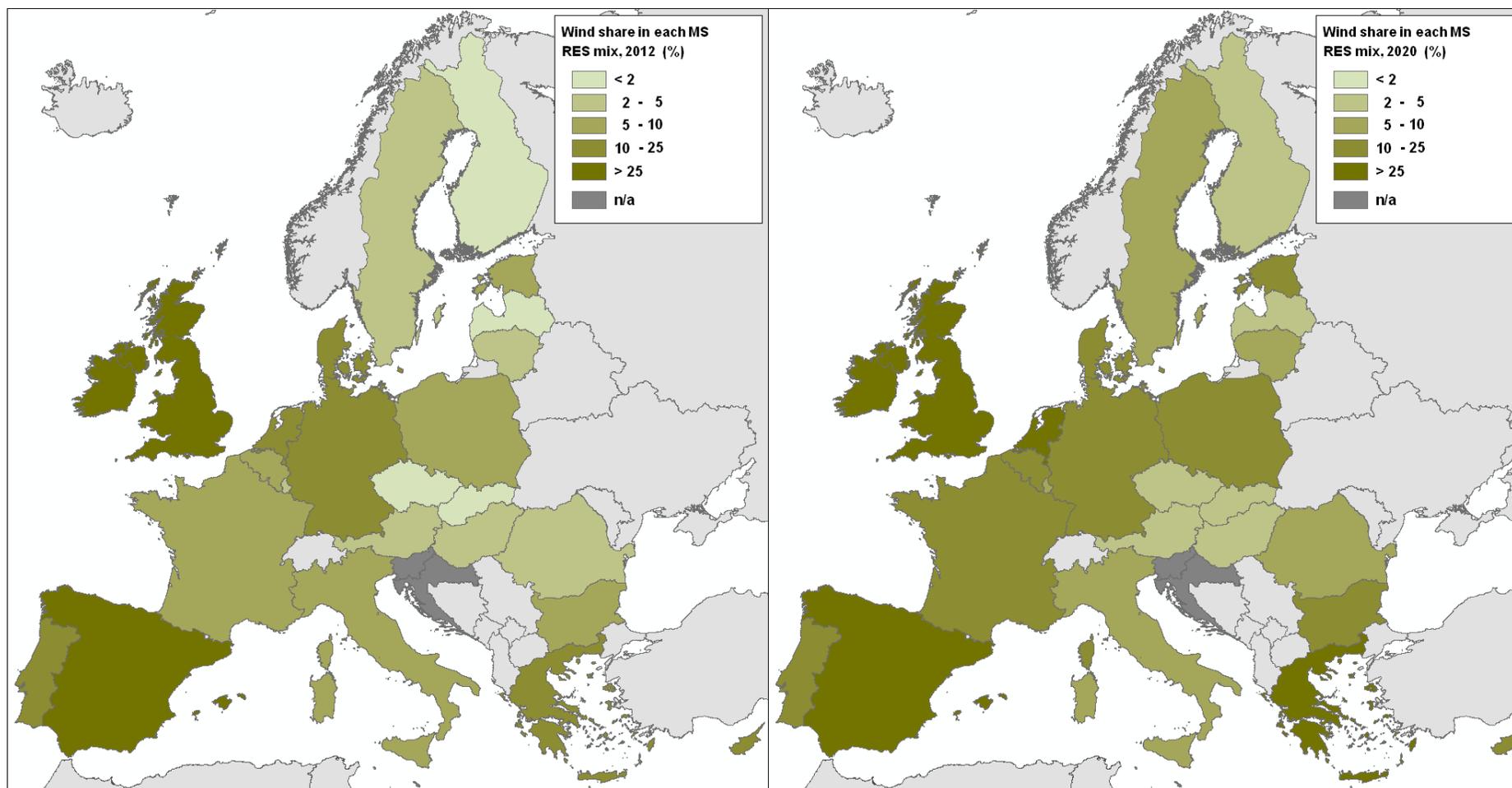


Figure A IV- 3. Wind power contribution in EU-28 MS renewable energy mix, 2012 (left) – 2020 (right)

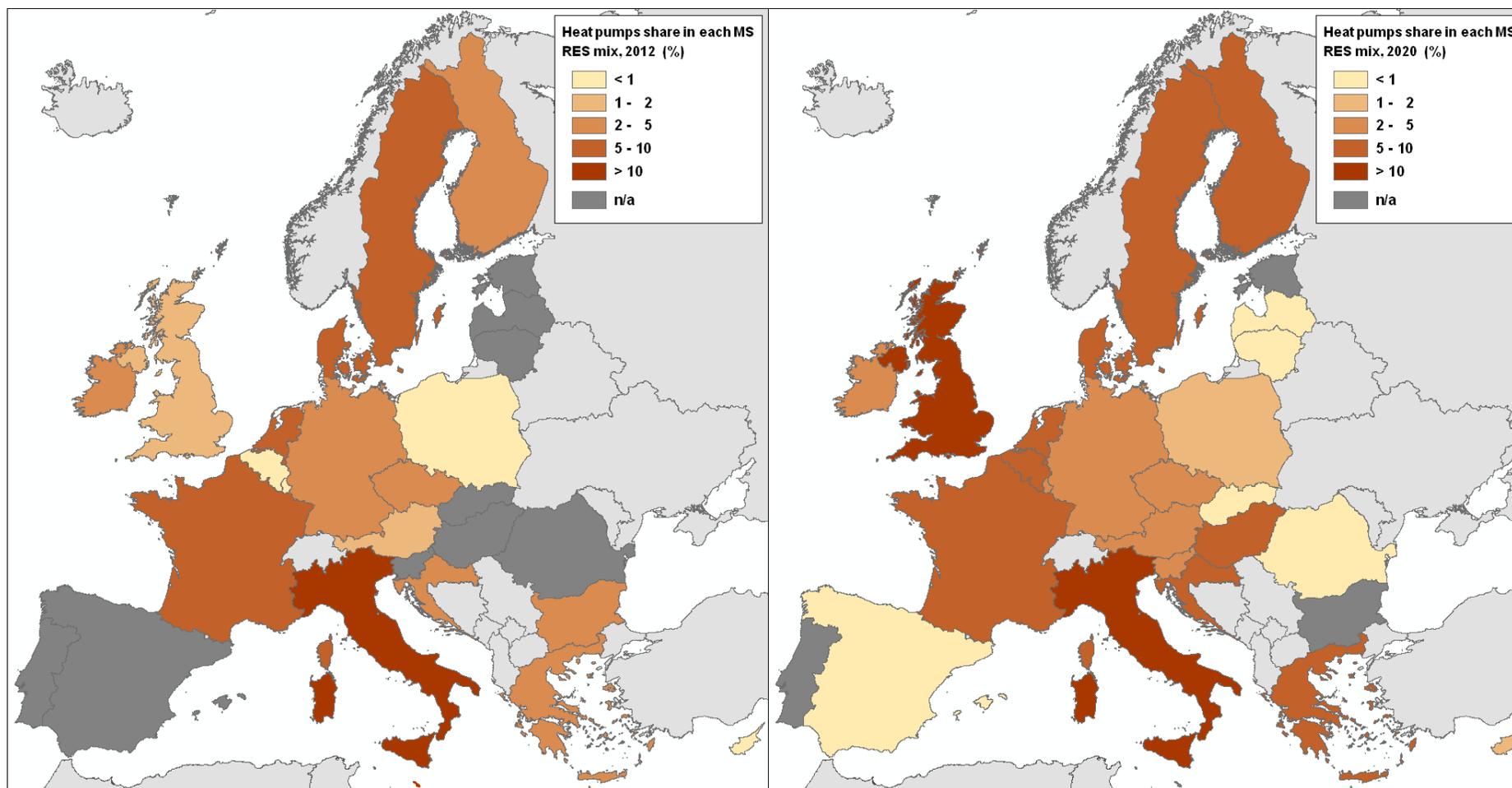


Figure A IV- 4. Heat pumps contribution in EU-28 MS renewable energy mix, 2012 (left) – 2020 (right)

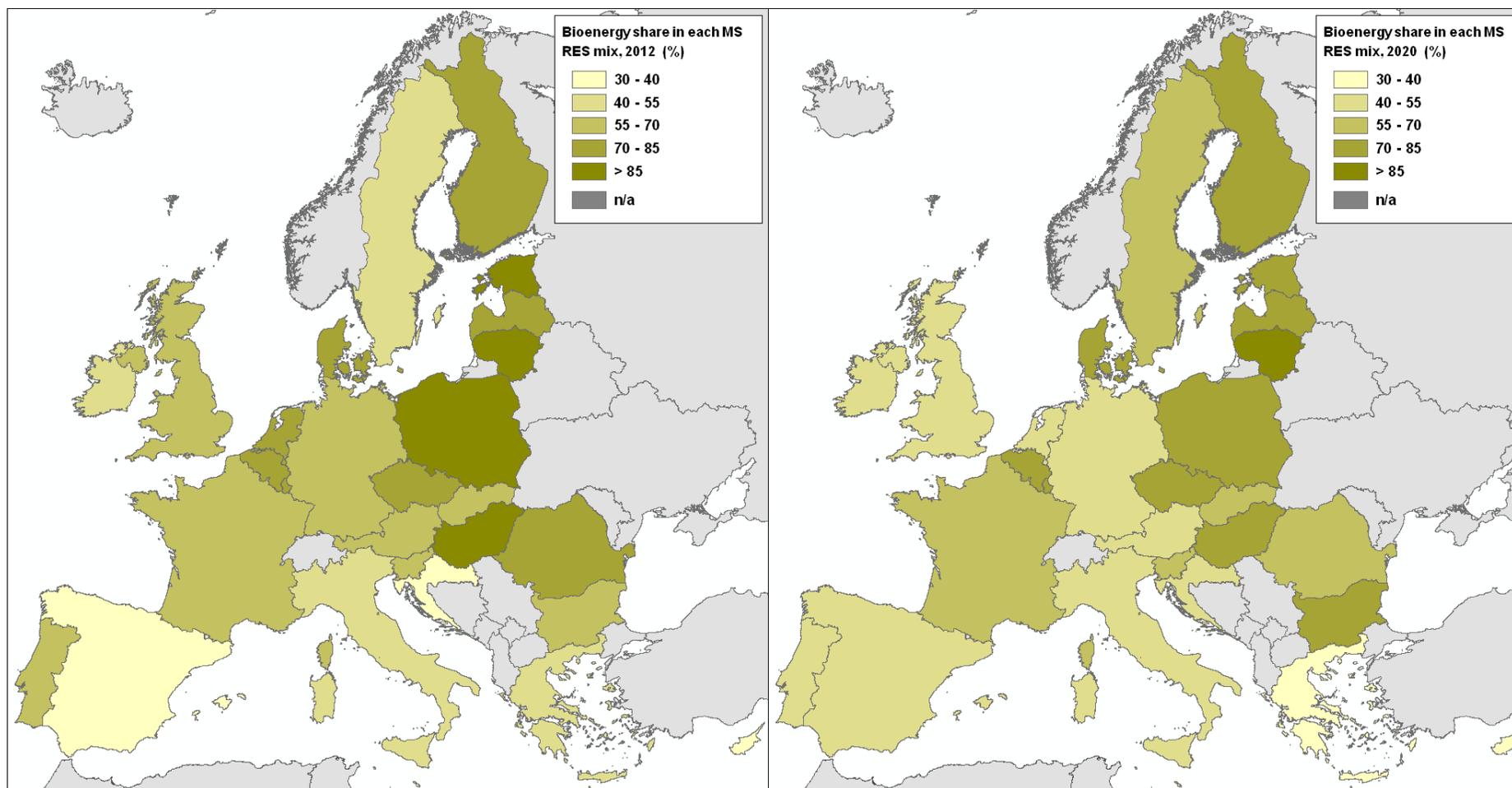


Figure A IV- 5. Bioenergy contribution in EU-28 MS renewable energy mix, 2012 (left) – 2020 (right)

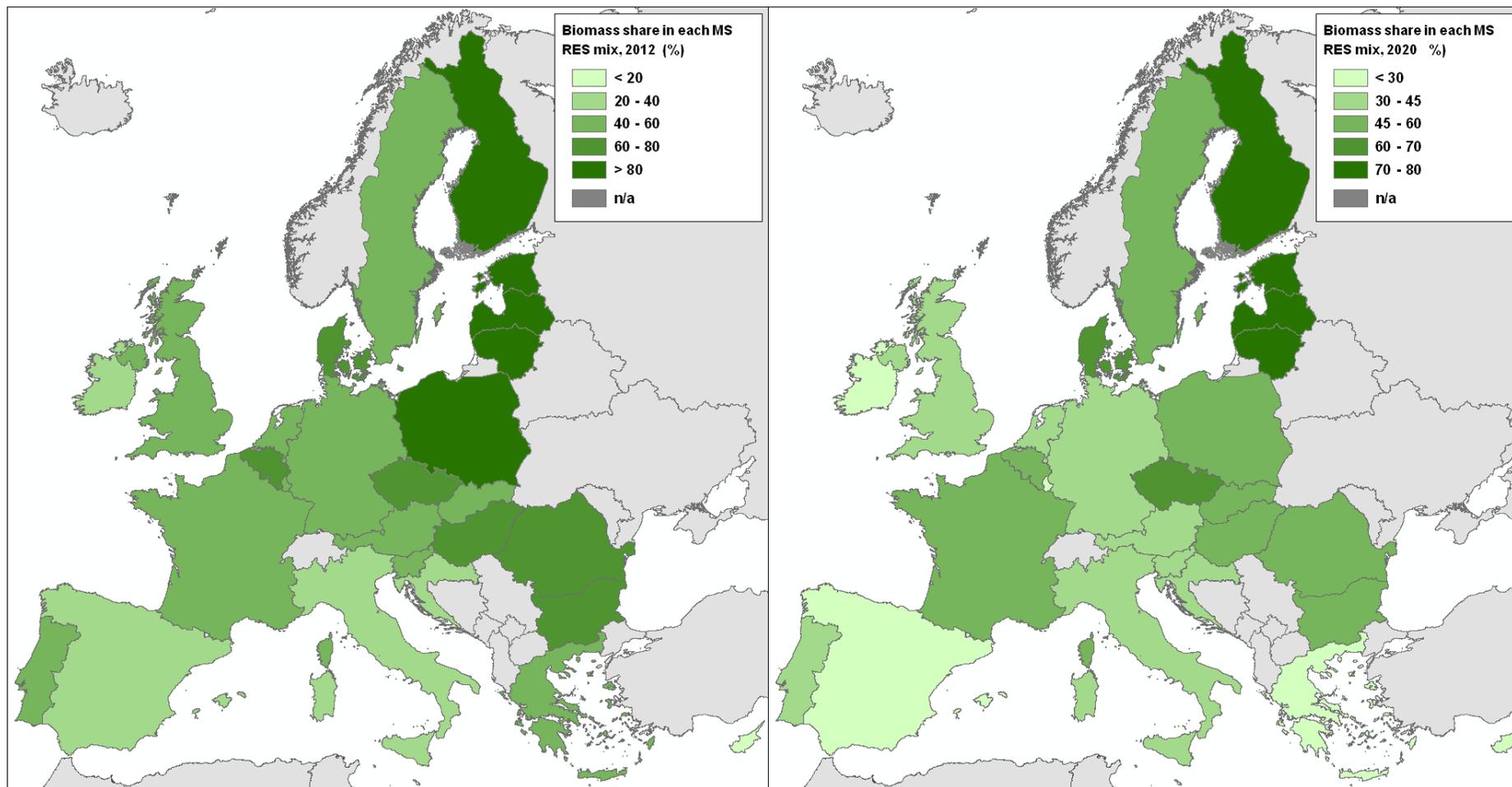


Figure A IV- 6. Biomass contribution in EU-28 MS renewable energy mix, 2012 (left) – 2020 (right)

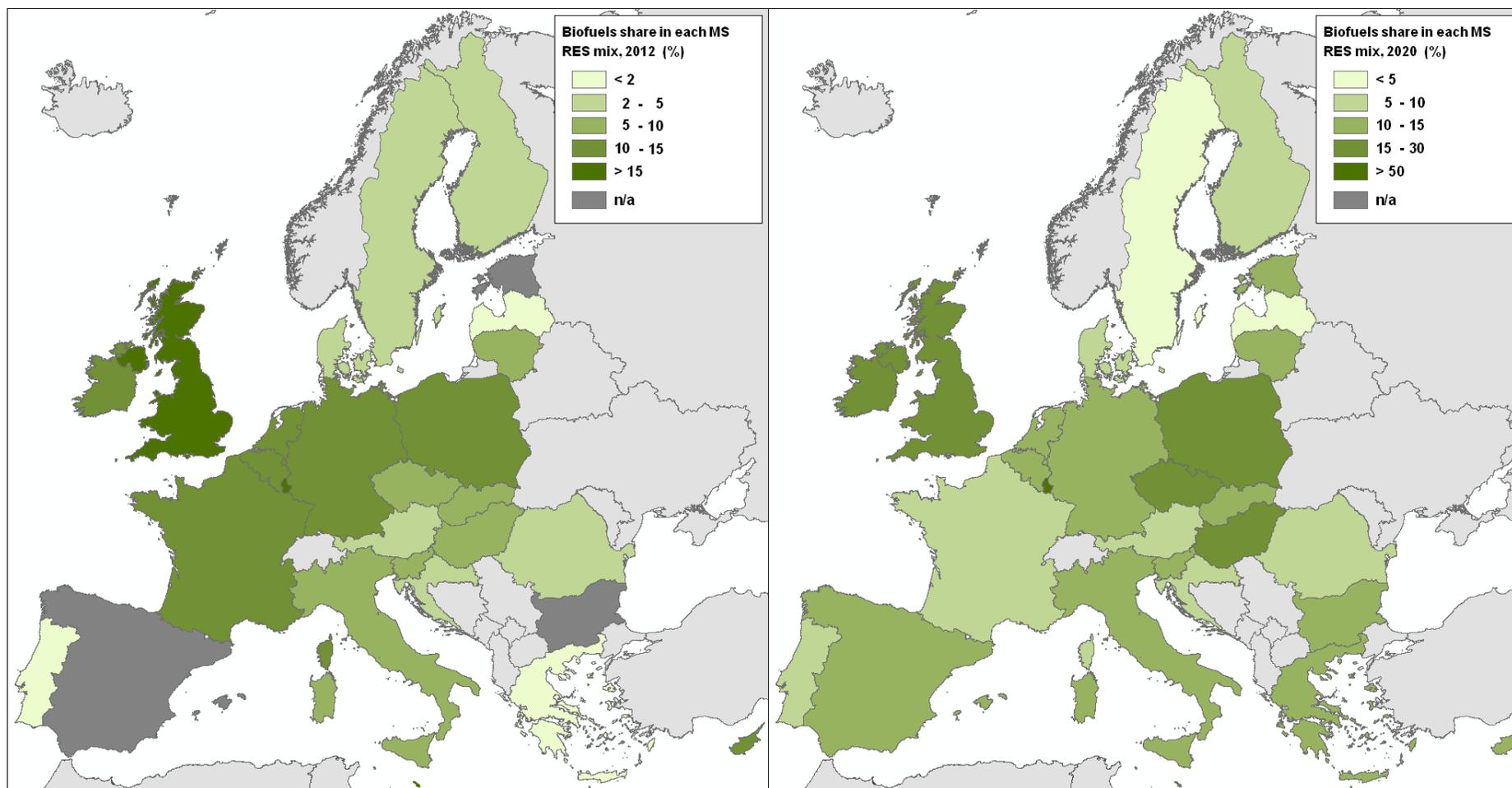


Figure A IV- 7. Biofuels contribution in EU-28 MS renewable energy mix, 2012 (left) – 2020 (right)

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