Covenant of Mayors: Fuel Switch and Sustainable Demand in signatories from "stress test" countries

Bulgaria, Estonia, Latvia, Lithuania, Slovakia, Finland

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Abstract
The Covenant of Mayors (CoM) is the mainstream European movement involving local authorities voluntarily committing to meet and exceed the European Union 20% CO2 reduction objective by 2020 by increasing energy efficiency and through the use of renewable energy sources on their territories. In this report main figures from SEAPs in CoM signatories from "stress test" countries, most exposed to risk related Russian natural gas imports (Bulgaria, Estonia, Latvia, Lithuania, Slovakia, Finland) are shown. Up to end of September 2014, 83 signatories from this region have joined the CoM initiative, representing 8 Millions of inhabitants in the region. By implementing the CoM programme, the European Commission has given visibility to the role of cities, their relevant contribution to EU2020 targets. The main findings can be summarized as follows: I) 60% of natural gas used in the Building sector can be saved due to energy efficiency measures planned in the Sustainable Energy Action Plans submitted by signatories from the region. II) The share of local energy production using Renewable sources for heating will double by 2020 due to fuel switch measures planned in the Sustainable Energy Action Plans submitted by CoM signatories in the region. It is important to stress the fact, that the majority of measures in replacing fossil fuels with renewables are taken place in the district heating networks and CHP plants.
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1. **INTRODUCTION**

The Covenant of Mayors (CoM) is the mainstream European movement involving local authorities voluntarily committing to meet and exceed the European Union 20% CO\(_2\) reduction objective by 2020 by increasing energy efficiency and through the use of renewable energy sources on their territories.

Up to end of September 2014, more than 6000 local authorities and cities have signed up to participate in the CoM. So far over 4000 have submitted a SEAP. In addition in September 2014 the first monitoring report have been submitted.

Acknowledging this success, the European Commission's **European Energy Security Strategy** calls on MS to accelerate the implementation of SEAPs in the region. Central and Eastern European Countries, most exposed to risk related Russian natural gas imports are Bulgaria, Estonia, Latvia, Lithuania, Slovakia and Finland grouped under the definition of "stress test" countries.

In this report main figures coming from cities of this region are shown. Up to end of September 2014, 83 signatories from "stress test" countries have signed the CoM initiative, covering in total 8 Millions of inhabitants in the region.

Each section is divided in three paragraphs reporting:

- The amount of GHG emissions along with the reduction targets by 2020. In order to achieve these targets, cities have planned actions which could be allocated mainly in two categories: a) shifting from existing fossil fuel usage into renewables and b) reducing the energy consumption in their territories.
- In the Sustainable Demand paragraphs are reported the amounts of energy consumptions and estimated energy savings by 2020, as planned in the SEAPs, due to end use efficiency. These figures are representing the sustainability in the Demand side.
- In the Fuel Switch paragraphs are reported the amount of local energy production and estimated local energy production from renewables. The existing local energy production is calculated as a summation of Heat distributed through District heating networks and distributed generation of Heat and Power using renewable sources.
I. **Sustainable Energy Action Plans in Bulgaria**

As of end of September 2014, 32 cities from Bulgaria joined the Covenant of Mayors Initiative. Those cities cover 35% of the total population, as it is shown in table 1. In this assessment report, only 80% in terms of population coverage of CoM signatories have been analysed as they have provided the Sustainable Energy Action Plans.

Table 1 Covenant of Mayors coverage in Bulgaria

<table>
<thead>
<tr>
<th>Number of signatories</th>
<th>32</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population covered</td>
<td>2,621,647 (35%)</td>
</tr>
<tr>
<td>Population covered in the sample</td>
<td>2,115,206</td>
</tr>
<tr>
<td>Estimation on Investment Cost [Millions of Euros]</td>
<td>3,077</td>
</tr>
</tbody>
</table>

In table 2 are reported the amount of GHG emissions along with the reduction targets for the year 2020. In order to achieve these targets, cities have planned actions which could reduce by **41%** the overall amount of GHG emissions by 2020.

Table 2 GHG Emissions and estimated reductions in CoM signatories in Bulgaria

<table>
<thead>
<tr>
<th>GHG Emissions in BEIs [tCO2-eq/year]</th>
<th>6,672,460</th>
</tr>
</thead>
<tbody>
<tr>
<td>GHG Emissions in BEIs per capita [tCO2-eq/cap]</td>
<td>3.15</td>
</tr>
<tr>
<td>Estimation on GHG Emissions reductions by 2020 [tCO2-eq]</td>
<td>2,747,594</td>
</tr>
<tr>
<td>Estimation on GHG Emissions reductions by 2020 per capita [tCO2-eq/cap]</td>
<td>1.3</td>
</tr>
<tr>
<td>Share of GHG Emissions Reductions by 2020</td>
<td>41%</td>
</tr>
</tbody>
</table>

**Sustainable Demand in the SEAPs**

In table 3 are reported the amounts of energy consumptions and estimated energy savings by 2020, as planned in the SEAPs, due to end use energy efficiency. The GHG reduction target will be achieved through a more sustainable demand by reducing the energy consumption in their territories (41%).

Table 3 Final energy consumptions and estimated energy savings in CoM signatories in Bulgaria

<table>
<thead>
<tr>
<th>Final Energy consumptions in BEIs [MWh/year]</th>
<th>14,845,578</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final Energy consumptions in BEIs per capita [MWh /cap]</td>
<td>7</td>
</tr>
</tbody>
</table>
Estimation on Energy savings by 2020 [MWh] 6,082,868

Estimation on Energy savings by 2020 per capita [MWh/cap] 3

Share of energy savings by 2020 41%

In the following are described the pattern of energy consumption in urban areas, reporting figures on the main sectors and types of fuel source.

The main pie chart in figure 1 shows the repartition of energy consumption in the urban territory: Electricity, Heat and Transport. While the second pie chart report the shares of Heat per type of fuel source. Clearly, the amount of Heat consumed represents the highest shares of energy consumption in urban areas (41%).

Figure 1 Shares of Final energy consumption per sector in CoM signatories in Bulgaria

Furthermore, Heat consumed in the urban areas, in the aforementioned signatories from Bulgaria, is supplied by district heating networks, representing 32% of the overall energy consumption in the territory.

In figure 2 are shown the shares of Heat supplied from District Heating network per type of fuel source. The main source used in the power plant connected to District Heating networks are fuelled by Natural Gas, with a share of 100%.

Figure 2 Shares of Heat supplied from District Heating network per type of fuel source in CoM signatories in Bulgaria
Typical measures for Sustainable Demand extracted from SEAPs in the region

Energy efficiency measures in buildings

- Energy renovation
- Implementation of energy management
- Integration of RES
- Assistance for energy renovation, fuel change, RES utilization, others
- Assistance for energy renovation, heating on biomass, heat pumps and other energy efficient technologies and RES, construction control
- Street lightening, energy monitoring and control system, refurbishment of the infrastructure

Transport

- Public transport modernization, new underground lines, comfort and attractive transport
- Reduction of the car use, shared transportation, mobility plans, traffic restriction

Fuel switch in the SEAPs

The GHG reduction target will be achieved also through the switch from existing fossil fuel usage into renewables (11%).

In table 4 are reported the amount of local energy production and estimated local energy production from renewables. The existing local energy production is calculated as a summation of Heat distributed through District heating networks and distributed generation of Heat and Power using renewable sources. The share of the local energy production, as defined above, represents 35 % of the total energy consumption in the territory.

Table 4 Local energy production and estimated local energy production from RES in CoM signatories in Bulgaria

| Current Local Energy Production in BEIs [MWh/year] | 5,197,425 |
| Estimation on Local Energy production with RES [MWh] | 572,406 |
| Share of estimated local energy production | 11 % |

In figure 3 are shown the shares of Estimated Local energy production using renewable sources. The highest share of estimated energy production is from distributed generation of Heat and Power (92%), and 8% are planned to take place in Combined Heat and Power plants.
In the following are reported typical measures taken from the SEAPs in Bulgaria, for sustainable energy demand and for fuel switch.

**Typical measures for Fuel Switch extracted from SEAPs in the region**

**Combined heat and power generation**
- Integrated project for the construction of installations for utilization of renewable energy sources to satisfy the energy needs of a complex of public buildings in the central city area
- Construction of thermal solar heating for hot water
- Construction of biomass heating plant
- Building of a system for combined heat and power for utilization of biogas from WWTP and waste depots
- Installation of 8MW HPP on the water pipeline
- Installation for cogeneration of electricity and heat from biomass electric power 0.4 MW and thermal power 0.63 MW and the storage and processing of biomass

**Distributed generation of heat and power**
- PV: Development of photovoltaic power plants in the municipality with a total capacity of 25 MWh and 1620 KWp.
- Installing the 25 thermo hot water installations on municipal buildings with year-round use (municipal administration, children and social institutions)
- PV: Installation of photovoltaic systems to generate electricity for use by the municipal sector
- PV: Building of big solar installations, installation of PV modules on public buildings,
- PV: Support for installation of PV on private buildings
- Replacing electric water heaters dual serpentine boilers for hot water heated by solar energy and bio-fuel heating equipment; Use of biomass for heating of private buildings
- Construction of a wind plant with a capacity of 36 MW
- By operating three wind turbines in the municipality Oryahovo
- Construction of wind turbines in the village of Saraevo and Mizia

Figure 3 Shares of Local energy production using renewable sources in CoM signatories in Bulgaria
II. SUSTAINABLE ENERGY ACTION PLANS IN ESTONIA

As of end of September 2014, 2 cities from Estonia joined the Covenant of Mayors Initiative. Those cities cover 43% of the total population, as it is shown in table 5. In this assessment report, only 75% in terms of population coverage of CoM signatories, have been analysed as they have provided the Sustainable Energy Action Plans.

Table 5 Covenant of Mayors coverage in Estonia

<table>
<thead>
<tr>
<th>Number of signatories</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population covered</td>
<td>549,173 (43%)</td>
</tr>
<tr>
<td>Population covered in the sample</td>
<td>413,727</td>
</tr>
<tr>
<td>Estimation on Investment Cost [Millions of Euros]</td>
<td>1,600</td>
</tr>
</tbody>
</table>

In table 6 are reported the amount of GHG emissions along with the reduction targets for the year 2020. In order to achieve these targets, cities have planned actions which could reduce by 25% the overall amount of GHG emissions by 2020.

Table 6 GHG Emissions and estimated reductions in CoM signatories in Estonia

| GHG Emissions in BEIs [tCO2-eq/year] | 3,931,041 |
| GHG Emissions per capita [tCO2-eq/cap] | 9,5 |
| Estimation on GHG Emissions reductions by 2020 [tCO2-eq] | 997,267 |
| Estimation on GHG Emissions reductions by 2020 per capita [tCO2-eq/cap] | 2,4 |
| Share of GHG Emissions Reductions by 2020 | 25% |

Sustainable Demand in the SEAPs

In table 7 are reported the amounts of energy consumptions and estimated energy savings by 2020, as planned in the SEAPs, due to end use energy efficiency. The GHG reduction target will be achieved through a more Sustainable Demand by reducing the energy consumption in their territories (5%).

Table 7 Final energy consumptions and estimated energy savings in CoM signatories in Estonia

| Final Energy consumptions [MWh/year] | 9,614,253 |
| Final Energy consumptions per capita [MWh/cap] | 23 |
Estimation on Energy savings by 2020 [MWh] 522,715

Estimation on Energy savings by 2020 per capita [MWh/cap] 1.6

Share of energy savings by 2020 5%

In the following is described the pattern of energy consumption in urban areas, reporting figures on the main sectors and types of fuel source.

The main pie chart in figure 4 shows the repartition of energy consumption in the urban territory: Electricity, Heat and Transport. While the second pies chart report the shares of Heat per type of fuel source. Clearly, the amount of Heat consumed represents the highest shares of energy consumption in urban areas (54%).

Figure 4 Shares of Final energy consumption per sector in CoM signatories in Estonia

Furthermore, Heat consumed in the urban areas, in the aforementioned signatories from Estonia, is supplied by district heating networks, representing 23 % of the overall energy consumption in the territory.

In figure 5 are shown the shares of Heat supplied from District Heating network per type of fuel source. The main source used in the power plant connected to District Heating networks are fuelled by Natural Gas, with a share of 95%.

Figure 5 Shares of Heat supplied from District Heating network per type of fuel source in CoM signatories in Estonia
In the following are reported typical measures taken from the SEAPs in Estonia, for sustainable energy demand.

**Typical measures for Sustainable Demand extracted from SEAPs in the region**

**Energy efficiency measures in buildings**

- Renovation of 48 kindergarten and 14 school buildings; Insulation of the building envelopes in 4 and renovation heating system in 3 social houses; Renovation the 4 social houses roof’s
- Renovation the municipal dwelling buildings
- Renovation a district heating network to the Zoo
- Building the municipal dwelling buildings
- Consuming green electricity
- Installation the new efficient lights and their control

**Transport**

- Electrical charging station for the electrical cars
- Supplying 20 new trams; Supplying 85 new busses
- Public transport subsidies
- Building the new tramlines
- Training the public bus drivers for Green Driving
- Consuming Green Electricity
- Using biofuels
- Bicycle paths

**Fuel Switch in the SEAPs**

The GHG reduction target will be achieved also through the switch from existing fossil fuel usage into renewables (68%).

In table 8 are reported the amount of local energy production and estimated local energy production from renewables. The existing local energy production is calculated as a summation of Heat distributed through District heating networks and distributed generation of Heat and Power using renewable sources. The share of the local energy production, as defined above, represents 27% of the total energy consumption in the territory.
Table 8 Local energy production and estimated local energy production from RES in CoM signatories in Estonia

| Current Local Energy Production [MWh/year] | 2,658,513 |
| Estimation on Local Energy production with RES [MWh] | 1,816,703 |

| Share of estimated local energy production | 68% |

In figure 6 is shown the shares of Estimated Local energy production using renewable sources. The highest share of estimated energy production is distributed generation of Heat and power using RES source (49%). Furthermore, 35% of estimated energy production are planned to take place in Combined Heat and Power plants, while 16% are planned to be distributed through district heating networks using Renewables as primary energy source.

![Figure 6 Shares of Local energy production using renewable sources in CoM signatories in Estonia](image)

In the following are reported typical measures taken from the SEAPs in Estonia, for sustainable energy Demand and for fuel switch.

**Typical measures for Fuel Switch extracted from SEAPs in the region**

- Building waste burning CHP Plant
- Building wood chips burning CHP Plant
- District Heating Plant burning wood chips
- Consuming Green Electricity
III. **Sustainable Energy Action Plans in Latvia**

As of end of September 2014, 2 cities from Latvia joined the Covenant of Mayors Initiative. Those cities cover 50% of the total population, as it is shown in table 9. In this assessment report, only 92% in terms of population coverage of CoM signatories have been analysed as they have provided the Sustainable Energy Action Plans.

Table 9 Covenant of Mayors coverage in Latvia

<table>
<thead>
<tr>
<th>Number of signatories</th>
<th>19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population covered</td>
<td>1,095,776 (50%)</td>
</tr>
<tr>
<td>Population covered in the sample</td>
<td>1,011,957</td>
</tr>
</tbody>
</table>

In table 10 are reported the amount of GHG emissions along with the reduction targets for the year 2020. In order to achieve these targets, cities have planned actions which could reduce by **55%** the overall amount of GHG emissions by 2020.

Table 10 GHG Emissions and estimated reductions in CoM signatories in Latvia

<table>
<thead>
<tr>
<th>GHG Emissions in BEIs [tCO2-eq/year]</th>
<th>4,646,361</th>
</tr>
</thead>
<tbody>
<tr>
<td>GHG Emissions in BEIs per capita [tCO2-eq/cap]</td>
<td>4.6</td>
</tr>
<tr>
<td>Estimation on GHG Emissions reductions by 2020 [tCO2-eq]</td>
<td>2,577,578.67</td>
</tr>
<tr>
<td>Estimation on GHG Emissions reductions by 2020 per capita [tCO2-eq/cap]</td>
<td>2.55</td>
</tr>
<tr>
<td>Share of GHG Emissions Reductions by 2020</td>
<td>55%</td>
</tr>
</tbody>
</table>

**Sustainable Demand in SEAPs**

In table 11 are reported the amounts of energy consumptions and estimated energy savings by 2020, as planned in the SEAPs, due to end use efficiency. The GHG reduction target will be achieved through a more Sustainable Demand by reducing the energy consumption in their territories (21%).

Table 11 Final energy consumptions and estimated energy savings in CoM signatories in Latvia

<table>
<thead>
<tr>
<th>Final Energy consumptions in BEIs [MWh/year]</th>
<th>21,923,421</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final Energy consumptions in BEIs per capita [MWh /cap]</td>
<td>21.6</td>
</tr>
</tbody>
</table>
Estimation on Energy savings by 2020 [MWh] 6,118,978

Estimation on Energy savings by 2020 per capita [MWh/cap] 6.05

Share of energy savings by 2020 28%

In the following is described the pattern of energy consumption in urban areas, reporting figures on the main sectors and types of fuel source. The main pie chart in figure 7 shows the repartition of energy consumption in the urban territory: Electricity, Heat and Transport. While the second pie chart report the shares of Heat per type of fuel source. Clearly, the amount of Heat consumed represents the highest shares of energy consumption in urban areas (72%).

Figure 7 Shares of Final energy consumption per sector in CoM signatories in Latvia

Furthermore, Heat consumed in the urban areas, in the aforementioned signatories from Latvia, is supplied by district heating networks, which represents 32 % of the overall energy consumption in the territory. In figure 14 are shown the shares of Heat supplied from District Heating network per type of fuel source. The main source used in the power plant connected to District Heating networks are fuelled by Natural Gas, with a share of 62%.

Figure 8 Shares of Heat supplied from District Heating network per type of fuel source in CoM signatories in Latvia
In the following are reported typical measure taken from the SEAPs in Latvia, for sustainable energy Demand.

Typical measures for Sustainable demand extracted from SEAPs in the region

- Renovation of buildings connected to the district heating system to achieve 1.5% yearly reduction in heat consumption compared to the average heat energy sold over 2010-2012 period.
- renovation of municipal buildings and residential buildings
- improvement of energy efficiency in street lighting by LED technology

**Fuel switch in SEAPs**

The GHG reduction target will be achieved also through the switch from existing fossil fuel usage into renewables (24%).

In table 12 are reported the amount of local energy production and estimated local energy production from renewables. The existing local energy production is calculated as a summation of Heat distributed through District heating networks and distributed generation of Heat and Power using renewable sources. The share of the local energy production, as defined above, represents 37 % of the total energy consumption in the territory.

Table 12 Local energy production and estimated local energy production from RES in CoM signatories in Latvia

| Current Local Energy Production in BEIs | 8,122,640 |
| Estimation on Local Energy production with RES by 2020 [MWh] | 723,508 |
| Share of estimated local energy production | 9% |

In figure 9 are shown the shares of Estimated Local energy production using renewable sources. The highest share of estimated energy production are planned to be distributed generation of Heat and power using RES source (70%). Furthermore, distributed through district heating networks using Renewables as primary energy source (20%), 10% of estimated energy production are planned to take place in Combined Heat and Power plants.

In the following are reported typical measure taken from the SEAPs in Latvia, for fuel switch.

**Typical measures for Fuel Switch extracted from SEAPs in the region**

- Production of heat using wood chips to produce energy at one of the cogeneration unit in Riga
- Production of additional heat using the absorption type heat pump in the cogeneration unit plant
Production of additional heat with the use of condensation economisers installed in the heat sources of a Riga cogeneration plant
- Recovering of Heat from flue gas and cooling flows in energy production plants.
- Installation of heat pumps at public and residential buildings
- Installation of solar collectors at public and residential buildings
- Using of biofuel for public buses in the transport sector
- Using of biofuel for private cars, transport sector
- Promotion and introduction of electric cars
- Conversion from the natural gas to the biomass in boiler houses in Ogre and Ogresgals till 2030
- Biomass utilisation in CHP and heat boilers

Figure 9 Shares of Local energy production using renewable sources in CoM signatories in Latvia

- Conversion from the natural gas to the biomass in the boiler house
- Fuel switching projects in municipal buildings
- Merging of boiler houses and replacing natural gas with wood chip
- Use of renewable energy in district heating network
- Woodchip boiler or another technology solution in Acone; in Saulkalne
- Alternative energy use for hot water production
- Replace fossil fuel (diesel fuel) with sustainable local fuel (biomass) In heat supply system, in the premises of recreation and information centre
- Installation of heat pumps; installation of solar collectors
- Technical and informative support for 3 projects for electricity production from renewables (for local entrepreneurs) and informative support for domestic
- Energy efficiency measures in municipal buildings using solar energy as an alternative source of energy for hot water during the summer months
- Kürsavas hospital building heating system equipped with solar energy equipment using for hot water preparation, which will also serve as object for society education.
- Use of solar energy for production of local electric energy, which is envisaged for lighting of various important objects in the municipality
As of end of September 2014, 14 cities from Lithuania joined the Covenant of Mayors Initiative. Those cities cover 42% of the total population, as it is shown in table 13. In this assessment report, only 84% in terms of population coverage of CoM signatories have been analyzed as they have provided the Sustainable Energy Action Plans.

Table 13 Covenant of Mayors coverage in Lithuania

<table>
<thead>
<tr>
<th>Number of signatories</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population covered</td>
<td>1,379,419 (42%)</td>
</tr>
<tr>
<td>Population covered in the sample</td>
<td>1,163,579</td>
</tr>
<tr>
<td>Estimation on Investment Cost [Millions of Euros]</td>
<td>2,325</td>
</tr>
</tbody>
</table>

In table 14 are reported the amount of GHG emissions along with the reduction targets for the year 2020. In order to achieve these targets, cities have planned actions which could reduce by 35% the overall amount of GHG emissions by the year 2020.

Table 14 GHG Emissions and estimated reductions in CoM signatories in Lithuania

| GHG Emissions in BEIs [tCO2-eq/year] | 4,558,116 |
| GHG Emissions in BEIs per capita [tCO2-eq/cap] | 3.9 |
| Estimation on GHG Emissions reductions by 2020 [tCO2-eq] | 1,572,830 |
| Estimation on GHG Emissions reductions by 2020 per capita [tCO2-eq/cap] | 1.3 |
| Share of GHG Emissions Reductions by 2020 | 35% |

Sustainable Demand in SEAPs

In table 15 are reported the amounts of energy consumptions and estimated energy savings by 2020, as planned in the SEAPs, due to end use energy efficiency. The GHG reduction target will be achieved through a more Sustainable Demand by reducing the energy consumption in their territories (20%).

Table 15 Final energy consumptions and estimated energy savings in CoM signatories in Lithuania

| Final Energy consumptions in BEIs [MWh/year] | 20,904,887 |
| Final Energy consumptions in BEIs per capita [MWh/cap] | 20 |
In the following is described the pattern of energy consumption in urban areas, reporting figures on the main sectors and types of fuel source.

The main pie chart in figure 10 shows the repartition of energy consumption in the urban territory: Electricity, Heat and Transport. While the second pie chart report the shares of Heat per type of fuel source. Clearly, the amount of Heat consumed represents the highest shares of energy consumption in urban areas (57%).

![Figure 10 Shares of energy consumption per sector in CoM signatories in Lithuania](image)

Furthermore, Heat consumed in the urban areas, in the aforementioned signatories from Lithuania, is supplied by district heating networks, which represents 37% of the overall energy consumption in the territory.

In figure 11 are shown the shares of Heat supplied from District Heating network per type of fuel source. The main source used in the power plant connected to District Heating networks are fuelled by Natural Gas, with a share of 69%.

![Figure 11 Shares of Heat supplied from District Heating network per type of fuel source in CoM signatories in Lithuania](image)
In the following are reported typical measures taken from the SEAPs in Lithuania, for sustainable energy demand.

**Typical measures for Sustainable Demand extracted from SEAPs in the region**

Energy efficiency in the buildings
- schools and hospitals renovation
- residential buildings renovation
- public lighting system renovation

Transport
- sustainable urban mobility development

**Fuel switch in SEAPs**

The GHG reduction target will be achieved also through the switch from existing fossil fuel usage into renewables (24%).

In Table 16 are reported the amount of local energy production and estimated local energy production from renewables. The existing local energy production is calculated as a summation of heat distributed through district heating networks and distributed generation of heat and power using renewable sources. The share of the local energy production, as defined above, represents 42% of the total energy consumption in the territory.

Table 16 Local energy production and estimated local energy production from RES in CoM signatories in Lithuania

| Current Local Energy Production in BEIs [MWh/year] | 8,736,978 |
| Estimation on Local Energy production with RES by 2020 [MWh] | 2,074,483 |
| Share of estimated local energy production by 2020 | 24% |

In Figure 12 is shown the shares of estimated local energy production using renewable sources. The highest share of estimated energy production are planned to take place in Combined Heat and Power plants (82%). Furthermore, 12% of estimated energy production are planned to be generated by Wind, while a share of 6% will be supplied by district heating networks using Renewables as primary energy source. Only a small share of production (0.3%) are planned to take place as distributed generation from RES in the urban territories.

In the following are reported typical measures taken from the SEAPs in Lithuania, for fuel switch.

**Typical measures for Fuel Switch extracted from SEAPs in the region**

- Construction of Kaunas sludge treatment plants.
- Old equipment in Kaunas CHP closing.
- Biofuel power plant construction (108 MW thermal power biofuel fired CHP)
- 40 MW gas turbine and boiler for biofuels construction in Inkaras boiler-house.

![Pie chart showing energy production sources in Lithuania](chart)

**Figure 12 Shares of Local energy production using renewable sources in CoM signatories in Lithuania**

- Construction of waste incineration cogeneration plant and development of biodegradable waste management infrastructure
- Building of biogas CHP
- Modernization and development of Kaunas city electricity network
- Power plant conversion to biomass
- Production of heat and electricity in biogas plants
- Constructing 1.5 MW power biofuel boiler in Kybartai boiler-house, as alternative for slate oil.
- Construction of 5 MW power biofuel boiler in Vilkaviškis boiler-house (alternative for natural gas).
- Construction of geothermal energy plant of 7.5 MW power
- Economiser installation works in Stadionas boiler house
- Economiser installation works in Venta boiler house
- Expanding heating pipes, connecting new consumers to centralised heat supply system eliminating one boiler-house operating combusting coal (demand of 170 MWh per year).
- Heat supply networks renovation
- Installation of economizers in the boiler houses, that use natural gas for heat production
- Reconstruction of boiler houses in district heating system (fossil fuel to biofuel)
- Replacing boiler equipment adjusting it to consume biomass instead of natural gas (5 MW)
- Replacing boiler equipment adjusting it to consume biomass instead of natural gas in boiler house (3 MW)
- Waste treatment development, waste incineration power plant implementation
- Hydropower plant system modernization automation, aiming to increase energy production from 800 thousand kW h to 1 800 thousand kWh.
- Construction of photovoltaic plants
- Refurbishment and renovation of apartments and private residential houses. Reconstruction of heating and hot water systems. Electricity savings in residential buildings. Sub-bottom geothermal systems.
- Building wind mill park
- Construction of small scale individual wind power plants in rural communities (power 5-15 kW).
- Construction of wind power park (70 MW)
- Construction of wind power plants of 250 kW power
- Construction of wind power stations
V. SUSTAINABLE ENERGY ACTION PLANS IN SLOVAKIA

As of end of September 2014, 4 cities from Slovakia joined the Covenant of Mayors Initiative. Those cities cover 10% of the total population, as it is shown in table 17. In this assessment report, have been analyzed as they have provided the Sustainable Energy Action Plans.

Table 17 Covenant of Mayors coverage in Slovakia

<table>
<thead>
<tr>
<th>Number of signatories</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population covered</td>
<td>566,961 (10%)</td>
</tr>
<tr>
<td>Population covered in the assessment</td>
<td>566,961</td>
</tr>
<tr>
<td>Estimation on Investment Cost [Millions of Euros]</td>
<td>710</td>
</tr>
</tbody>
</table>

In table 18 are reported the amount of GHG emissions along with the reduction targets for the year 2020. In order to achieve these targets, cities have planned actions which could reduce by 22% the overall amount of GHG emissions by 2020.

Table 18 GHG Emissions and estimated reductions in CoM signatories in Slovakia

| GHG Emissions in BEIs [tCO2-eq/year] | 2,691,158 |
| GHG Emissions in BEIs per capita [tCO2-eq/cap] | 4.7 |
| Estimation on GHG Emissions reductions by 2020 [tCO2-eq] | 583,241 |
| Estimation on GHG Emissions reductions by 2020 per capita [tCO2-eq/cap] | 1.03 |
| Share of GHG Emissions Reductions by 2020 | 22% |

Sustainable Demand in the SEAPs

In table 19 are reported the amounts of energy consumptions and estimated energy savings by 2020, as planned in the SEAPs, due to end use efficiency. The GHG reduction target will be achieved through a more Sustainable Demand by reducing the energy consumption in their territories (15%).

Table 19 Final energy consumptions and estimated energy savings in CoM signatories in Slovakia

| Final Energy consumptions in BEIs [MWh/year] | 11,228,369 |
| Final Energy consumptions in BEIs per capita [MWh/cap] | 20 |
In the following is described the pattern of energy consumption in urban areas, reporting figures on the main sectors and types of fuel source.

The main pie chart in figure 13 shows the repartition of energy consumption in the urban territory: Electricity, Heat and Transport. While the second pie chart report the shares of Heat per type of fuel source. Clearly, the amount of Heat consumed represents the highest shares of energy consumption in urban areas (49%).

Figure 13 Shares of Final energy consumption per sector in CoM signatories in Slovakia

Furthermore, Heat consumed in the urban areas, in the aforementioned signatories from Finland, is supplied by district heating networks, which represents 24% of the overall energy consumption in the territory.

In figure 14 are shown the shares of Heat supplied from District Heating network per type of fuel source. The main source used in the power plant connected to District Heating networks are fuelled by Natural Gas, with a share of 98%.

Figure 14 Shares of Heat supplied from District Heating network per type of fuel source in CoM signatories in Slovakia
In the following are reported typical measures taken from the SEAPs in Slovakia, for sustainable energy Demand.

Typical measures for sustainable Demand extracted from SEAPs in the region

Energy efficiency measures in buildings and Transport
- Renovation and energy management in public buildings;
- Tax bonus for effective residential building restoration
- Expansion of Bratislava Integrated Transport system;
- Utilisation of the Danube River as a transport corridor
- Increasing of energy efficiency of centralized heat supply systems

Fuel switch in SEAPs

The GHG reduction target will be achieved also through the switch from existing fossil fuel usage into renewables (3%).

In Table 20 are reported the amount of local energy production and estimated local energy production from renewables. The existing local energy production is calculated as a summation of Heat distributed through District heating networks and distributed generation of Heat and Power using renewable sources. The share of the local energy production, as defined above, represents 25% of the total energy consumption in the territory.

Table 20 Local energy production and estimated local energy production from RES in CoM signatories in Slovakia

<table>
<thead>
<tr>
<th>Current Local Energy Production in BEIs [MWh/year]</th>
<th>2,716,703</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimation on Local Energy production with RES by 2020 [MWh]</td>
<td>72,296</td>
</tr>
<tr>
<td>Share of estimated local energy production by 2020</td>
<td>3%</td>
</tr>
</tbody>
</table>

In Figure 15 are shown the shares of estimated Local energy production using renewable sources. The highest share of estimated energy production is Heat supplied by District heating networks using renewable source as primary energy (66%). Furthermore, 15% of estimated energy production from RES are planned to take place in Combined Heat and Power plants, and 19% is represented by distributed generation of Heat and Power in the territory.
In the following are reported typical measures taken from the SEAPs in Slovakia, for fuel switch.

**Typical measures for Fuel Switch extracted from SEAPs in the region**

- CHP Biogas station Moldava nad Bodvou
- DH Biomass boiler
- DH Biomethane station construction
- PV: construction of 10 photovoltaic power plants - building permit process in progress
- Improve the insulating properties, replacement heaters, production of energy from renewable sources.
- Wind Power: power plant preparation of wind power plant and air turbines in the cadaster area of Moldava nad Bodvou
VI. Sustainable Energy Action Plans in Finland

As of end of September 2014, 8 cities from Finland joined the Covenant of Mayors Initiative. Those cities cover 35% of the total population, as it is shown in table 21. In this assessment report, 86% in terms of population coverage have been analysed as they have provided the Sustainable Energy Action Plans.

Table 21 Covenant of Mayors coverage in Finland

<table>
<thead>
<tr>
<th>Number of signatories</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population covered</td>
<td>1,791,457 (35%)</td>
</tr>
<tr>
<td>Population covered in the assessment</td>
<td>1,539,482</td>
</tr>
<tr>
<td>Estimation on Investment Cost [Millions of Euros]</td>
<td>799</td>
</tr>
</tbody>
</table>

In table 22 are reported the amount of GHG emissions along with the reduction targets for the year 2020. In order to achieve these targets, cities have planned actions which could reduce by 24% the emission in the territory by 2020.

Table 22 GHG Emissions and estimated reductions in CoM signatories in Finland

<table>
<thead>
<tr>
<th>GHG Emissions in BEIs [tCO2-eq/year]</th>
<th>7,450,597</th>
</tr>
</thead>
<tbody>
<tr>
<td>GHG Emissions in BEIs per capita [tCO2-eq/cap]</td>
<td>4.83</td>
</tr>
<tr>
<td>Estimation on GHG Emissions reductions by 2020 [tCO2-eq]</td>
<td>1,767,124</td>
</tr>
<tr>
<td>Estimation on GHG Emissions reductions by 2020 per capita [tCO2-eq/cap]</td>
<td>1.5</td>
</tr>
<tr>
<td>Share of GHG Emissions Reductions by 2020</td>
<td>24%</td>
</tr>
</tbody>
</table>

Sustainable Demand in SEAPs

In table 23 are reported the amounts of energy consumptions and estimated energy savings by 2020, as planned in the SEAPs, due to end use efficiency. The GHG reduction target will be achieved through a more Sustainable Demand by reducing the energy consumption in their territories (13%).

Table 23 Final energy consumptions and estimated energy savings in CoM signatories in Finland

<table>
<thead>
<tr>
<th>Final Energy consumptions in BEIs [MWh/year]</th>
<th>29,684,111</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final Energy consumptions in BEIs per capita [MWh/cap]</td>
<td>19</td>
</tr>
</tbody>
</table>
In the following is described the pattern of energy consumption in urban areas, reporting figures on the main sectors and types of fuel source. The main pie chart in figure 16 shows the repartition of energy consumption in the urban territory: Electricity, Heat and Transport. While the second pie chart report the shares of Heat per type of fuel source. Clearly, the amount of Heat consumed represents the highest shares of energy consumption in urban areas (49%).

![Figure 16 Shares of Final energy consumption per sector in CoM signatories in Finland](image)

Furthermore, Heat consumed in the urban areas, in the aforementioned signatories from Finland, is supplied by district heating networks, which represents 37% of the overall energy consumption in the territory.

In figure 17 are shown the shares of Heat supplied from District Heating network per type of fuel source. The main source used in the power plant connected to District Heating networks are fuelled by coal, with a share of 66%.

![Figure 17 Shares of Heat supplied from District Heating network per type of fuel source in CoM signatories in Finland](image)

In the following are reported typical measure taken from the SEAPs in Finland, for sustainable energy Demand.
Typical measures for Sustainable Demand extracted from SEAPs in the region

Energy efficiency measures in buildings

- Energy efficient operation of existing buildings with staff education and implementing best practices
- Low energy and nearly zero energy buildings in housing sector and in tertiary sector
- Improvement of energy consumption monitoring
- Energy auditing and implementing identified energy saving measures
- Energy efficient operation of existing buildings: motivation and information
- New installations and replacements of existing public lighting with energy efficient lighting

Transport sector

- Increasing the share of renewable fuels to 20%
- Replacing existing fleet with energy efficient and low emission vehicles
- Improvement of fuel consumption monitoring
- Improving energy efficiency of metro and tram systems
- Energy efficiency requirements for bus service tendering
- Training for fuel saving way of driving
- Improving incentive parking facilities
- Congestion charges

Fuel switch in SEAPs

The GHG reduction target will be achieved also through the switch from existing fossil fuel usage into renewables (6.3%).

In table 24 are reported the amount of local energy production and estimated local energy production from renewables. The existing local energy production is calculated as a summation of Heat distributed through District heating networks and distributed generation of Heat and Power using renewable sources. The share of the local energy production, as defined above, represents 38% of the total energy consumption in the territory.

Table 24 Local energy production and estimated local energy production from RES in CoM signatories in Finland

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Local Energy Production in BEIs</td>
<td>11,286,975</td>
</tr>
<tr>
<td>Estimation on Local Energy production with RES by 2020</td>
<td>712,797</td>
</tr>
<tr>
<td>Share of estimated local energy production from RES by 2020</td>
<td>6.3%</td>
</tr>
</tbody>
</table>

In figure 18 are shown the shares of Estimated Local energy production using renewable sources. The highest share of estimated energy production is distributed generation of Heat and Power in the urban territory (65%). While 35% of estimated energy production from Res, are planned to take place in Combined Heat and Power plants.
Figure 18 Shares of Local energy production using renewable sources in CoM signatories in Finland

As reported in the SEAPs actions, 35% of fossil fuel energy source in CHP power plants will be replaced with renewable source.

In the following are reported typical measures taken from the SEAPs in Finland, for fuel switch.

**Typical measures for Fuel Switch extracted from SEAPs in the region**

- **CHP**: Increase in the usage of renewable energy sources in the local combined heat and power plant by 20%
- Small scale renewable energy production in buildings
- Procurement of zero emission electricity. By 2012 50% renewable electricity, by 2015 minimum 60% renewable electricity, by 2020 100% renewable electricity.
- Buildings built after 2013 are connected to the district heating network or to a heating system based on renewable energy
- Oil heating replaced 10% with district heating and 90% with renewable energy
- Small scale renewable energy production in buildings
- Replacing oil heating with geothermal heat or other renewable energy source in buildings other than residential buildings
- Service, municipal and industrial buildings built after 2013 are connected to the district heating network or to a heating system based on renewable energy
- Solid waste management and water and sewage treatment
2. RESULTS

Based on the assessment reports in these countries, we can summarize in the tables 25-27 the overall results coming from the Sustainable Energy Action Plans submitted by signatories who joined the Covenant of Mayors initiative from the "stress test" countries.

In table 25 are reported the average GHG emissions per capita by country, while the average in the region is \(4.4 \text{ [tCO}_2\text{-eq/year]}\). The EU-28 average for GHG Emission in CoM sectors\(^1\) (residential, transport, services and power generation sectors) is \(6.46 \text{ [tCO}_2\text{-eq/cap]}\). The average GHG emission reduction by 2020 in the region is \(1.5 \text{ [tCO}_2\text{-eq/cap]}\) or better expressed in terms of shares \(34\%\).

Table 25 GHG Emission per capita and estimated GHG Emission Reduction per capita in CoM signatories from "stress test" countries

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>3.15</td>
<td>1.30</td>
<td>41%</td>
</tr>
<tr>
<td>Estonia</td>
<td>9.50</td>
<td>2.41</td>
<td>25%</td>
</tr>
<tr>
<td>Latvia</td>
<td>4.59</td>
<td>2.55</td>
<td>55%</td>
</tr>
<tr>
<td>Lithuania</td>
<td>3.92</td>
<td>1.35</td>
<td>35%</td>
</tr>
<tr>
<td>Slovakia</td>
<td>4.75</td>
<td>1.03</td>
<td>22%</td>
</tr>
<tr>
<td>Finland</td>
<td>4.84</td>
<td>1.15</td>
<td>24%</td>
</tr>
</tbody>
</table>

In table 26 are reported the average Final energy consumption by country, while the average in the region is \(16 \text{ [MWh/cap]}\). The EU-28 average Final energy consumption is \(19.22 \text{ [MWh/cap]}\) (transport, residential and services sectors)\(^2\). The average energy savings by 2020 in the region is \(3.3 \text{ [MWh/cap]}\) or better expressed in terms of shares \(21\%\).

Table 26 Final energy consumption per capita and estimated energy savings per capita in CoM signatories from "stress test" countries

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>7.02</td>
<td>2.88</td>
<td>41%</td>
</tr>
<tr>
<td>Estonia</td>
<td>23.24</td>
<td>1.26</td>
<td>5%</td>
</tr>
<tr>
<td>Latvia</td>
<td>21.66</td>
<td>6.05</td>
<td>28%</td>
</tr>
</tbody>
</table>


\(^2\)Data from Eurostat website reference year 2005: Final energy consumption in transport, residential and services sectors
In table 27 are reported the Local energy production by country, the share of Local energy production in the Final energy consumption, the Estimated local energy production from RES, and their share on the Local energy production. The share of Local energy production in the region is 36% of the Final Energy Consumption. While the share of Estimated Local energy production from RES by 2020 is 15% of the current Local energy production.

Table 27 Local energy production and estimated Local Energy Production from RES by 2020 in CoM signatories from "stress test" countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Local energy production in BEIs [MWh/year]</th>
<th>Share of Local energy production on Final energy consumption</th>
<th>Estimated local energy production with RES by 2020 [MWh]</th>
<th>Share of Estimated local energy production from RES by 2020 on Local energy production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>5,197,425</td>
<td>35%</td>
<td>572,406</td>
<td>11%</td>
</tr>
<tr>
<td>Estonia</td>
<td>2,658,513</td>
<td>28%</td>
<td>1,816,703</td>
<td>68%</td>
</tr>
<tr>
<td>Latvia</td>
<td>8,122,640</td>
<td>37%</td>
<td>723,508</td>
<td>9%</td>
</tr>
<tr>
<td>Lithuania</td>
<td>8,736,978</td>
<td>42%</td>
<td>2,074,483</td>
<td>24%</td>
</tr>
<tr>
<td>Slovakia</td>
<td>2,716,703</td>
<td>24%</td>
<td>72,296</td>
<td>3%</td>
</tr>
<tr>
<td>Finland</td>
<td>11,286,975</td>
<td>38%</td>
<td>712,797</td>
<td>6%</td>
</tr>
</tbody>
</table>
3. CONCLUSIONS

By implementing the CoM programme, the European Commission has given visibility to the role of cities, their relevant contribution to EU2020 targets.

Based on the assessment of measures from SEAPs of signatories from "stress test" countries, the main findings are reported in the following.

The current Final energy consumption in the heating sector using natural gas as primary source is 3,661 Millions of cubic meters (or 3.03 Mtoe). The Estimated Energy savings by 2020 from SEAPs results in 22.5 TWh (or 1.94 Mtoe). Due to the fact that this amount of energy savings will derive mainly from actions focused on the Building sector, this will be translated in a reduction of natural gas consumption of around 2,343 Millions of cubic meters of natural gas. In conclusion we can affirm that:

60% of natural gas consumed in the building sector for heating can be saved due to energy efficiency measures planned in the Sustainable Energy Action Plans submitted by CoM signatories in the region.

Furthermore, the estimated local energy production using renewables in the building sector as primary source results in 5.9 TWh (or 0.51 Mtoe) by 2020. The current energy production from renewables is 5.3 TWh (or 0.45 Mtoe). In addition, Gas consumption in district heating in Estonia, Latvia, Lithuania and Finland represents more than 10% of the total gas consumption and around 7% in Slovakia (Eurostat source). In conclusion we can affirm that:

The share of local energy production using Renewable sources will double by 2020 due to fuel switch measures planned in the Sustainable Energy Action Plans submitted by CoM signatories in the region.

It is important to stress the fact, that the majority of measures in replacing fossil fuels with renewables are taken place in the district heating networks and CHP plants.
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Stimulating innovation
Supporting legislation

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