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EU energy technology trade

Import and export

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Title EU energy technology trade: Import and export.

Abstract

This report analyses the EU trade in low-carbon energy technologies. It shows commercial exchanges with countries outside the EU as well as trade within the EU at the level of individual Member States. Trade performances vary in relation to sectors: for some technologies the EU has a positive trade balance, while in others the EU needs to import from abroad.

Contents

- Executive summary 1
- 1 Introduction 2
- 2 European trade in the LCETs sector 5
- 3 Biofuels 9
- 4 Clean coal and gas 13
- 5 Energy storage 17
- 6 Heating 21
- 7 Hydropower 25
- 8 Insulation 29
- 9 Nuclear energy 33
- 10 Smart meters 37
- 11 Solar PV 41
- 12 Solar thermal 46
- 13 Wind 50
- 14 Conclusions 54
- References 56
- List of abbreviations and definitions 60
- List of boxes 61
- List of figures 62
- List of tables 63
- Annexes 64
 - Annex 1. Identification of low-carbon energy technologies (LCETs) 64
 - Annex 2. Background 68
 - Annex 3. Available dataset 70
 - Annex 4. List of countries 78

Executive summary

The focus of this report is on the international trade in the sector of low-carbon energy technologies (LCETs). It helps better assessing the European Union's (EU) comparative advantage in each technology sector. It also allows the analysis at the level of individual Member States.

For some technologies, as in the case of clean coal and gas, wind and heating, the value of EU exports overcomes the value of imports, indicating a positive trade balance; on the other side, in the solar photovoltaic (PV) sector the EU has a negative trade balance.

The total of commercial exchanges regarding LCETs has increased over time, in particular because of the growing relationship with China and with countries in western Asia and northern Africa. These complement the already established partnerships with the United States (US) and the other European countries (Norway, Russia and Switzerland).

In the low-carbon technologies sector, total internal European trade is higher in value than the total trade with countries outside the EU. Furthermore, some Member States show the opposite trade balances in respect to these two groups. Depending on technology areas and on the period of analysis, the trade balance of individual countries varies over time and according to the partner countries considered.

Policy context

The Communication 'Towards an Integrated Strategic Energy Technology (SET) Plan: Accelerating the European energy system transformation' called for a further strengthened SETIS, the information system that manages and operates the monitoring and reporting scheme of the SET Plan. SETIS supports the implementation and continuous development of the integrated SET Plan, through a more diligent and intelligent use of the available information, data and reporting practices by stakeholders and Member States. In this context, the monitoring and reporting activities of SETIS support the following:

- The Annual State of the Energy Union Report: SETIS monitors and reports on a number of key indicators that are used to measure progress in the implementation of the fifth dimension of the Energy Union, i.e. on Research, Innovation and Competitiveness (RIC).
- SET Plan implementation: SETIS will reports as necessary, addressing various aspects of SET Plan implementation, in agreement and collaboration with the Member States.

This report is relevant to further develop and enhance the SETIS support for the implementation of the Energy Union strategy, in particular the fifth pillar, RIC. It adds to the existing key performance indicators (KPIs), namely trend in patents and investments in research and innovation, and a new dimension of analysis: import and export in the sector of low-carbon energy technologies.

1 Introduction

International trade is a key determinant of both economic growth of countries and activity of companies. This dual perspective, however, has often caused the misleading association of company competitiveness with country competitiveness (Krugman, 1994). Companies compete in the market and a lack of competitiveness might cause failure. In contrast, countries trade and this benefits all. While market size for companies can grow, and they can expand their activities even beyond that market, always aiming at higher competitiveness, at country level this does not work: globally, the sum of all trade balances must equal zero, by definition. Therefore, the benefits of trade for countries go beyond the simple trade balance: for instance a country benefits from import of necessary goods that it is not able to produce with its own resources and capabilities, or able to produce in a competitive way. On the other hand, increasing export is linked to higher productivity, which is subordinated to technological capabilities and factor endowments. The combination of continued accumulation of capabilities and exploitation of enabling factors boosts the comparative advantage of countries. Clearly, a country has a higher benefit from trade when it specialises in sectors in which it has a comparative advantage. For these reasons it is important to monitor international trade between countries. It helps to better assess which countries have a comparative advantage, in which sectors and, consequently, it also enables an assessment of countries' specialisation.

The focus of this report is on international trade in the sector of low-carbon energy technologies (LCETs). The European Union (EU) in the most recent years has provided relevant support to promote a model of sustainable economic growth in line with the achievement of environmental goals. This report allows an assessment of European competitiveness in the sector of LCETs (European Commission, 2015a, b). It facilitates the analysis of the ability to generate competitive capabilities in LCETs sector, both at level of individual European Member States and at the level of the whole EU. The evaluation of competitiveness will provide stakeholders with useful insights for planning policy interventions and business strategies.

In order to convey clear messages, infographics are used to present data. The report analyses trade flows from 2000 to 2015. Many graphs show data aggregated in four periods: from 2000 to 2003, from 2004 to 2007, from 2008 to 2011 and from 2012 to 2015. This choice facilitates comparison of four important steps in the LCETs sector in Europe. The first, 2000-2003, is considered as the period in which the process towards a "Sustainable Europe" started (European Commission, 2000, 2001). The following period, 2004-2007, is characterised by the implementation of the Phase 1 of the EU Emissions Trading System (EU ETS) Directive (2003/87/EC). The third period, 2008-2011, mainly reflects an analysis of the consequences of the global financial crisis rather than of policy actions. Lastly, the period 2012-2015 highlights to what extent the EU has recovered from the economic crisis, in relation to trade in LCETs.

Trade flows related to LCETs are analysed in monetary terms: import (M) and export (X) are expressed in billion euros [EUR Bn]. The way in which the commercial trade of goods is codified at international level and the classifications used to determine low-carbon energy technologies are explained in Annex 1. Eleven technologies have been identified (Table 2): biofuels, clean coal & gas, energy storage, heating, hydropower, insulation, nuclear energy, smart meters, solar PV, solar thermal and wind. Annex 2 provides a general background of studies on both the identification of energy-related technologies and early findings in relation to international trade. Among the available datasets (see Annex 3), the Easy Comext database was chosen as the unique source of data. It provides trade data for the 28 European Member States (EU28), which are the only reporting countries. Trade within the EU28 defines the concept of intra-EU28 trade, while extra-EU28 consists of all the other countries worldwide. Annex 4 gives the complete list of countries considered in this report, including their classification in geographic areas.

The following section gives an overview of the European trade for the selected LCETs, while the remaining sections examine trade for each individual technology. At the beginning of each section a short paragraph summarises the main findings derived from the subsequent infographics.

Section 2 consists of six figures:

- *a) EU28 - Trade balance (X-M) with Extra-EU28 [EUR Bn]*. This figure shows the trade balance (calculated as import minus export) for each technology, over time (2000-2015). It facilitates the comparison between technologies and displays whether the EU has a positive or negative trade balance with extra-EU28 countries, and on what scale.
- *b) EU28 - Technology share over total export and import with Extra-EU28 [EUR Bn]*. This figure shows, for the four periods, the total value of export and import. Each pie chart also presents the share of each technology. It is possible to analyse how import and export differentiate, how they change over time and how technologies impact on trade.
- *c) EU28 - Total trade (X+M) with Extra-EU28 and Intra-EU28 [EUR Bn]*. The bar-chart compares the total trade flow, split by technology, between intra-EU28 and extra-EU28 and over the four periods. Total trade flow is calculated as the sum of import (M) and export (X), and gives an indication on the total monetary quantity that has been exchanged, differentiated between intra-EU28 and extra-EU28.
- *d) Country trade balance (X-M) with Extra-EU28 [EUR Bn]*. This figure shows the 28 trade balances at the level of Member States with extra-EU28, differentiated between technologies and over the four periods. It provides useful elements to assess changes in countries' trade balance over time and between them.
- *e) EU28 - Top 20 Extra-EU28 in 2000 [EUR Bn]*. The two bar charts show the total export to and total import from the top 20 countries outside the EU in 2000. For each country the technology share is also shown. The comparison between figure e) and figure f) permits the analysis of changes between 2000 and 2015.
- *f) EU28 - Top 20 Extra-EU28 in 2015 [EUR Bn]*. The two bar charts show the total export to and total import from the top 20 countries outside the EU in 2015. For each country the technology share is also shown. The comparison between figure e) and figure f) permits the analysis of changes between 2000 and 2015.

The other sections examine each technology individually, and consist of five figures:

- *i) EU28 - Technology trade balance (X-M) with Extra-EU28 [EUR Bn]*. This figure presents, for each year, the import from and export to extra-EU28 countries, and the trade balance. It permits the analysis of EU technology specialisation on a yearly basis.
- *ii) Number of Extra-EU trading countries*. Two bar charts, regarding respectively export and import, represent the number of extra-EU28 countries having commercial relationships with the EU. This information makes it possible to assess whether the number of partners has increased or not over time for a given technology.
- *iii) EU28 - Trade balance (X-M) with world regions outside EU28 [EUR Bn]*. Four maps, representative of the four periods, show the scale of European trade balances (negative in red, positive in green) with geographic areas outside the EU28. For a given technology sector, it enables the analysis of the intensity of the EU trade flows with different parts of the world.
- *iv) EU28 - Sum of export vs sum of import with Extra-EU28. Bubble size: Avg.GDP [EUR Bn]*. Four scatter plots, related to the four periods, indicate how countries outside the EU are positioned in respect to European import and export for a

specific technology. It compares commercial relations among different partners and the changes over the periods.

- *v) Country trade balance (X-M) with Extra-EU28 and Intra-EU28 [EUR Bn].* This infographic shows the 28 Member States on eight different maps. Four maps show the countries' trade balances with extra-EU28 in the four periods, and the other four regard trade balances with intra-EU28 countries. The different scale of the colours indicates whether Member States have positive (in green) or negative (in red) trade balances, related to exchanges inside and outside the European Union.

2 European trade in the LCETs sector

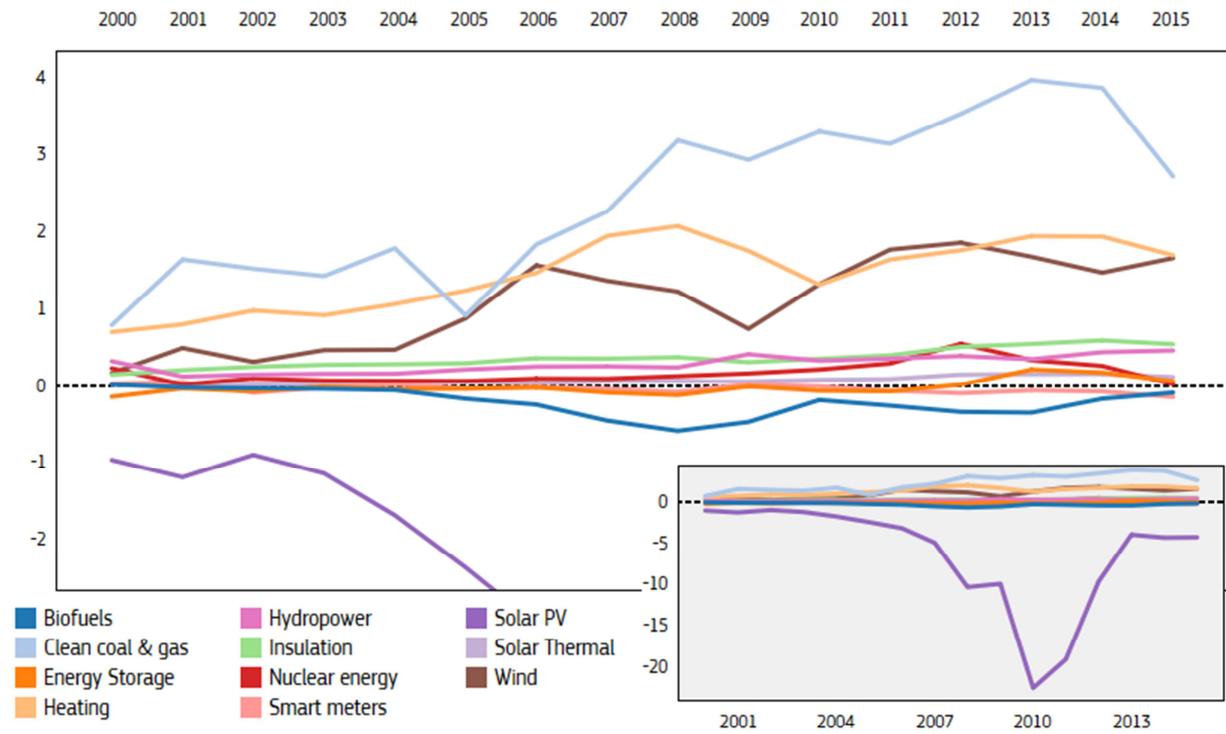
The European trade balances with extra-EU28 countries vary across technologies. During the whole period analysed, from 2000 to 2015, the EU experiences positive trade balances in the following sectors: clean coal and gas, heating and wind. This positive trend is greater than that of other technologies, such as insulation, hydropower, nuclear and solar thermal. With respect to two other sectors, namely energy storage and smart meters, the EU has roughly the same level of import and export, resulting in an almost neutral trade balance over time. In contrast, the EU has negative trade balances for the remaining two sectors: biofuels and solar PV. The last one, however, shows a large negative trough in 2010, which is due to two concurrent events: the global financial crisis and the internal Chinese policies in this sector (more details in section 11 and in Box 1).

Over the four periods of analysis, the total value of export from the EU to extra-EU28 countries increases substantially: between the periods 2000-2003 and 2012-2015, its value almost doubles. Between these two periods, many sectors increase their export: in particular the share of export of wind technology over the total export increases from 4% to 11%, and it moves from 5% to 9% in the solar PV sector. At the same time, the share of export of clean coal and gas decreases from 56% to 45%. On the other hand, the value of EU import from extra-EU28 countries shows a different trend. During the period 2008-2011, the EU imports 3.5 times more than the value registered in the first period, 2000-2003. This is mainly due to the increase in import in the solar PV sector: its share, over the total import, increases from 23% to 72%. Nevertheless, in the following period, 2012-2015, both the total import and its share decrease, resulting in a higher impact of other technologies.

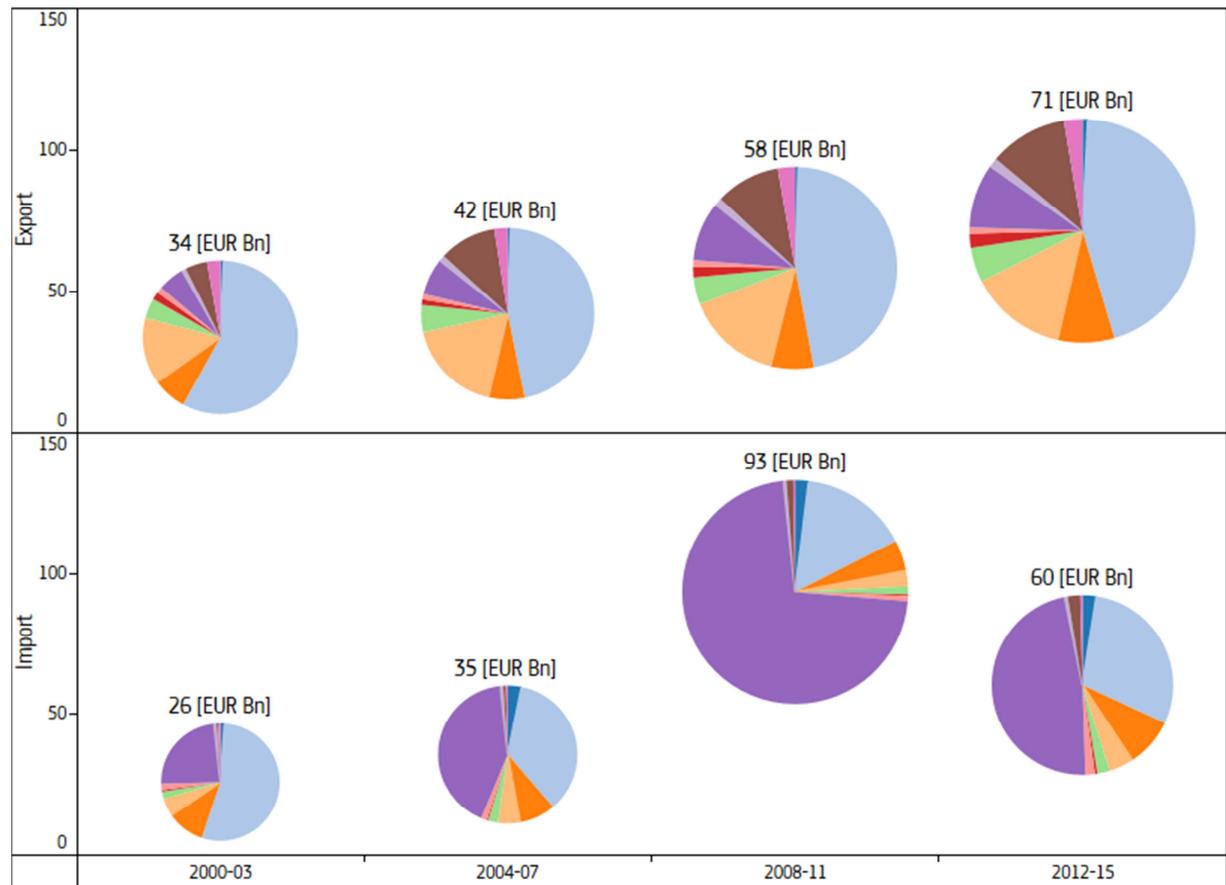
In all the four periods analysed, the total trade flow (calculated as the sum of import plus export) within the 28 Member States is higher than the total trade flow between the EU and extra-EU28 countries. However, this figure differentiates among technologies. For example, the total trade flow of clean coal and gas with countries outside the EU is always bigger than the total flow intra-EU28. On the contrary, other sectors, such as biofuels, energy storage, insulation and wind, show the reverse tendency: they have the total trade flow intra-EU28 bigger than the flow with extra-EU28 countries. In the solar PV sector the total trade flow grows considerably in the period 2008-2011 in comparison with the previous two periods. This trend takes into account both flows within the EU and those with countries outside the EU. However this figure decreases in the next period.

At country level, each Member States shows different characteristics. The individual trade balances with extra-EU28 countries vary over time and among technologies. In the first period, 2000-2003, three countries have a positive trade balance, considering the sum of the 11 technologies. These are Denmark, France and Italy. Germany and the United Kingdom, instead, have a positive balance that is almost equal to their negative balance, resulting in a quasi-neutral balance. A similar tendency is present in the subsequent period, 2004-2007. Only Spain and the Netherlands differentiate, since they show an overall negative trade balance. During the third period, 2008-2011, the majority of the Member States experience a negative trade balance in the solar PV sector. This affects particularly Germany, Spain, Italy and the Netherlands. In the final period, 2012-2015, countries' trade balances changes completely. For example, Germany, by reducing the negative balance in the solar PV sector and at the same time increasing its positive balance in both wind and clean coal and gas sectors, shows a total positive balance. Even if at a lower degree, the same change in the trade balances is noticeable for Spain, Italy and France. Differently, the Netherlands and the United Kingdom continue to have a negative trade balance in the solar PV sector. Interestingly, Denmark, in the four periods analysed, shows more or less the same level of trade balance which is almost totally influenced by the positive balance in the wind sector.

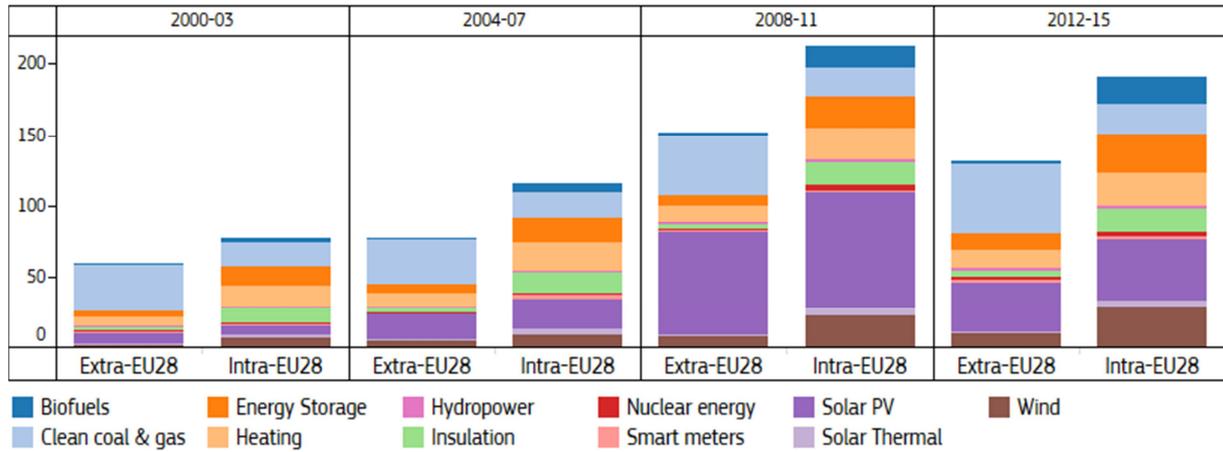
a) EU28 - Trade balance (X-M) with Extra-EU28 [EUR Bn]



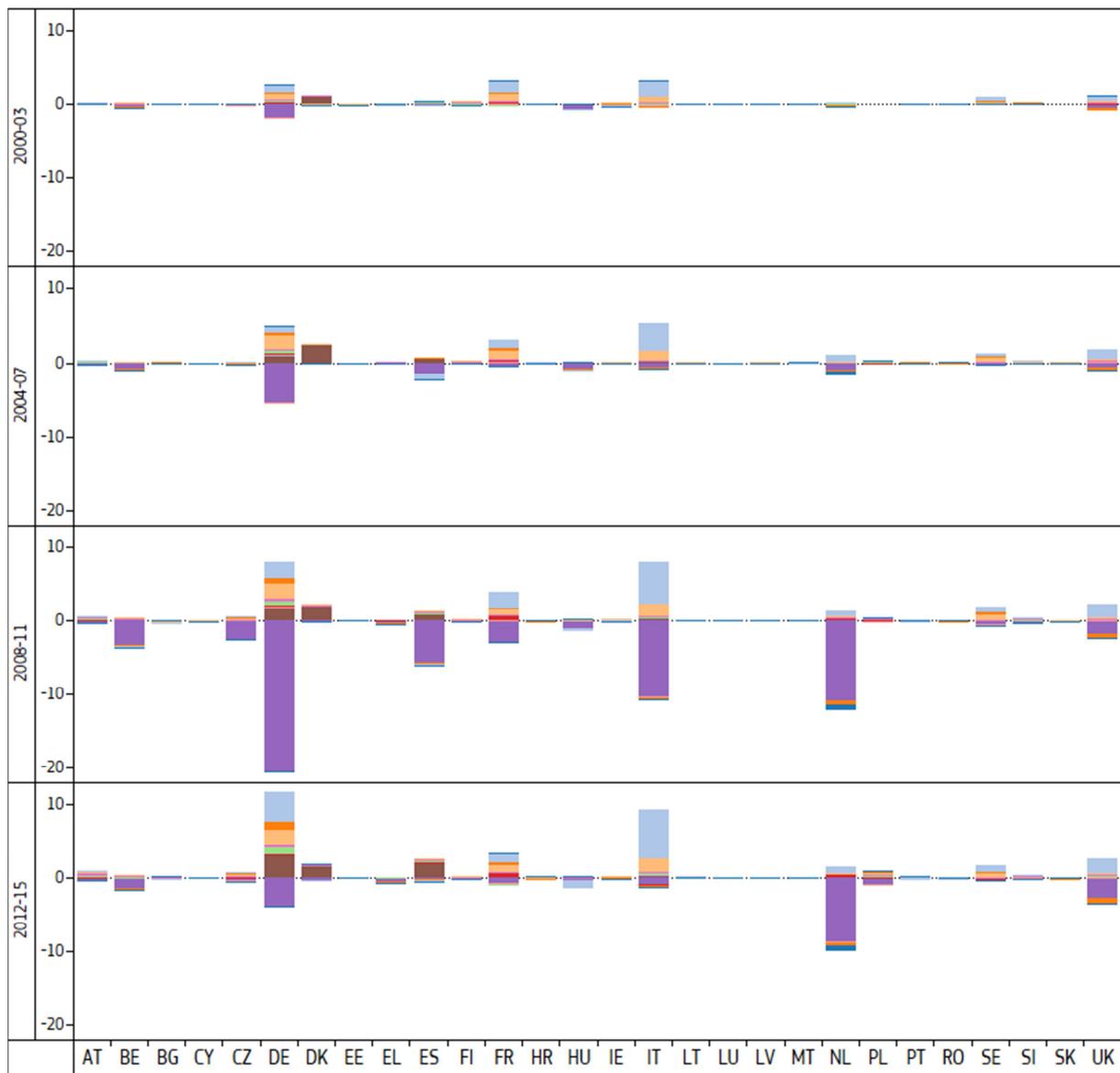
b) EU28 - Technology share over total export and import with Extra-EU28 [EUR Bn]



c) EU28 - Total trade (X+M) with Extra-EU28 and Intra-EU28 [EUR Bn]

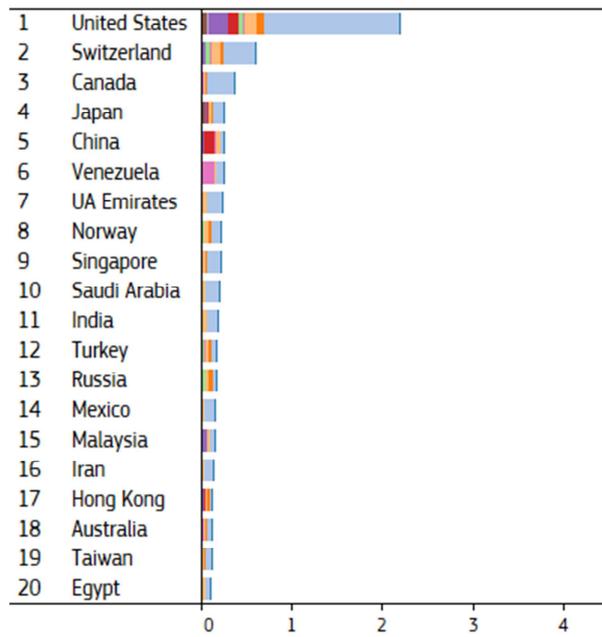


d) Country trade balance (X-M) with Extra-EU28 [EUR Bn]

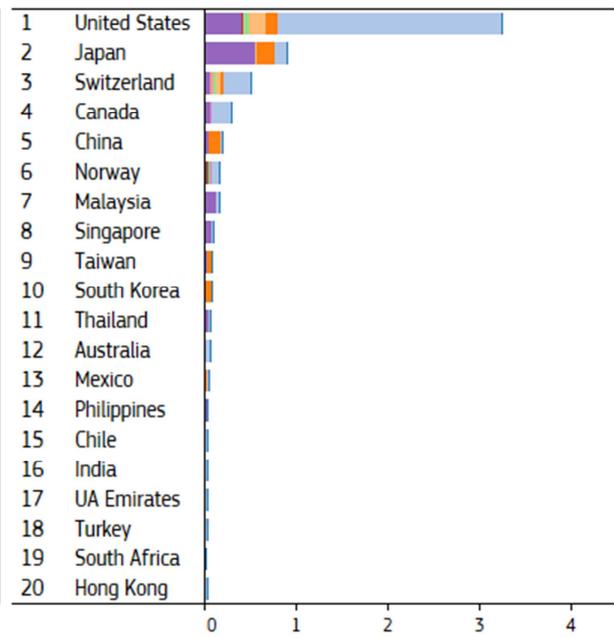


e) EU28 - Top 20 Extra-EU28 in 2000 [EUR Bn]

Export

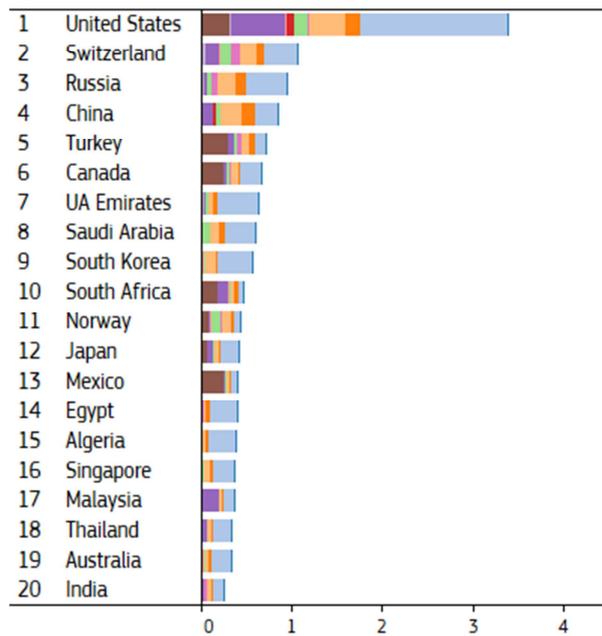


Import

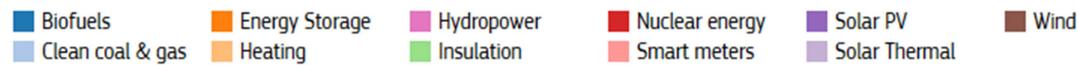
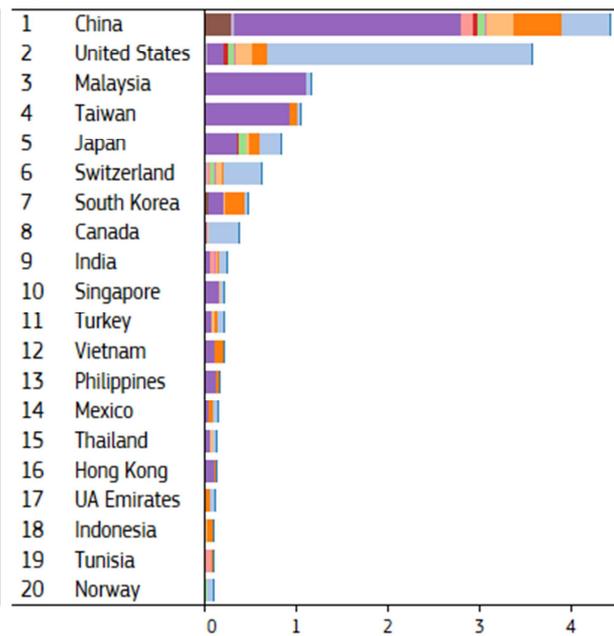


f) EU28 - Top 20 Extra-EU28 in 2015 [EUR Bn]

Export



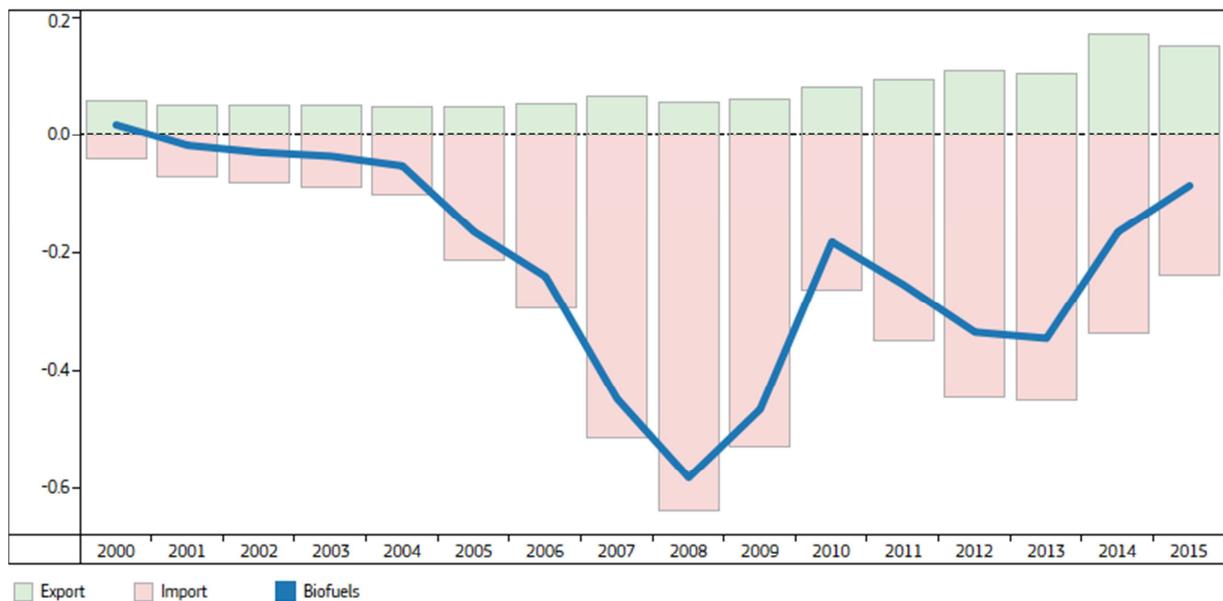
Import



3 Biofuels

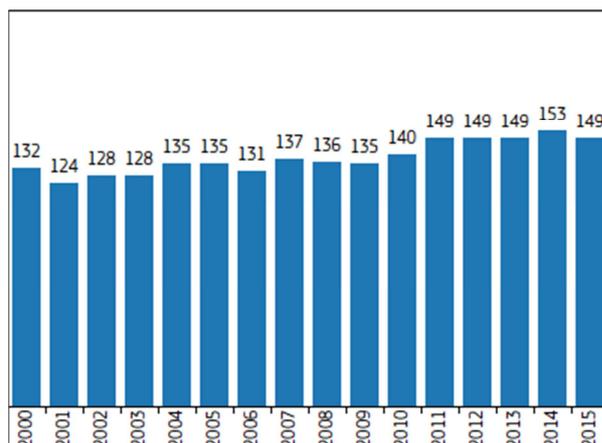
The EU trade balance in the biofuels sector is negative in all the years, from 2001 to 2015, with the lowest point in 2008. On average, the number of commercial partners increases for both export and import. South America is the region of the world with which the EU has the largest level of negative balance, while the balance is positive with eastern and western Asia, and with middle and western Africa. At country level, the EU imports mainly from Brazil, Guatemala and Peru and exports more to United States, Switzerland, Norway, Hong Kong and Cameroon, but the individual Member States perform differently. The Netherlands is the country with the largest negative trade balance with extra-EU28 countries, while it has a positive balance with intra-EU28. However, France is the European country with the highest positive trade balance with EU countries, while Germany has the largest negative balance with intra-EU28.

i) EU28 - Technology trade balance (X-M) with Extra-EU28 [EUR Bn]: Biofuels

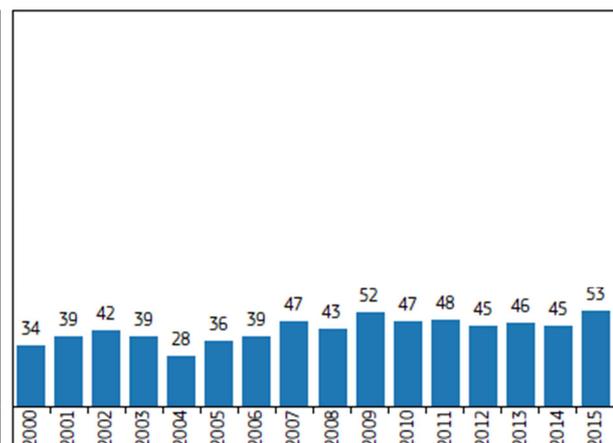


ii) Number of Extra-EU trading countries: Biofuels

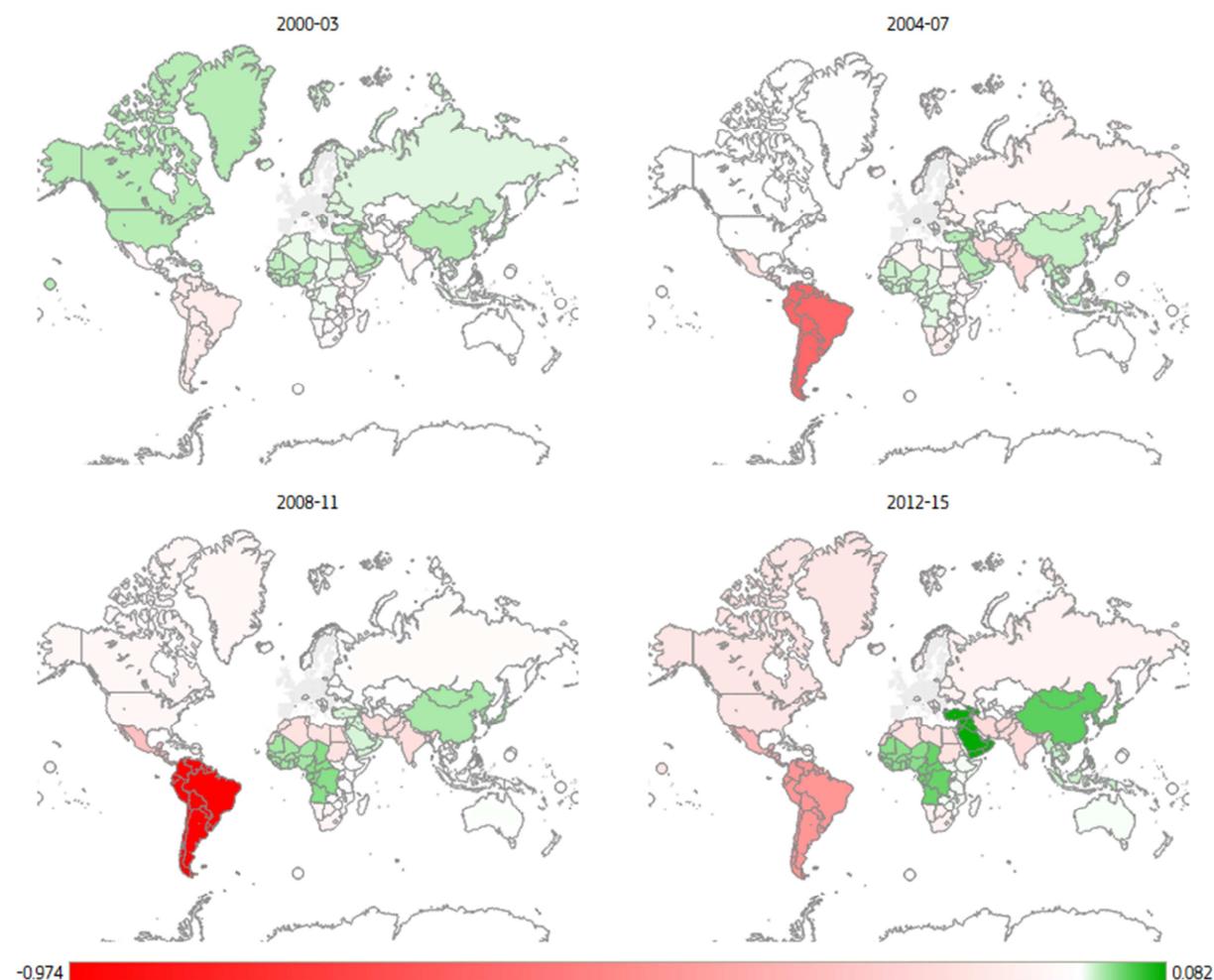
Export



Import



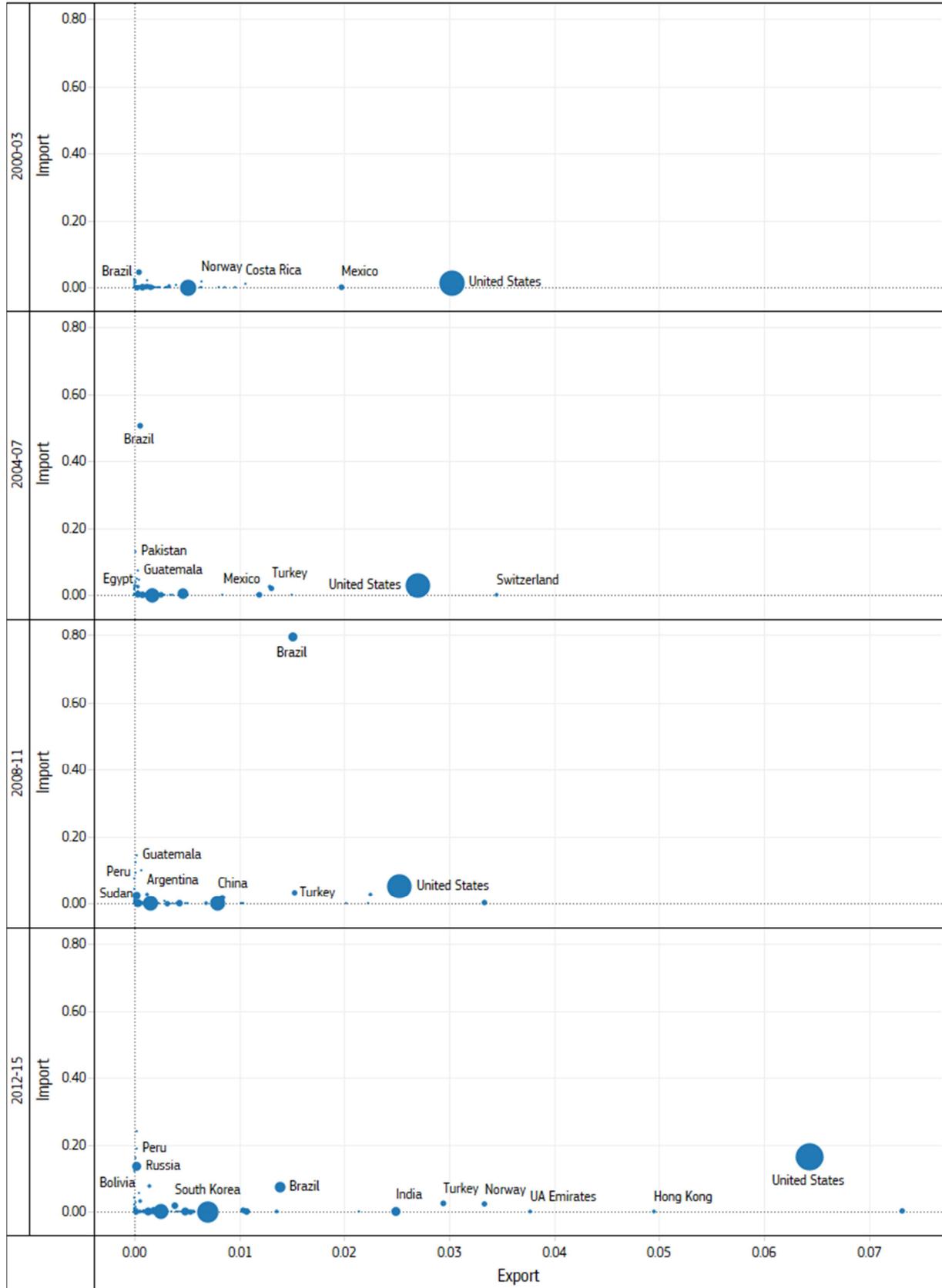
iii) EU28 - Trade balance (X-M) with world regions outside EU28 [EUR Bn]: Biofuels



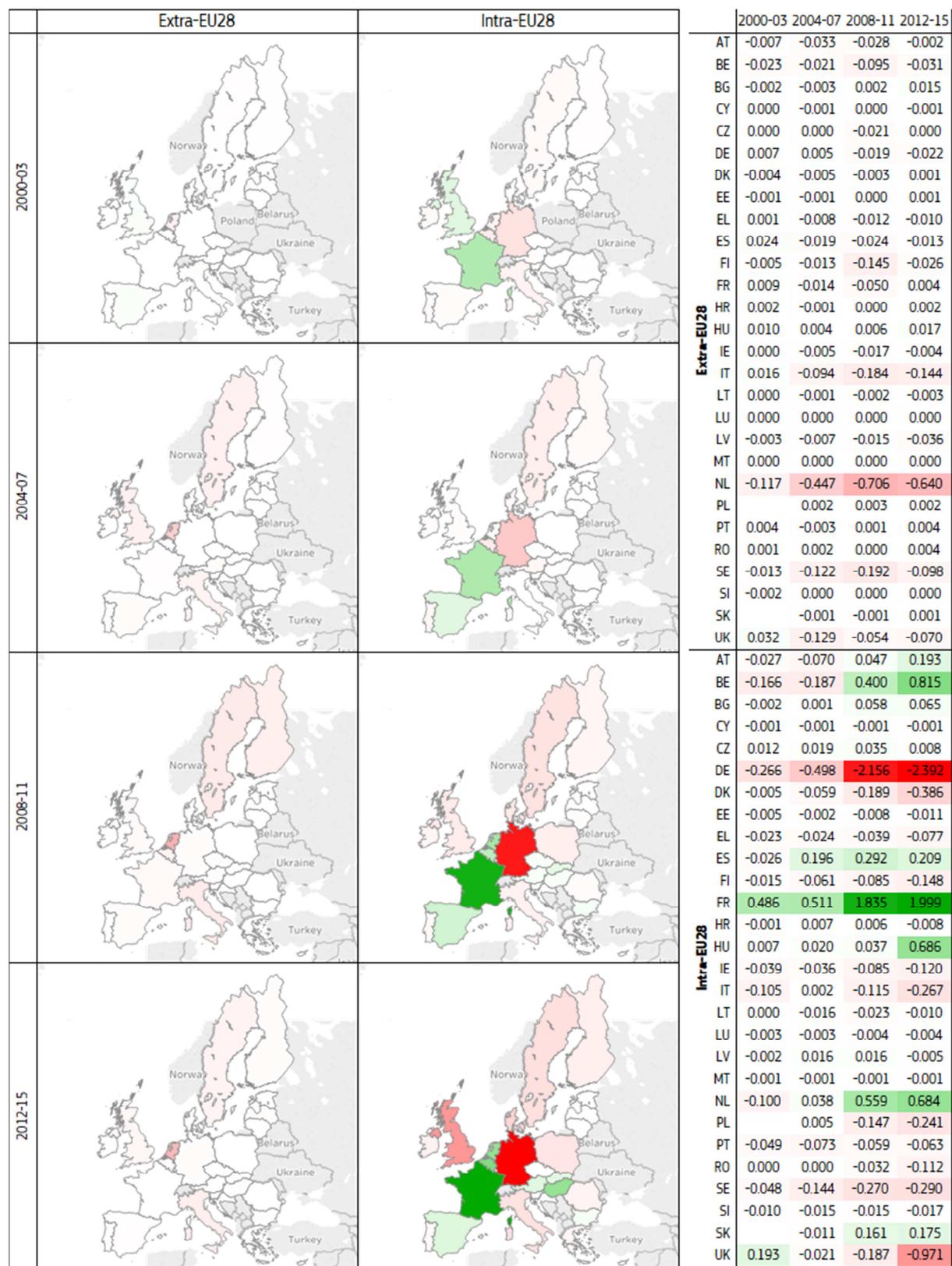
Region	2000-03				2004-07				2008-11				2012-15			
	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15
Africa, Eastern	-0.027	-0.024	-0.013	0.003												
Africa, Middle	0.003	0.007	0.031	0.042												
Africa, Northern	0.006	-0.032	-0.107	-0.109												
Africa, Southern	-0.026	-0.054	-0.038	-0.049												
Africa, Western	0.016	0.012	0.024	0.031												
America, Caribbean	0.011	-0.022	-0.045	-0.046												
America, Central	-0.024	-0.107	-0.234	-0.278												
America, Northern	0.018	0.000	-0.028	-0.094												
America, South	-0.065	-0.573	-0.974	-0.397												
Antarctica	0.000	0.000	0.000	0.000												
Asia, Central	0.000	0.000	-0.007	0.000												
Asia, Eastern	0.018	0.015	0.023	0.045												
Asia, South-Eastern	0.004	0.014	-0.004	0.013												
Asia, Southern	-0.025	-0.127	-0.117	-0.133												
Asia, Western	0.019	0.018	0.010	0.082												
Oceania, Australia & New Zealand	0.000	0.000	0.001	0.002												
Oceania, Melanesia	0.000	0.001	0.001	0.001												
Oceania, Micronesia	0.000	0.000	0.000	0.000												
Oceania, Polynesia	0.000	0.000	0.000	0.000												
Rest of Europe	0.008	-0.036	-0.009	-0.044												

Top 10 Extra-EU28					
	2000-03	2004-07	2008-11	2012-15	
Export	1	United States	Switzerland	Switzerland	Switzerland
	2	Switzerland	United States	United States	United States
	3	Mexico	Israel	Norway	Hong Kong
	4	Costa Rica	Turkey	Cameroon	UA Emirates
	5	Jamaica	Norway	Hong Kong	Norway
	6	Israel	Mexico	Turkey	Turkey
	7	Algeria	Hong Kong	Brazil	India
	8	Norway	Singapore	Guinea	Cameroon
	9	Nigeria	Cameroon	Israel	Brazil
	10	Hong Kong	China	Algeria	Israel
Import	1	Brazil	Brazil	Brazil	Guatemala
	2	Pakistan	Pakistan	Guatemala	Peru
	3	Zimbabwe	Guatemala	Pakistan	United States
	4	Guatemala	Ukraine	Egypt	Pakistan
	5	Nicaragua	Egypt	Peru	Russia
	6	South Africa	Peru	Bolivia	Bolivia
	7	Norway	Swaziland	United States	Egypt
	8	Bolivia	United States	Costa Rica	Brazil
	9	United States	Costa Rica	Turkey	Sudan
	10	Ukraine	South Africa	Jamaica	Costa Rica

iv) EU28 - Sum of export vs. sum of import with Extra-EU28. Bubble size: Avg.GDP [EUR Bn]: Biofuels



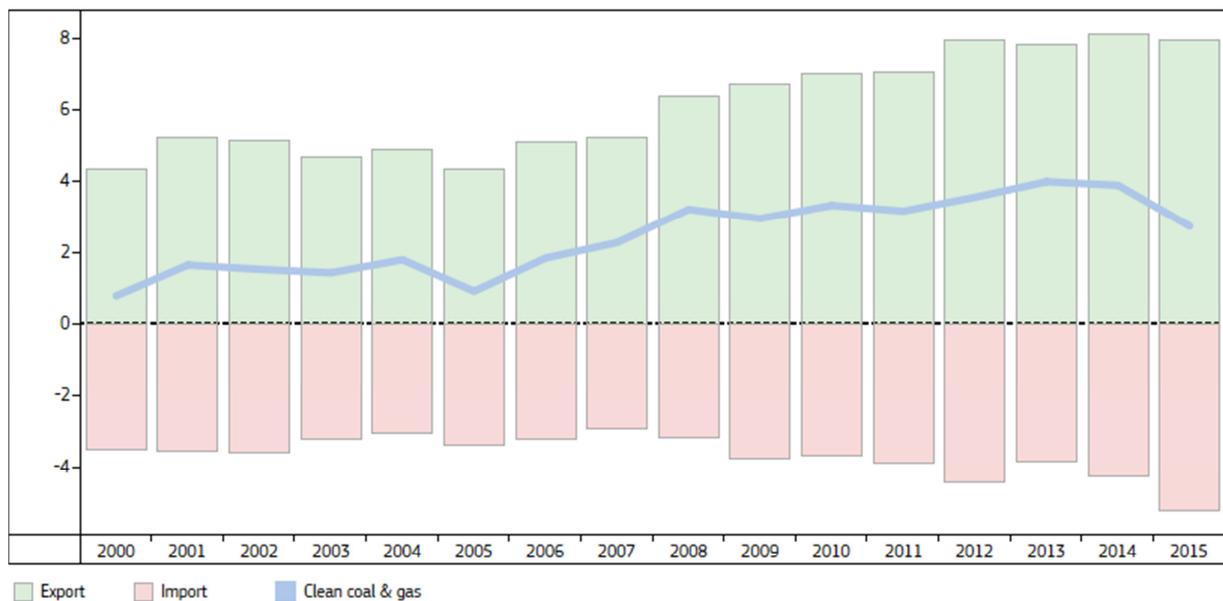
v) Country trade balance (X-M) with Extra-EU28 and Intra-EU28 [EUR Bn]: Biofuels



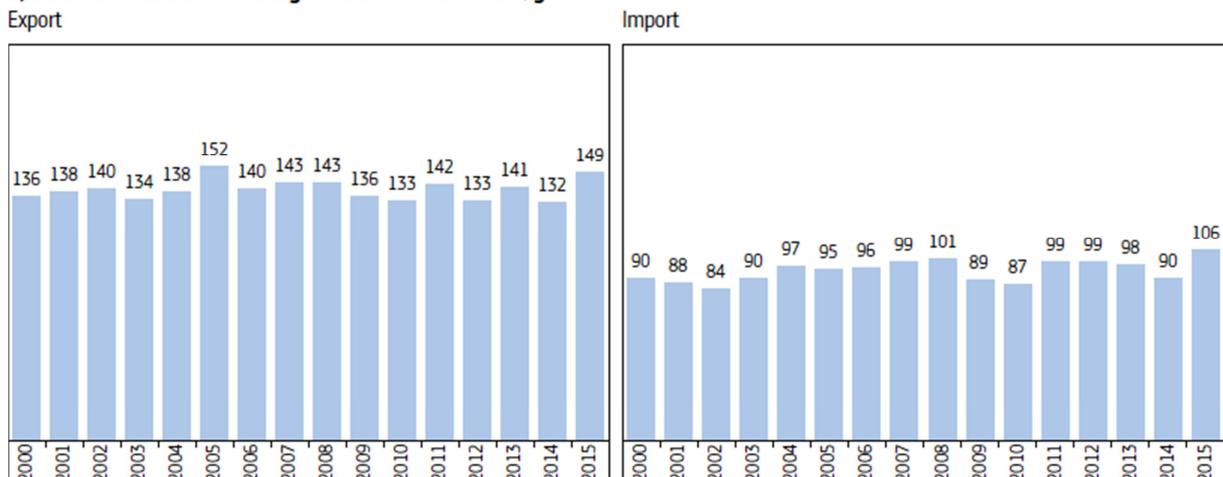
4 Clean coal and gas

The EU trade balance in clean coal and gas sector is always positive, with an increasing trend between 2005 and 2008. The number of commercial partners is almost constant over time, except in 2008 and 2009 when it shows a reduction for both import and export. North America is the region of the world with which the EU has the largest level of negative balance, while the balance is positive with many other regions of the world, in particular with western Asia and northern Africa. The United States and Canada are the two main partners for both import and export, followed by Switzerland and Japan, for import, and by the United Arab Emirates, Iran and China for export. Among the individual Member States, Italy has the highest level of positive trade balance with extra-EU28, while its trade is negative with intra-EU28. However, in the last period, the Netherlands has the largest negative balance with intra-EU28 and Hungary with extra-EU28.

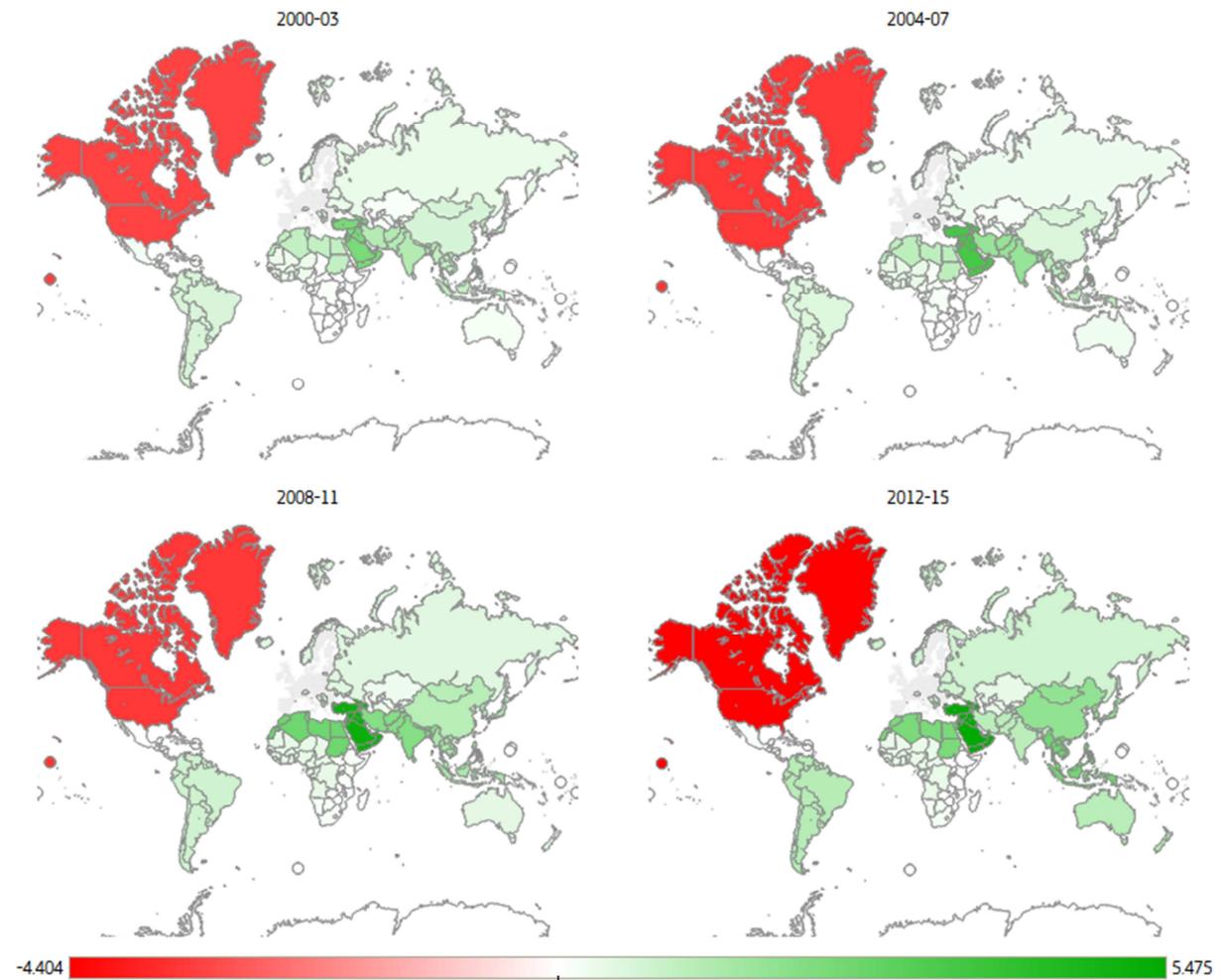
i) EU28 - Technology trade balance (X-M) with Extra-EU28 [EUR Bn]: Clean coal & gas



ii) Number of Extra-EU trading countries: Clean coal & gas



iii) EU28 - Trade balance (X-M) with world regions outside EU28 [EUR Bn]: Clean coal & gas

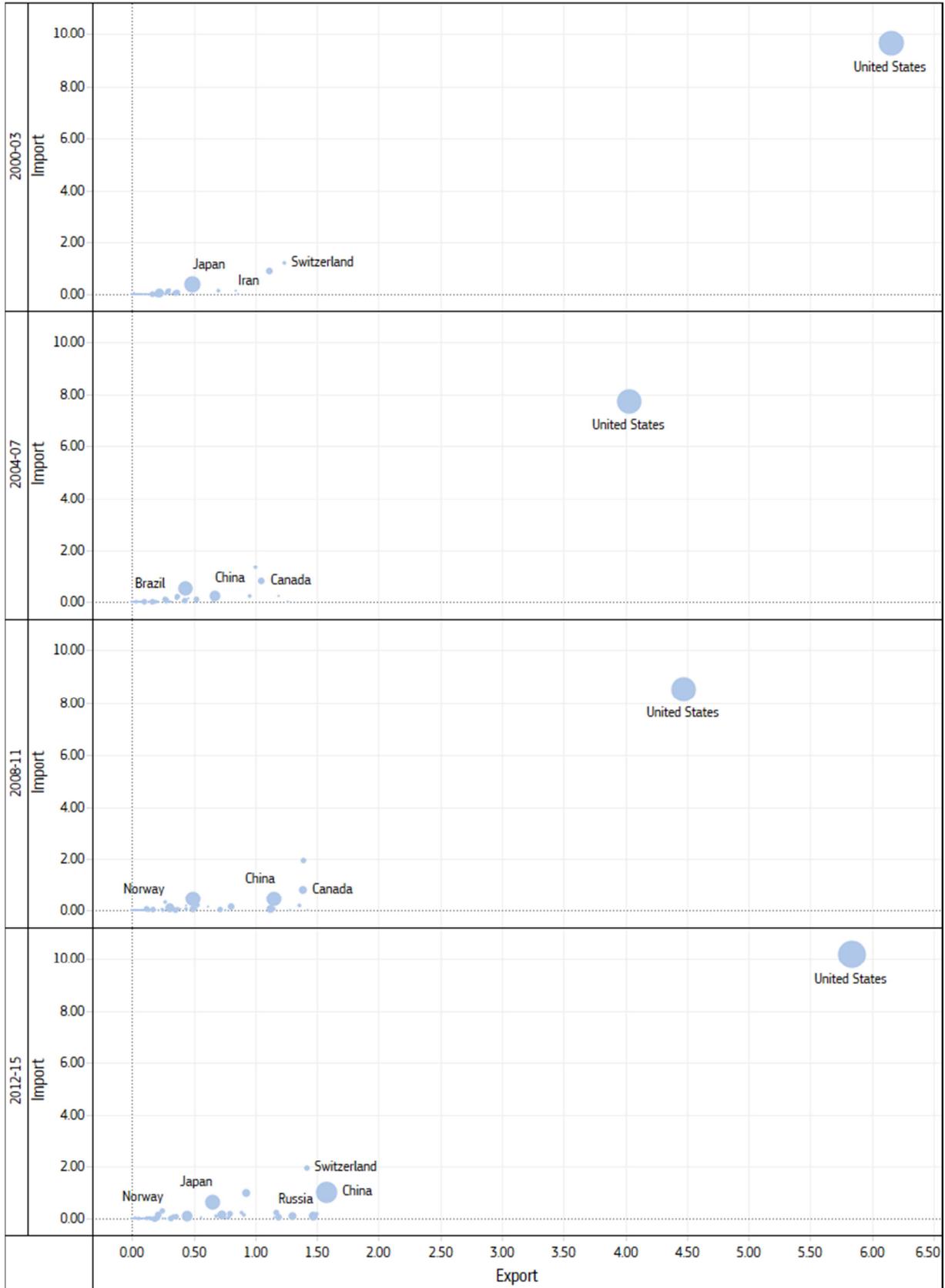


-4.404 5.475

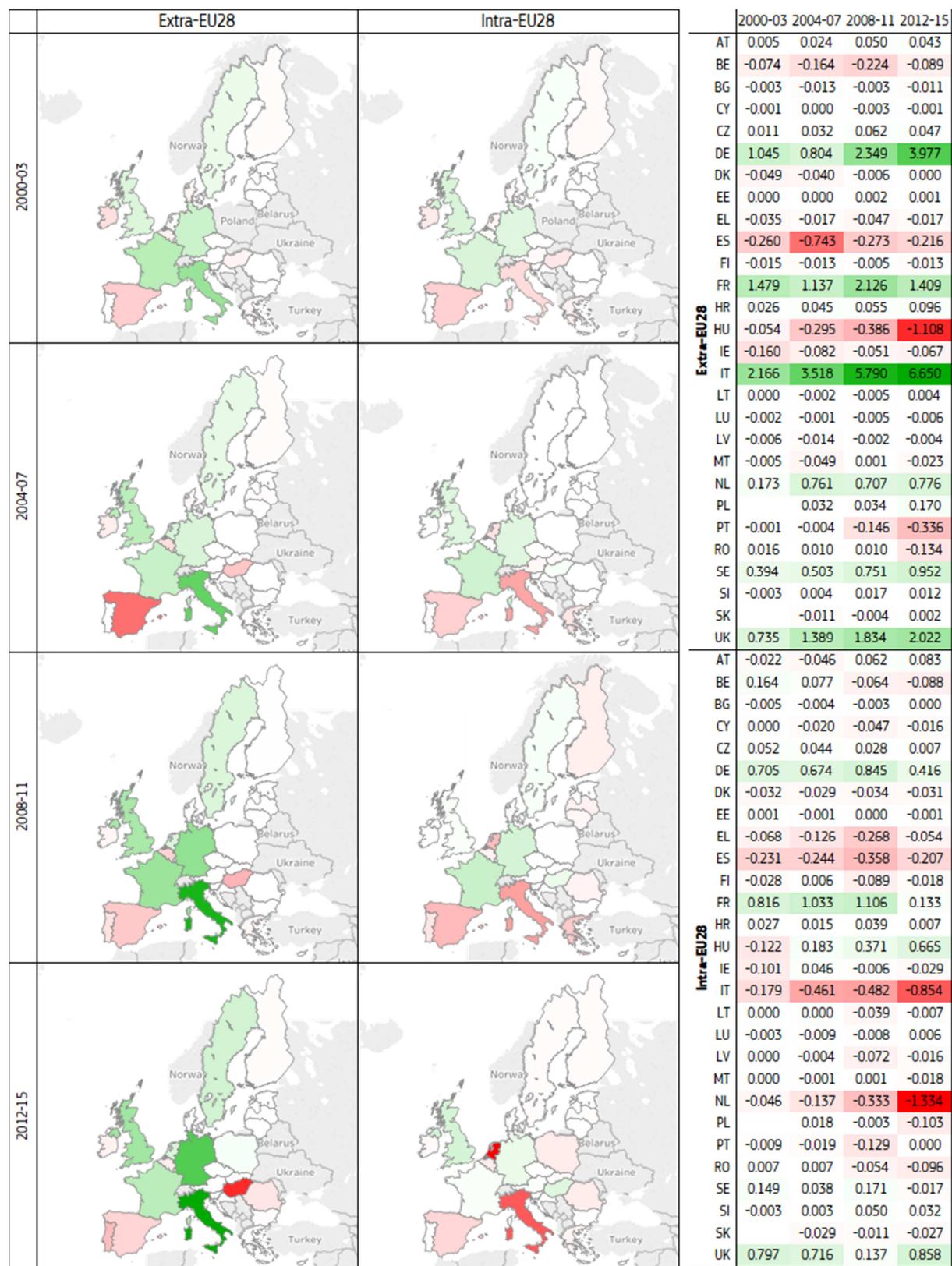
Region	2000-03				2004-07				2008-11				2012-15			
	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15
Africa, Eastern	0.062	0.025	0.111	0.022												
Africa, Middle	0.083	0.168	0.390	0.374												
Africa, Northern	1.019	1.106	2.664	2.410												
Africa, Southern	0.025	0.029	0.137	0.197												
Africa, Western	0.315	0.417	0.390	0.373												
America, Caribbean	0.179	0.078	0.136	0.079												
America, Central	0.190	0.083	0.055	0.093												
America, Northern	-3.234	-3.434	-3.430	-4.404												
America, South	0.651	0.573	0.819	1.243												
Antarctica	0.000	0.000	0.000	0.000												
Asia, Central	0.121	0.161	0.262	0.400												
Asia, Eastern	0.693	0.628	1.221	1.920												
Asia, South-Eastern	1.005	1.104	1.482	2.637												
Asia, Southern	1.292	1.837	2.175	1.162												
Asia, Western	2.437	3.548	5.164	5.475												
Oceania, Australia & NewZealand	0.170	0.237	0.470	1.224												
Oceania, Melanesia	0.010	0.001	0.024	0.105												
Oceania, Micronesia	0.004	-0.002	0.001	0.000												
Oceania, Polynesia	0.000	0.001	0.001	0.003												
Rest of Europe	0.378	0.262	0.537	0.801												

Top 10 Extra-EU28					
	2000-03	2004-07	2008-11	2012-15	
Export	1	United States	United States	United States	United States
	2	Switzerland	Iran	Algeria	China
	3	Canada	UA Emirates	Switzerland	UA Emirates
	4	Iran	Canada	Canada	Russia
	5	UA Emirates	Switzerland	UA Emirates	Switzerland
	6	Saudi Arabia	Saudi Arabia	Iraq	Australia
	7	Singapore	China	China	South Korea
	8	Japan	Qatar	Iran	Saudi Arabia
	9	Algeria	India	Russia	Algeria
	10	India	Algeria	India	Canada
Import	1	United States	United States	United States	United States
	2	Switzerland	Switzerland	Switzerland	Switzerland
	3	Canada	Canada	Canada	China
	4	Japan	Japan	Japan	Canada
	5	Norway	Saudi Arabia	China	Japan
	6	Australia	China	Norway	Norway
	7	UA Emirates	UA Emirates	Turkey	Malaysia
	8	Singapore	Turkey	Malaysia	Saudi Arabia
	9	Saudi Arabia	Norway	UA Emirates	UA Emirates
	10	India	Singapore	India	Turkey

iv) EU28 - Sum of export vs. sum of import with Extra-EU28. Bubble size: Avg.GDP [EUR Bn]: Clean coal & gas



v) Country trade balance (X-M) with Extra-EU28 and Intra-EU28 [EUR Bn]: Clean coal & gas

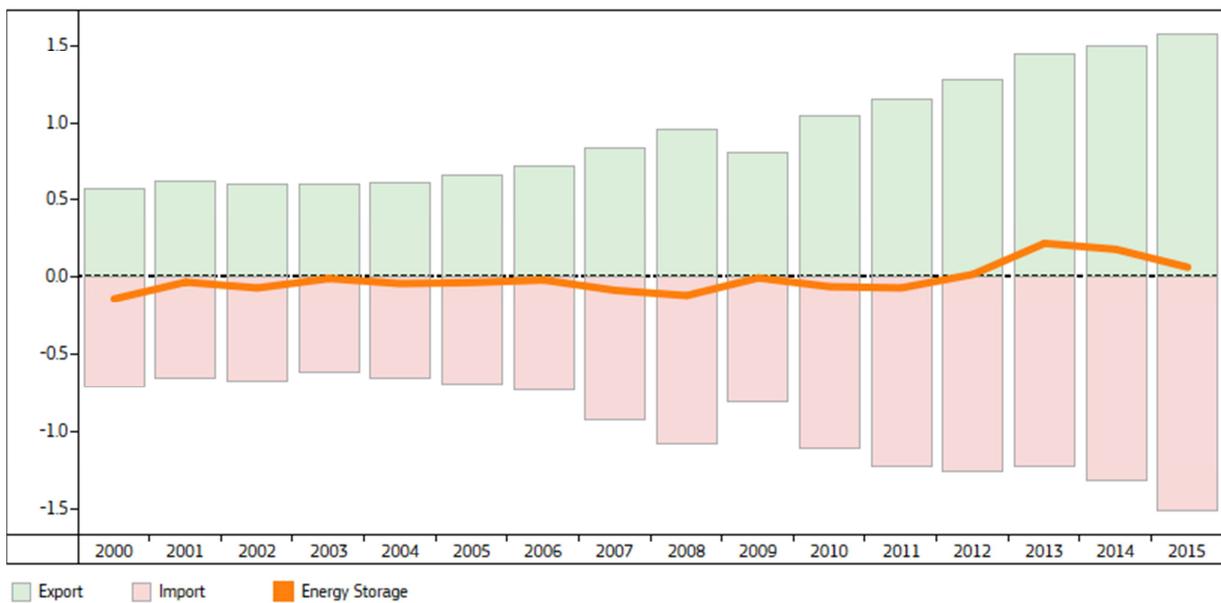


-1.334 6.650

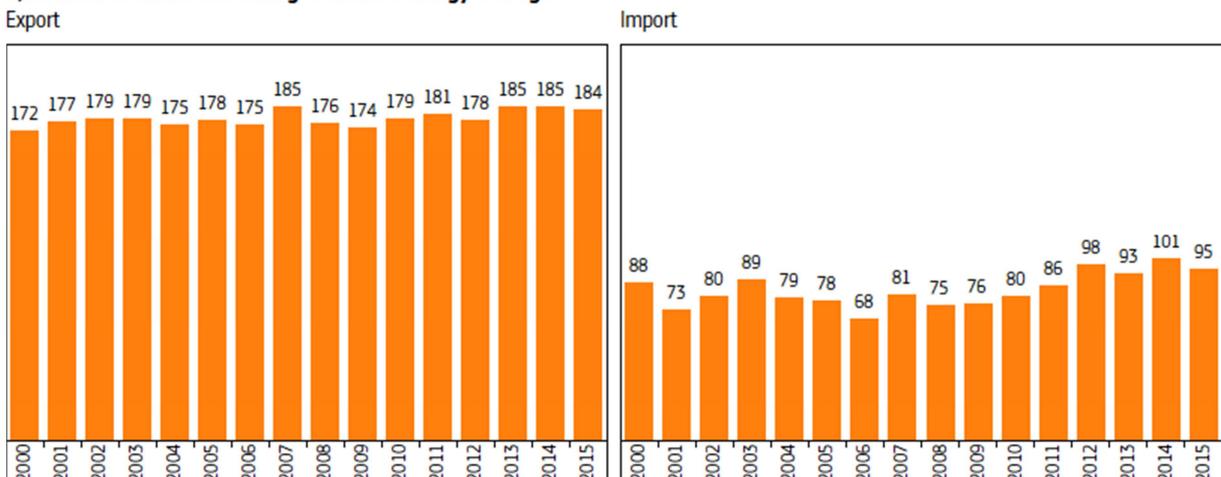
5 Energy storage

The EU trade balance in energy storage is, on average, neutral, except for the last years where it is positive, although decreasing. The number of countries, to which the EU exports, is very high both in absolute terms and in relation to those from which it imports. The EU has the largest level of negative balance with eastern Asia, while the highest positive balance is with the rest of the European countries. At country level, in addition to the United States, the EU exports mainly to Russia and Switzerland, while it imports more from China, South Korea and Japan. The individual Member States perform differently. Germany and France have the highest positive trade balance with extra-EU28 while the United Kingdom has the largest negative balance with the same group of partners. Within the EU, Spain is the Member State with the highest positive trade balance, while France has the largest negative balance.

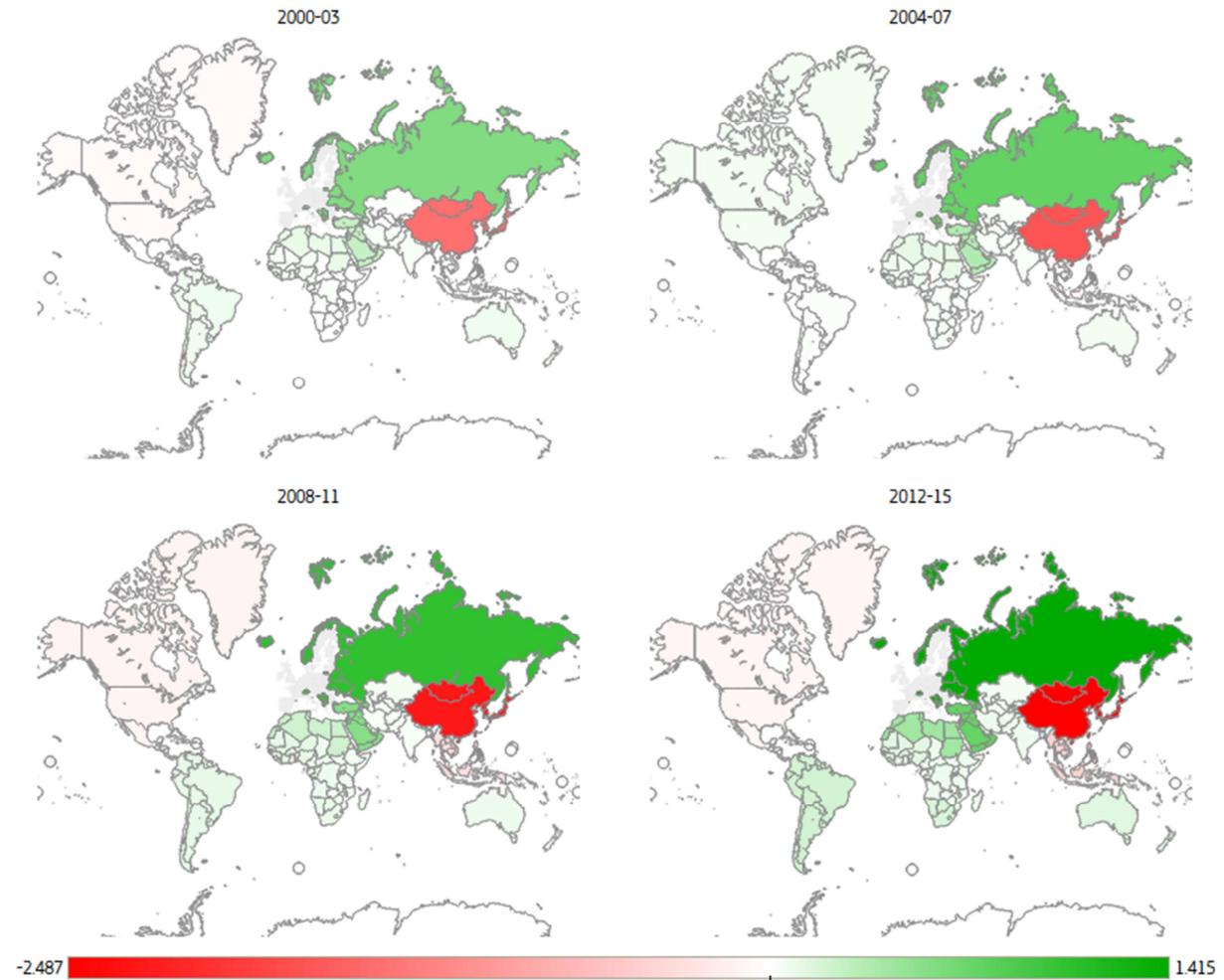
i) EU28 - Technology trade balance (X-M) with Extra-EU28 [EUR Bn]: Energy Storage



ii) Number of Extra-EU trading countries: Energy Storage



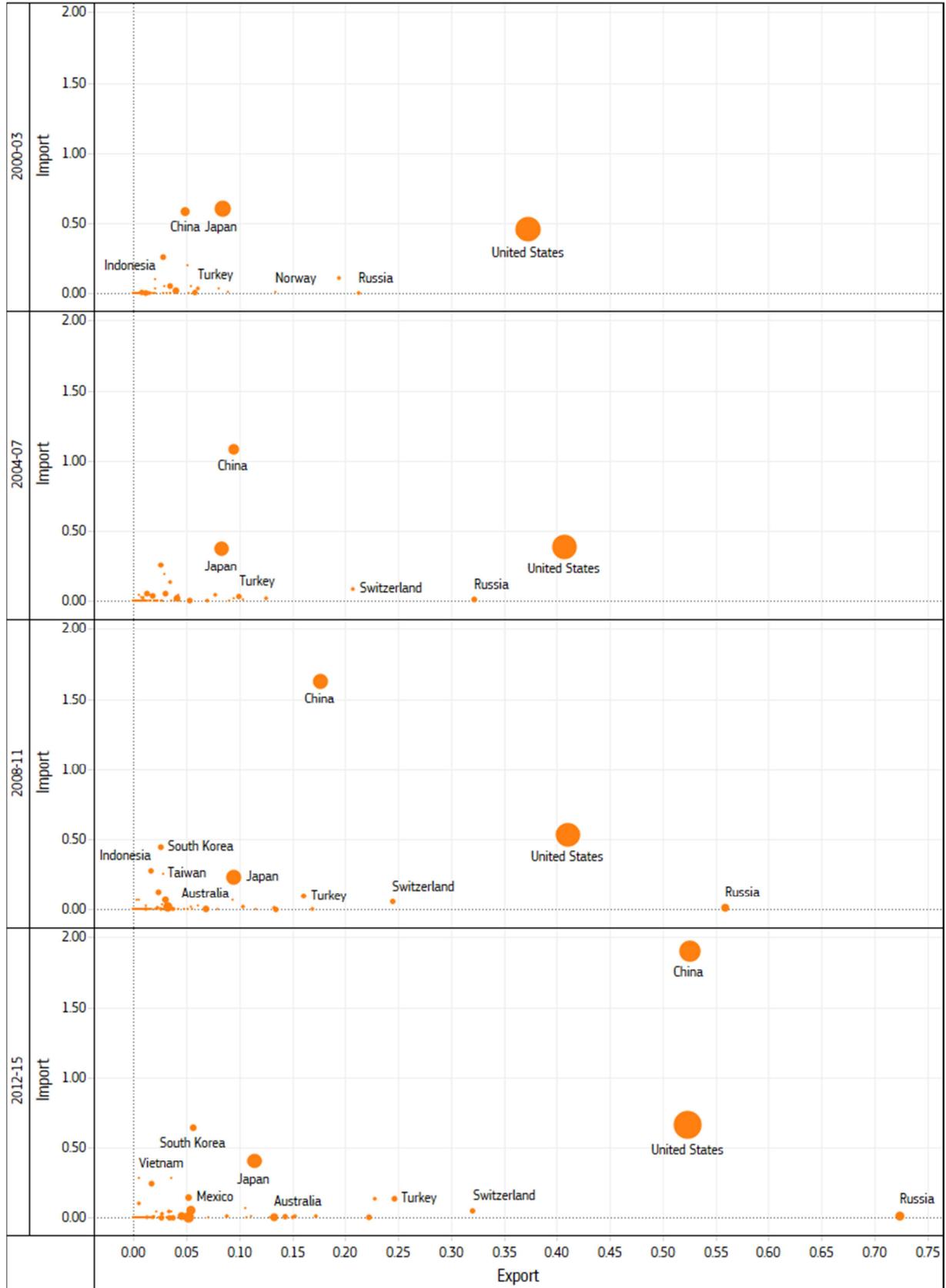
iii) EU28 - Trade balance (X-M) with world regions outside EU28 [EUR Bn]: Energy Storage



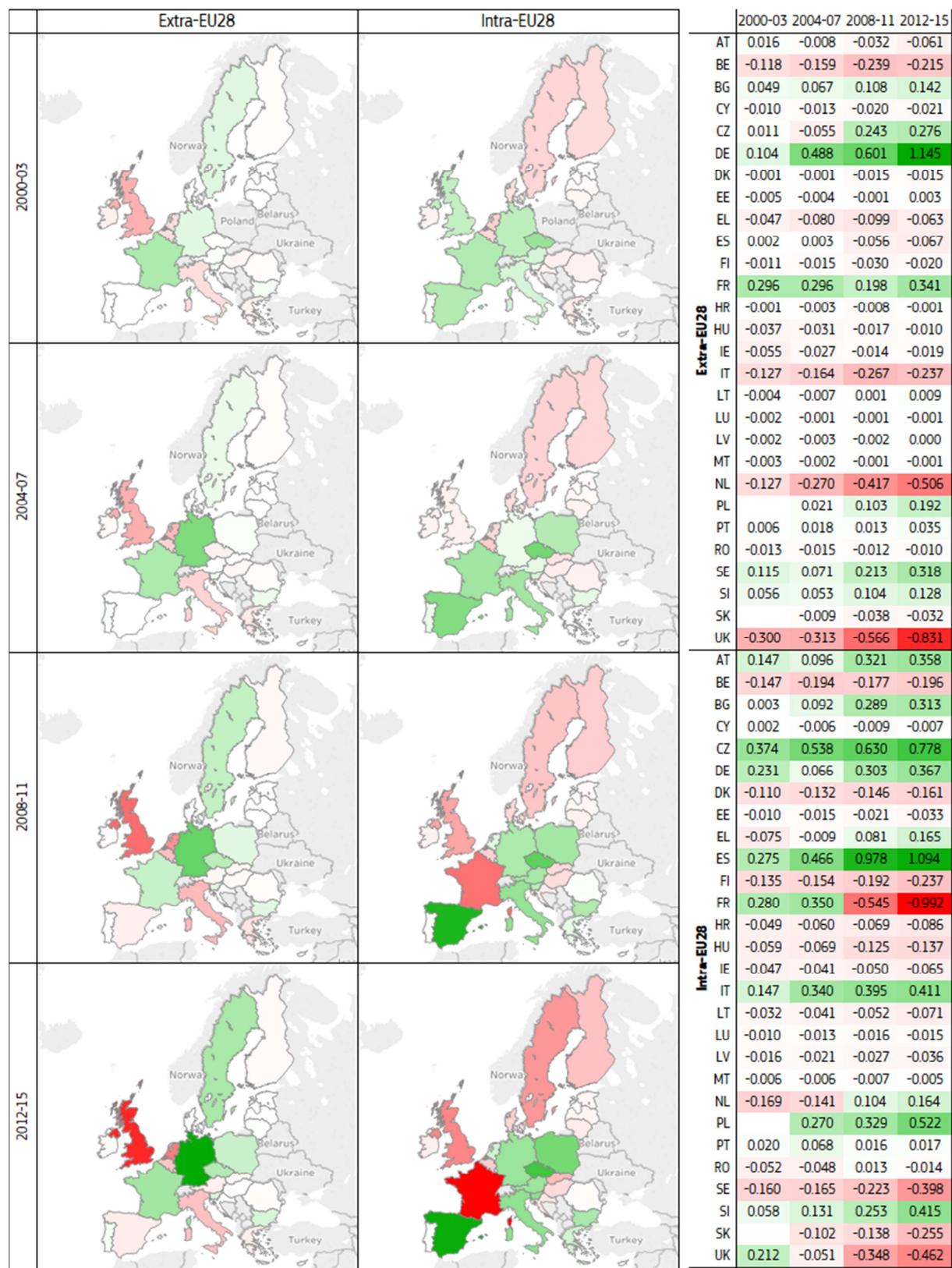
Region	2000-03				2004-07				2008-11				2012-15			
	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15
Africa, Eastern	0.016	0.026	0.054	0.075												
Africa, Middle	0.018	0.030	0.068	0.069												
Africa, Northern	0.098	0.105	0.217	0.426												
Africa, Southern	0.003	0.038	0.087	0.169												
Africa, Western	0.048	0.066	0.112	0.125												
America, Caribbean	0.012	0.016	0.017	0.025												
America, Central	-0.011	-0.012	-0.091	-0.081												
America, Northern	-0.055	0.050	-0.098	-0.090												
America, South	0.062	0.021	0.105	0.201												
Antarctica	0.000	0.000	0.000	0.000												
Asia, Central	0.016	0.029	0.051	0.054												
Asia, Eastern	-1.382	-1.650	-2.239	-2.487												
Asia, South-Eastern	-0.020	-0.095	-0.288	-0.402												
Asia, Southern	0.035	0.039	0.038	0.068												
Asia, Western	0.251	0.343	0.559	0.741												
Oceania, Australia & NewZealand	0.062	0.058	0.072	0.139												
Oceania, Melanesia	0.005	0.006	0.012	0.016												
Oceania, Micronesia	0.000	0.000	0.000	0.001												
Oceania, Polynesia	0.006	0.007	0.009	0.012												
Rest of Europe	0.588	0.748	1.064	1.415												

Top 10 Extra-EU28					
	2000-03	2004-07	2008-11	2012-15	
Export	1	United States	United States	Russia	Russia
	2	Russia	Russia	United States	China
	3	Switzerland	Switzerland	Switzerland	United States
	4	Norway	Norway	China	Switzerland
	5	Singapore	Singapore	UA Emirates	Turkey
	6	Japan	Turkey	Turkey	UA Emirates
	7	Hong Kong	Ukraine	Saudi Arabia	Saudi Arabia
	8	Turkey	China	Norway	South Africa
	9	Australia	UA Emirates	Singapore	Singapore
	10	Saudi Arabia	Japan	South Africa	Egypt
Import	1	Japan	China	China	China
	2	China	United States	United States	United States
	3	United States	Japan	South Korea	South Korea
	4	South Korea	South Korea	Indonesia	Japan
	5	Taiwan	Taiwan	Taiwan	Vietnam
	6	Switzerland	Indonesia	Japan	Taiwan
	7	Indonesia	Switzerland	Mexico	Indonesia
	8	South Africa	Brazil	Turkey	Mexico
	9	Mexico	Mexico	Malaysia	Turkey
	10	Malaysia	Malaysia	India	UA Emirates

iv) EU28 - Sum of export vs. sum of import with Extra-EU28. Bubble size: Avg.GDP [EUR Bn]: Energy Storage



v) Country trade balance (X-M) with Extra-EU28 and Intra-EU28 [EUR Bn]: Energy Storage

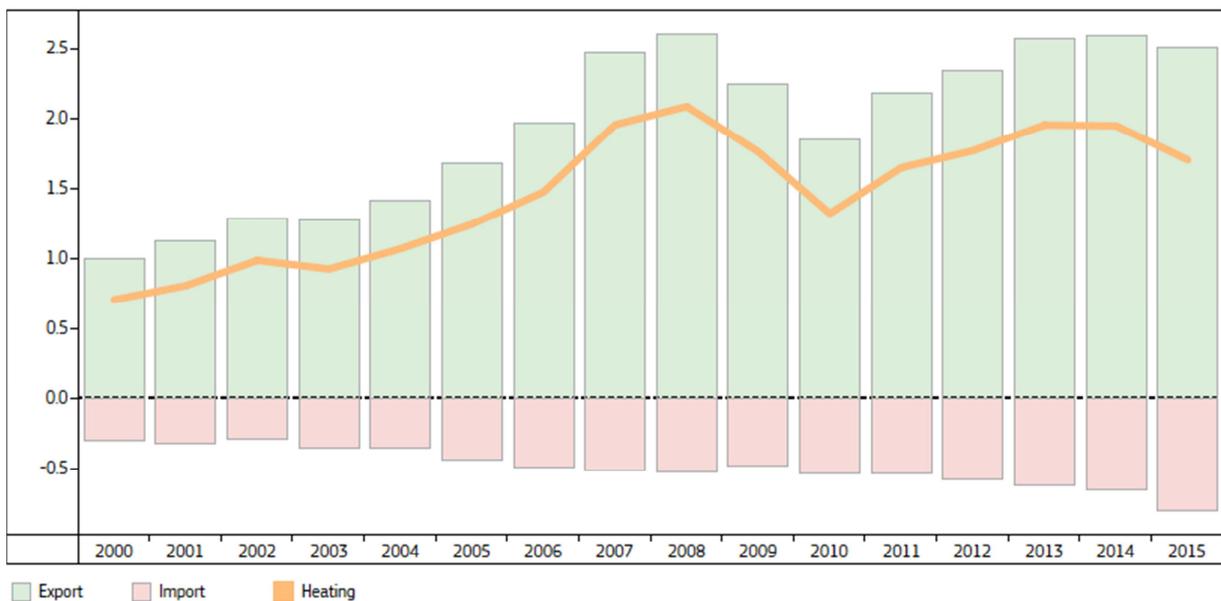


-0.992 1.145

6 Heating

The EU trade balance in the heating sector is positive in all the years, showing a decreasing trend only from 2008 to 2010. The number of commercial partners, on average, increases for both export and import. Apart from the first period, 2000-2003, the EU has a positive trade balance with all the geographic areas worldwide. In particular, it has the highest positive balance with the other European countries: mainly with Russia and Switzerland. The EU also exports to and imports from the United States and China. Germany, France, Italy and Sweden are the four Member States with the highest positive trade balance with extra-EU28 countries. In contrast to France, Italy and Sweden, which maintain this performance also within the EU, Germany shows a negative balance in both the first and the last periods. The United Kingdom and Belgium have the largest negative trade balance with intra-EU28.

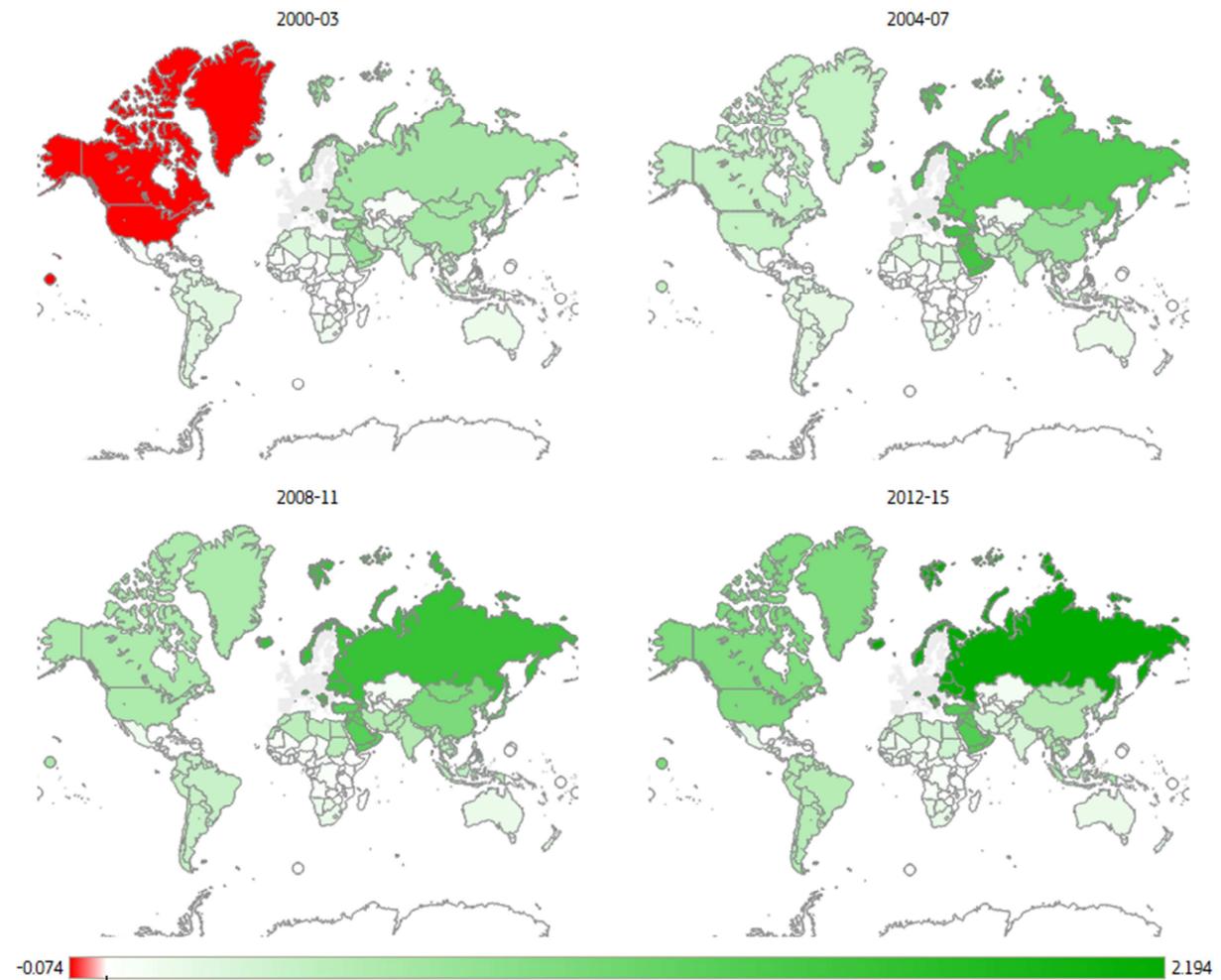
i) EU28 - Technology trade balance (X-M) with Extra-EU28 [EUR Bn]: Heating



ii) Number of Extra-EU trading countries: Heating



iii) EU28 - Trade balance (X-M) with world regions outside EU28 [EUR Bn]: Heating



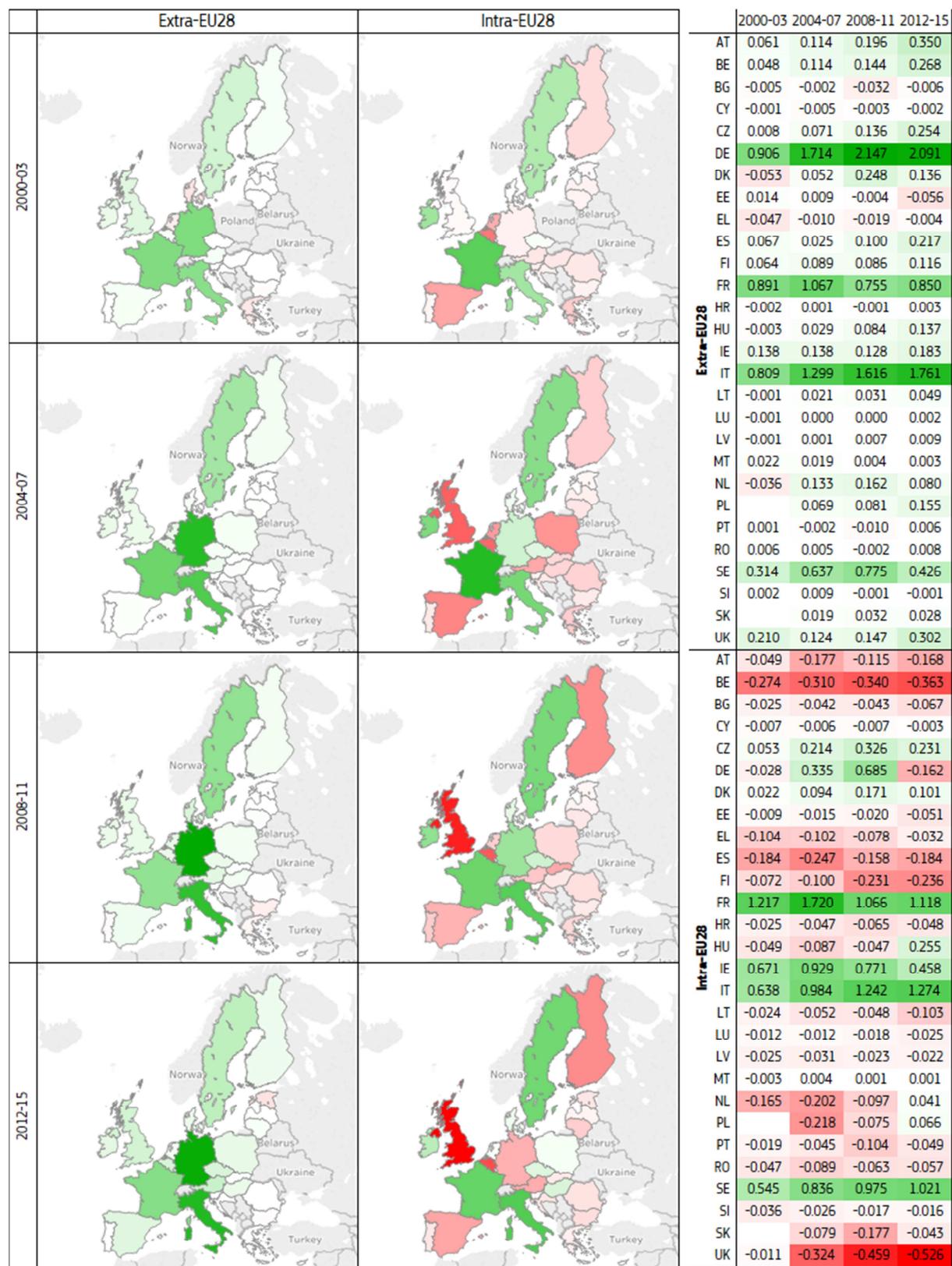
Region	2000-03				2004-07				2008-11				2012-15			
	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15
Africa, Eastern	0.012	0.020	0.027	0.040	0.012	0.023	0.042	0.048	0.012	0.023	0.042	0.048	0.012	0.023	0.042	0.048
Africa, Middle	0.012	0.023	0.042	0.048	0.012	0.023	0.042	0.048	0.012	0.023	0.042	0.048	0.012	0.023	0.042	0.048
Africa, Northern	0.237	0.245	0.447	0.320	0.237	0.245	0.447	0.320	0.237	0.245	0.447	0.320	0.237	0.245	0.447	0.320
Africa, Southern	0.096	0.128	0.137	0.150	0.096	0.128	0.137	0.150	0.096	0.128	0.137	0.150	0.096	0.128	0.137	0.150
Africa, Western	0.042	0.044	0.046	0.121	0.042	0.044	0.046	0.121	0.042	0.044	0.046	0.121	0.042	0.044	0.046	0.121
America, Caribbean	0.053	0.049	0.072	0.048	0.053	0.049	0.072	0.048	0.053	0.049	0.072	0.048	0.053	0.049	0.072	0.048
America, Central	0.061	0.076	0.108	0.132	0.061	0.076	0.108	0.132	0.061	0.076	0.108	0.132	0.061	0.076	0.108	0.132
America, Northern	-0.074	0.400	0.568	0.944	-0.074	0.400	0.568	0.944	-0.074	0.400	0.568	0.944	-0.074	0.400	0.568	0.944
America, South	0.190	0.184	0.375	0.493	0.190	0.184	0.375	0.493	0.190	0.184	0.375	0.493	0.190	0.184	0.375	0.493
Antarctica	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Asia, Central	0.054	0.092	0.071	0.093	0.054	0.092	0.071	0.093	0.054	0.092	0.071	0.093	0.054	0.092	0.071	0.093
Asia, Eastern	0.640	0.749	0.970	0.522	0.640	0.749	0.970	0.522	0.640	0.749	0.970	0.522	0.640	0.749	0.970	0.522
Asia, South-Eastern	0.272	0.275	0.435	0.529	0.272	0.275	0.435	0.529	0.272	0.275	0.435	0.529	0.272	0.275	0.435	0.529
Asia, Southern	0.315	0.500	0.524	0.271	0.315	0.500	0.524	0.271	0.315	0.500	0.524	0.271	0.315	0.500	0.524	0.271
Asia, Western	0.732	1.473	1.257	1.308	0.732	1.473	1.257	1.308	0.732	1.473	1.257	1.308	0.732	1.473	1.257	1.308
Oceania, Australia & NewZealand	0.125	0.131	0.133	0.136	0.125	0.131	0.133	0.136	0.125	0.131	0.133	0.136	0.125	0.131	0.133	0.136
Oceania, Melanesia	0.001	0.004	0.008	0.011	0.001	0.004	0.008	0.011	0.001	0.004	0.008	0.011	0.001	0.004	0.008	0.011
Oceania, Micronesia	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Oceania, Polynesia	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Rest of Europe	0.648	1.338	1.586	2.194	0.648	1.338	1.586	2.194	0.648	1.338	1.586	2.194	0.648	1.338	1.586	2.194

Top 10 Extra-EU28					
	2000-03	2004-07	2008-11	2012-15	
Export	1	United States	United States	China	United States
	2	Switzerland	Russia	United States	Russia
	3	China	China	Russia	China
	4	Russia	Switzerland	Switzerland	Switzerland
	5	UA Emirates	Saudi Arabia	South Korea	South Korea
	6	Iran	UA Emirates	Norway	Saudi Arabia
	7	Norway	South Korea	Qatar	Norway
	8	South Korea	India	Saudi Arabia	Turkey
	9	Turkey	Turkey	UA Emirates	Brazil
	10	Japan	Norway	Turkey	UA Emirates
Import	1	United States	United States	China	China
	2	Switzerland	Switzerland	United States	United States
	3	Japan	China	Switzerland	Switzerland
	4	South Korea	Japan	South Korea	Japan
	5	China	South Korea	Japan	Turkey
	6	Norway	Singapore	Israel	South Korea
	7	Canada	Turkey	Turkey	India
	8	Turkey	UA Emirates	India	Israel
	9	Brazil	Canada	Russia	Thailand
	10	Israel	Israel	Malaysia	Malaysia

iv) EU28 - Sum of export vs. sum of import with Extra-EU28. Bubble size: Avg.GDP [EUR Bn]: Heating



v) Country trade balance (X-M) with Extra-EU28 and Intra-EU28 [EUR Bn]: Heating

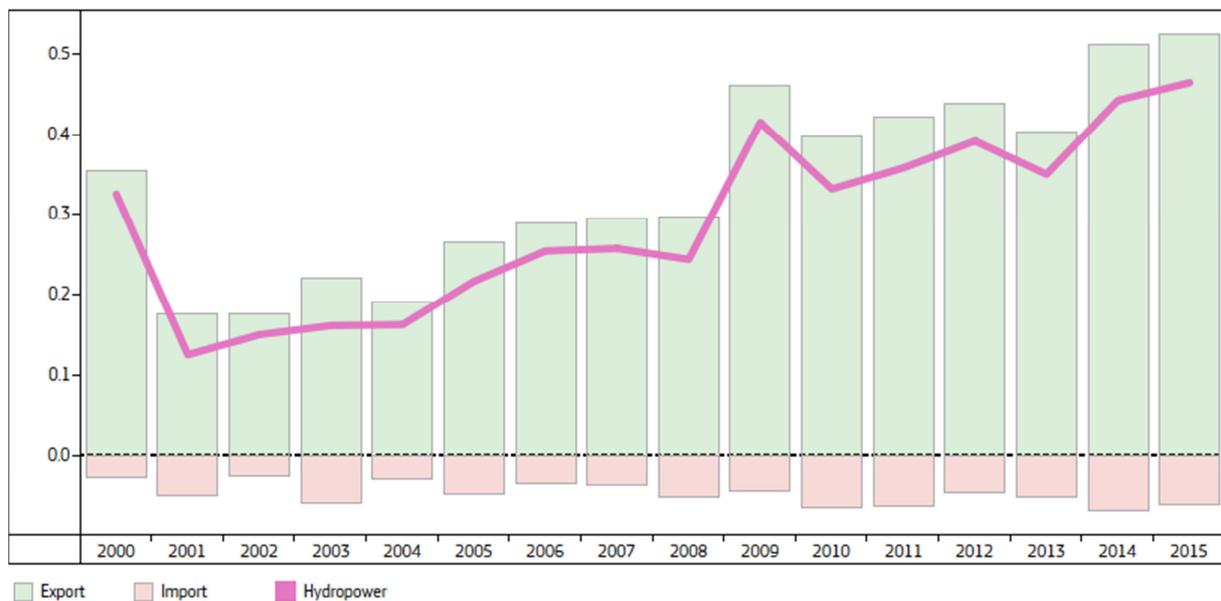


-0.526 2.147

7 Hydropower

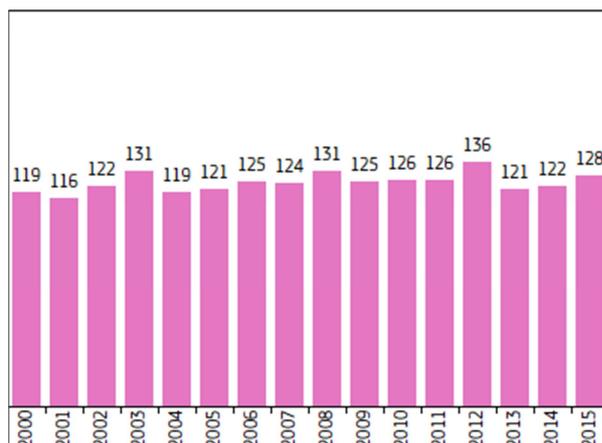
The EU trade balance in the hydropower sector is positive and increasing over the years. The number of commercial partners, on average, remains constant for export, while it has a greater variability for import. Apart from the last period, 2012-2015, the EU has positive trade balance with all the geographic areas worldwide. In particular, it has the highest positive balance with the other European countries, mainly with Switzerland and with Turkey. The EU imports mostly from Brazil, China and India. On average, the Member States have opposite trade performance in relation to extra-EU28 and intra-EU28. Many of them (in particular Austria, Germany, Spain, France and Italy) have positive trade balances with countries outside the EU, while their trade balances is negative with the other Member States. The Czech Republic has the highest positive trade balance with intra-EU28.

i) EU28 - Technology trade balance (X-M) with Extra-EU28 [EUR Bn]: Hydropower

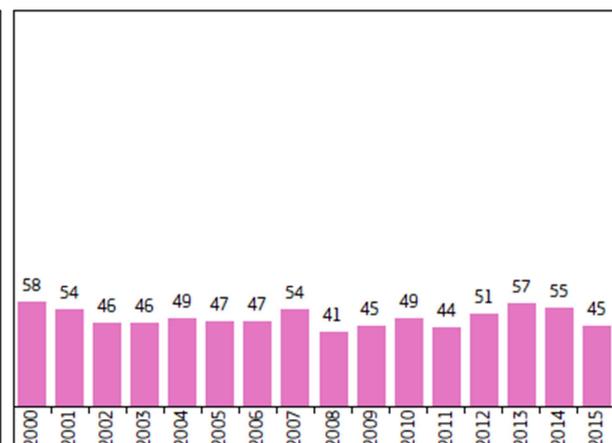


ii) Number of Extra-EU trading countries: Hydropower

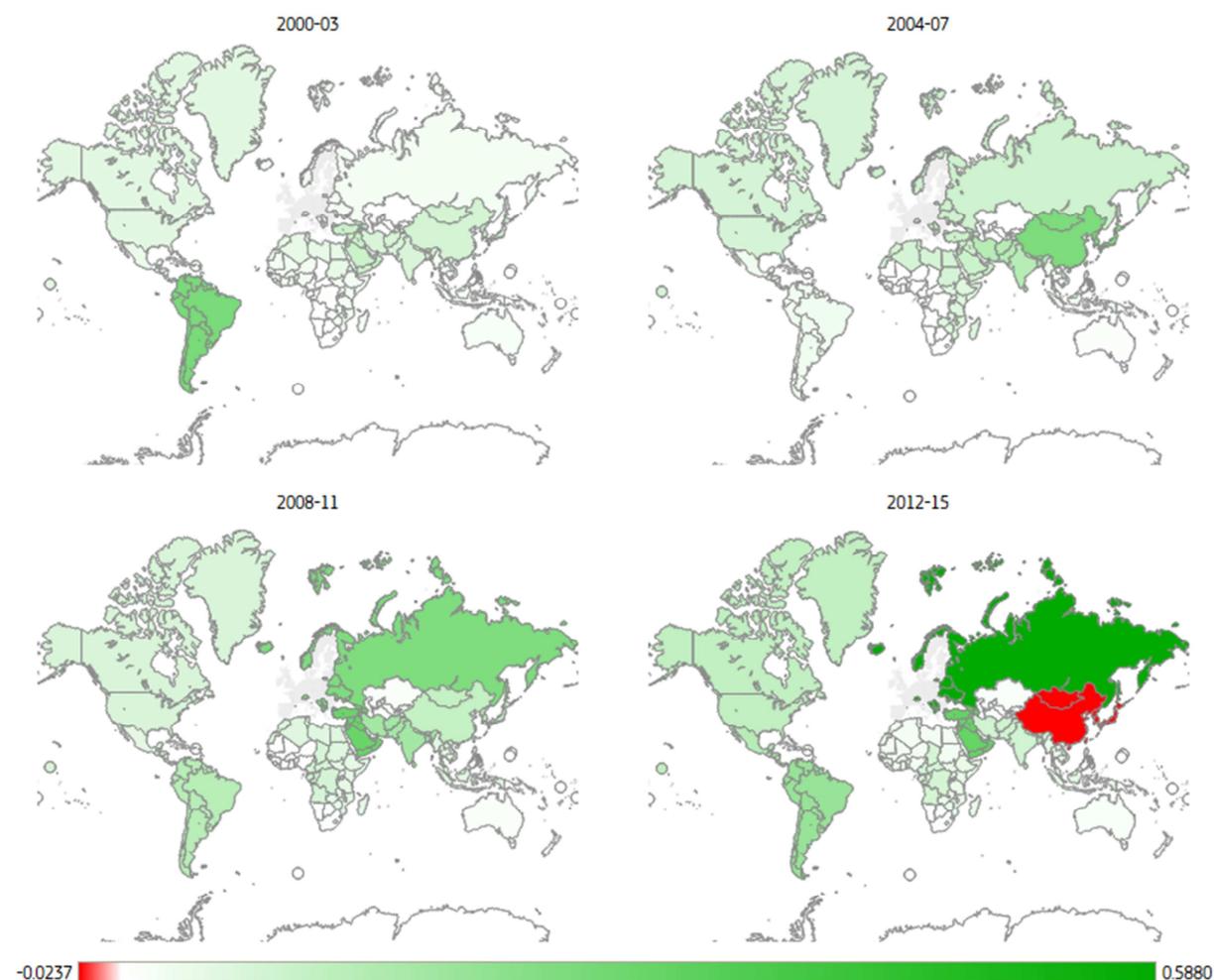
Export



Import



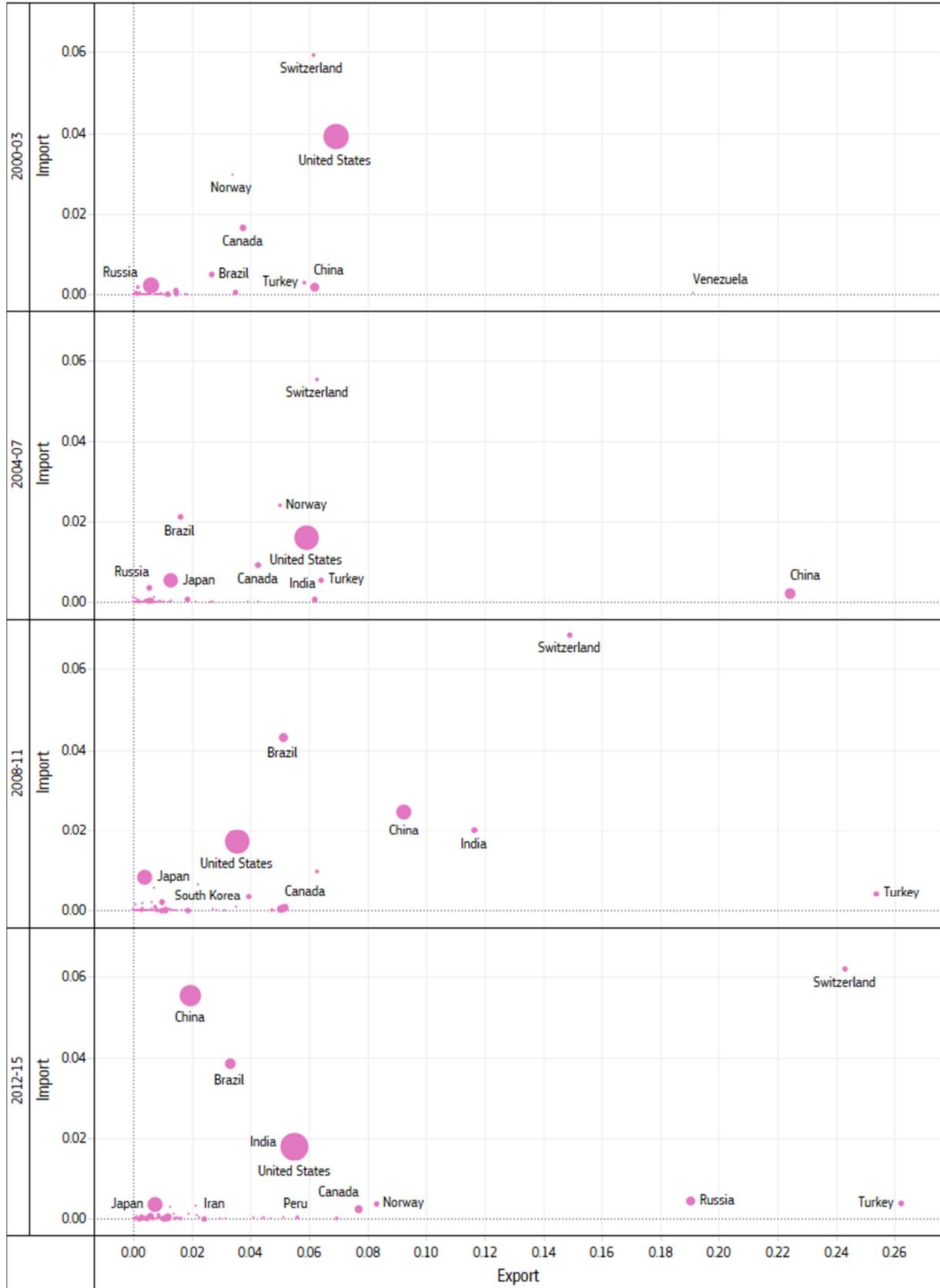
iii) EU28 - Trade balance (X-M) with world regions outside EU28 [EUR Bn]: Hydropower



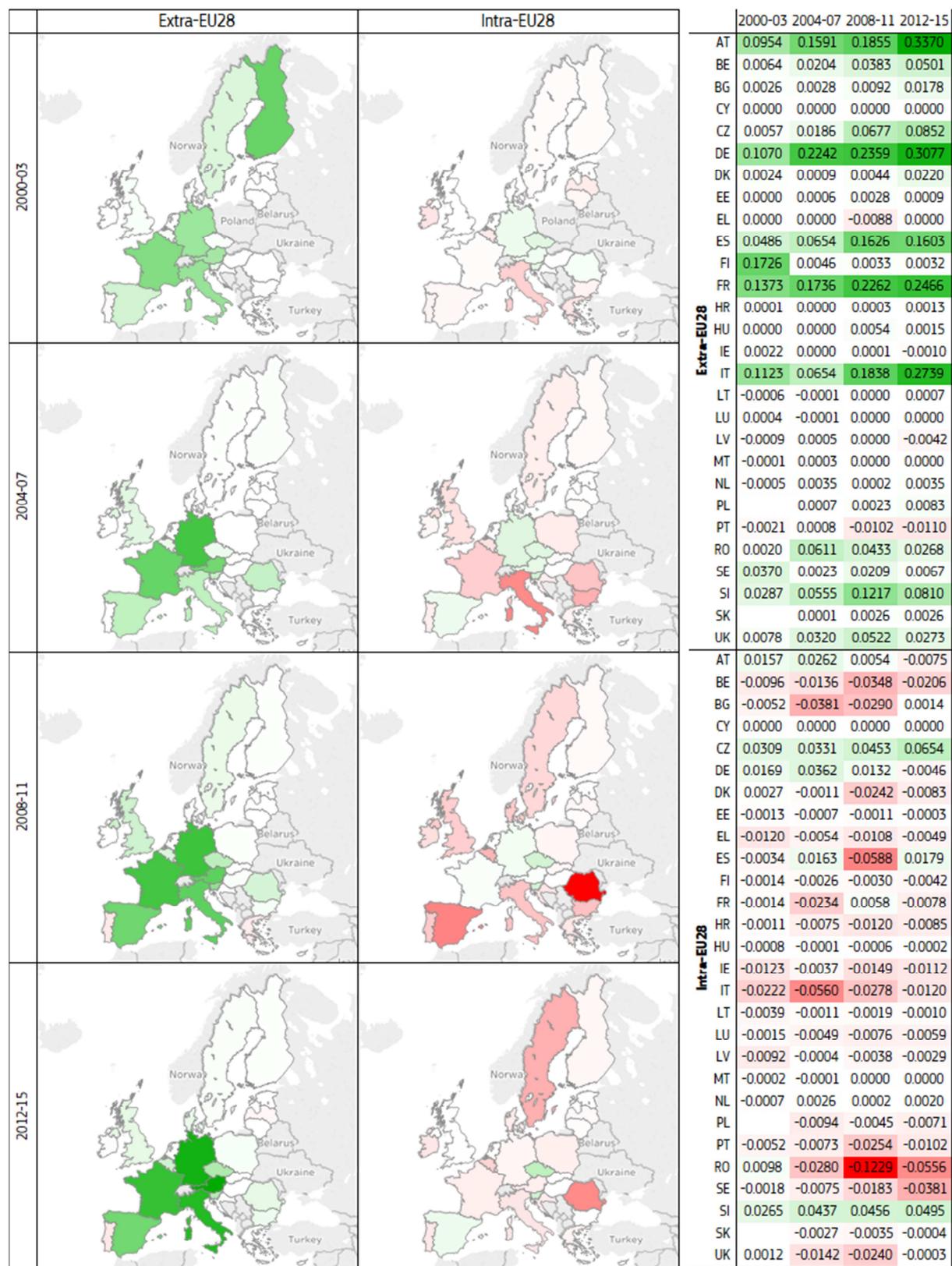
Region	2000-03				2004-07				2008-11				2012-15			
	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15
Africa, Eastern	0.0206	0.0598	0.0461	0.0404												
Africa, Middle	0.0045	0.0053	0.0758	0.0760												
Africa, Northern	0.0435	0.0773	0.0600	0.0215												
Africa, Southern	0.0012	0.0026	0.0098	0.0094												
Africa, Western	0.0231	0.0062	0.0069	0.0224												
America, Caribbean	0.0166	0.0031	0.0028	0.0083												
America, Central	0.0351	0.0259	0.0495	0.1329												
America, Northern	0.0510	0.0766	0.0693	0.1120												
America, South	0.2622	0.0262	0.1299	0.1964												
Antarctica	0.0000	0.0000	0.0000	0.0000												
Asia, Central	0.0008	0.0012	0.0114	0.0106												
Asia, Eastern	0.0794	0.2529	0.1070	-0.0237												
Asia, South-Eastern	0.0207	0.0257	0.0534	0.0443												
Asia, Southern	0.0701	0.1344	0.1702	0.0857												
Asia, Western	0.0953	0.0936	0.2968	0.3080												
Oceania, Australia & NewZealand	0.0152	0.0070	0.0120	0.0128												
Oceania, Melanesia	0.0019	0.0020	0.0013	0.0039												
Oceania, Micronesia	0.0000	0.0000	0.0000	0.0000												
Oceania, Polynesia	0.0004	0.0004	0.0004	0.0008												
Rest of Europe	0.0208	0.0915	0.2473	0.5880												

Top 10 Extra-EU28					
	2000-03	2004-07	2008-11	2012-15	
Export	1	Venezuela	China	Turkey	Turkey
	2	United States	Turkey	Switzerland	Switzerland
	3	China	Switzerland	India	Russia
	4	Switzerland	India	China	Norway
	5	Turkey	United States	Norway	Canada
	6	Canada	Norway	Canada	Colombia
	7	India	Iran	Brazil	Chile
	8	Norway	Canada	Russia	United States
	9	Brazil	Sudan	Iran	India
	10	Colombia	Ethiopia	Venezuela	Peru
Import	1	Switzerland	Switzerland	Switzerland	Switzerland
	2	United States	Norway	Brazil	China
	3	Norway	Brazil	China	Brazil
	4	Canada	United States	India	India
	5	Brazil	Canada	United States	United States
	6	Turkey	Turkey	Norway	Russia
	7	Japan	Japan	Japan	Turkey
	8	Russia	Russia	Serbia	Norway
	9	China	China	Ukraine	Japan
	10	South Korea	Paraguay	Turkey	Mexico

iv) EU28 - Sum of export vs. sum of import with Extra-EU28. Bubble size: Avg.GDP [EUR Bn]: Hydropower



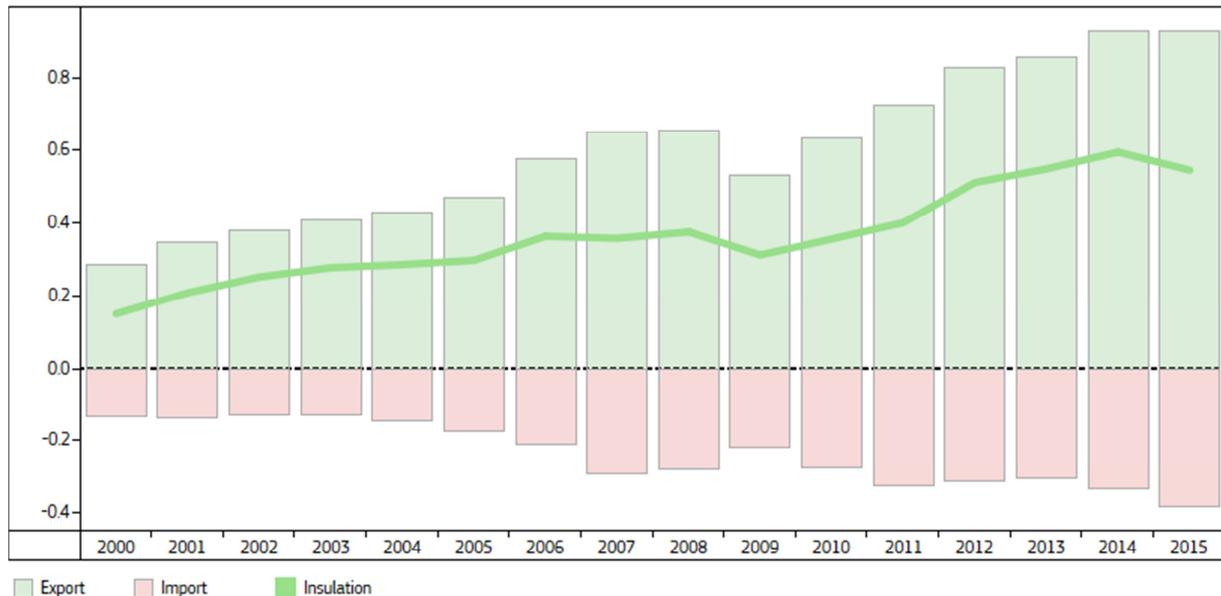
v) Country trade balance (X-M) with Extra-EU28 and Intra-EU28 [EUR Bn]: Hydropower



8 Insulation

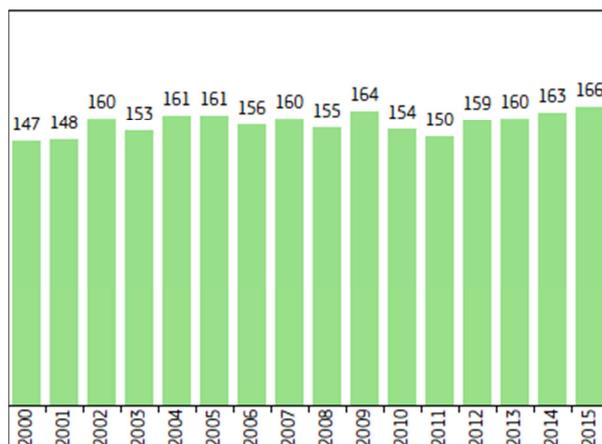
The EU trade balance in the insulation sector is positive and increasing over the years. On average, the number of commercial partners increases for both export and import over time. The EU has a positive trade balance with the other European countries, while it is negative with Easter Asia. In the first three periods analysed, the EU has a negative trade balance with northern America, while in the last period, 2012-2015, it is positive. Norway, Russia and Switzerland are the three countries to which the EU exports more, while it imports mainly from China, Japan and the United States. Germany is the Member State with the highest positive trade balance with both extra-EU28 and intra-EU28. Austria, Denmark, Italy and France, on the contrary, have the largest negative balance with intra-EU28.

i) EU28 - Technology trade balance (X-M) with Extra-EU28 [EUR Bn]: Insulation

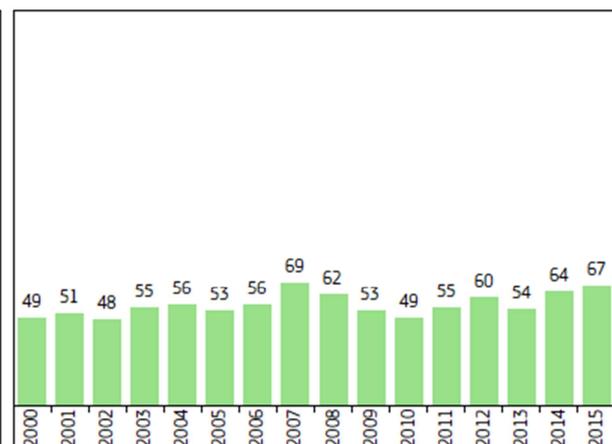


ii) Number of Extra-EU trading countries: Insulation

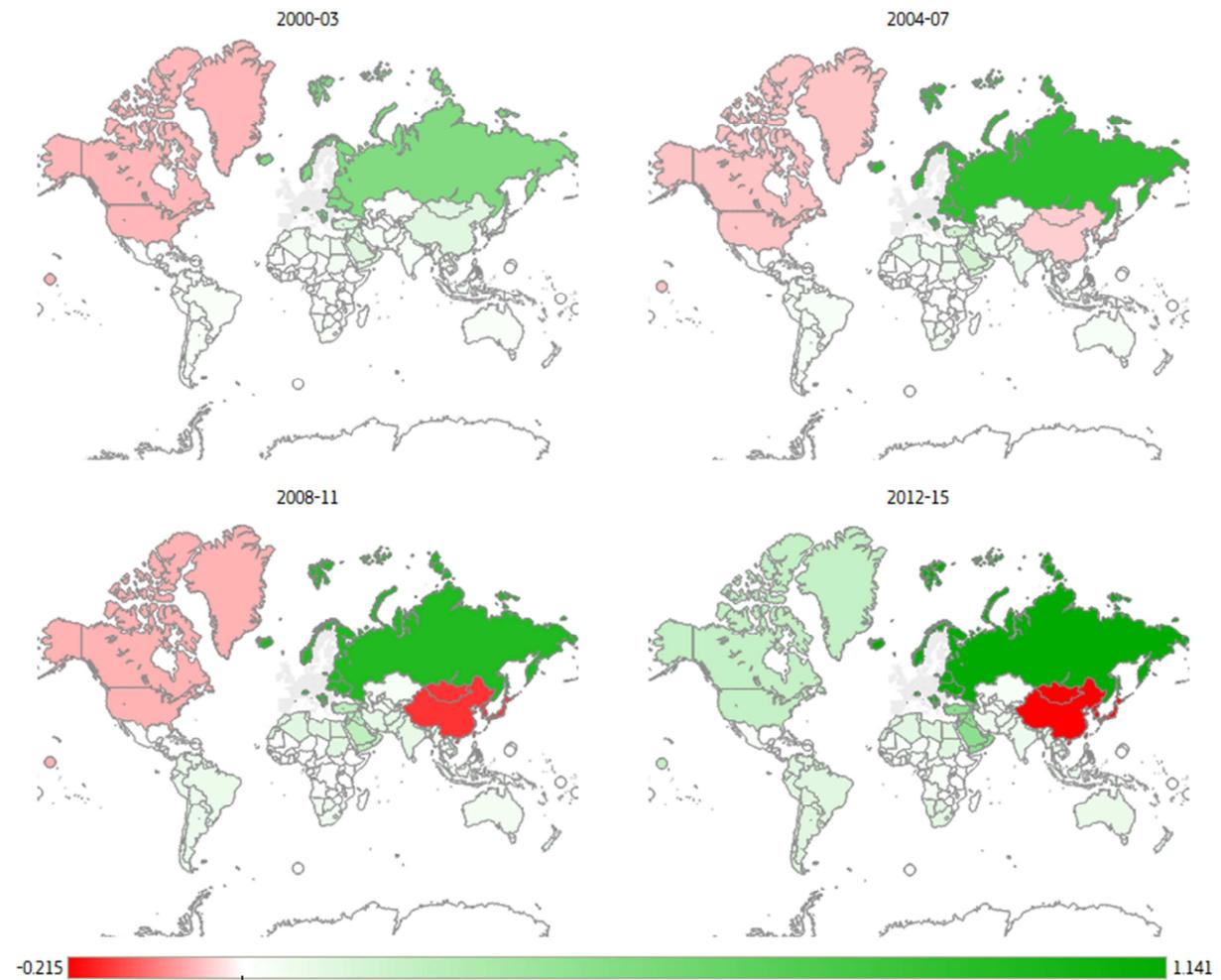
Export



Import



iii) EU28 - Trade balance (X-M) with world regions outside EU28 [EUR Bn]: Insulation



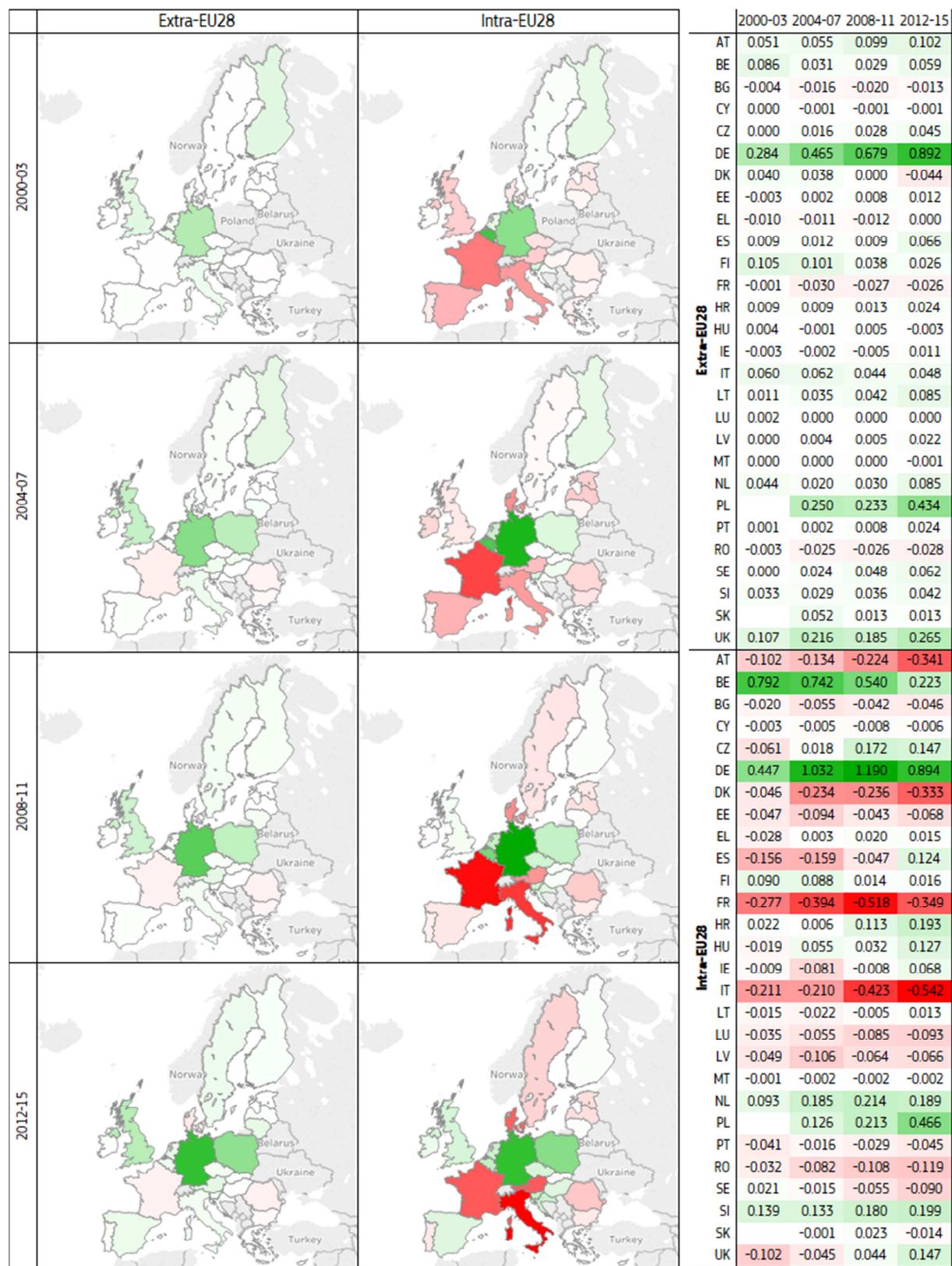
Region	2000-03				2004-07				2008-11				2012-15			
	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15
Africa, Eastern	0.004	0.004	0.007	0.011												
Africa, Middle	0.017	0.010	0.015	0.029												
Africa, Northern	0.049	0.060	0.101	0.106												
Africa, Southern	0.022	0.042	0.054	0.095												
Africa, Western	0.012	0.012	0.017	0.029												
America, Caribbean	0.006	0.010	0.012	0.012												
America, Central	0.007	0.017	0.015	0.029												
America, Northern	-0.060	-0.049	-0.064	0.206												
America, South	0.022	0.030	0.063	0.108												
Antarctica	0.000	0.000	0.000	0.000												
Asia, Central	0.017	0.040	0.033	0.029												
Asia, Eastern	0.108	-0.040	-0.170	-0.215												
Asia, South-Eastern	0.040	0.041	0.051	0.068												
Asia, Southern	0.032	0.056	0.085	0.057												
Asia, Western	0.114	0.155	0.225	0.420												
Oceania, Australia & NewZealand	0.024	0.033	0.046	0.070												
Oceania, Melanesia	0.001	0.002	0.005	0.006												
Oceania, Micronesia	0.000	0.000	0.000	0.000												
Oceania, Polynesia	0.002	0.003	0.002	0.002												
Rest of Europe	0.473	0.879	0.947	1.141												

Top 10 Extra-EU28					
	2000-03	2004-07	2008-11	2012-15	
Export	1	Russia	Russia	Switzerland	Switzerland
	2	Switzerland	Switzerland	Russia	United States
	3	United States	Ukraine	Norway	Norway
	4	Norway	United States	United States	Russia
	5	Japan	Norway	Ukraine	China
	6	Turkey	Turkey	Turkey	Saudi Arabia
	7	Ukraine	Japan	China	Turkey
	8	UA Emirates	UA Emirates	UA Emirates	South Africa
	9	China	Belarus	Japan	Belarus
	10	Hong Kong	China	Belarus	Ukraine
Import	1	United States	United States	United States	Japan
	2	Switzerland	Switzerland	Japan	United States
	3	Norway	Japan	China	China
	4	Japan	China	Switzerland	Switzerland
	5	China	Norway	Norway	Norway
	6	Turkey	Turkey	Russia	Serbia
	7	Canada	Canada	Turkey	Russia
	8	Mexico	Russia	Serbia	Turkey
	9	Iceland	UA Emirates	Mexico	South Korea
	10	Yugoslavia	Saudi Arabia	South Korea	Bosnia-Herzegovina

iv) EU28 - Sum of export vs. sum of import with Extra-EU28. Bubble size: Avg.GDP [EUR Bn]: Insulation



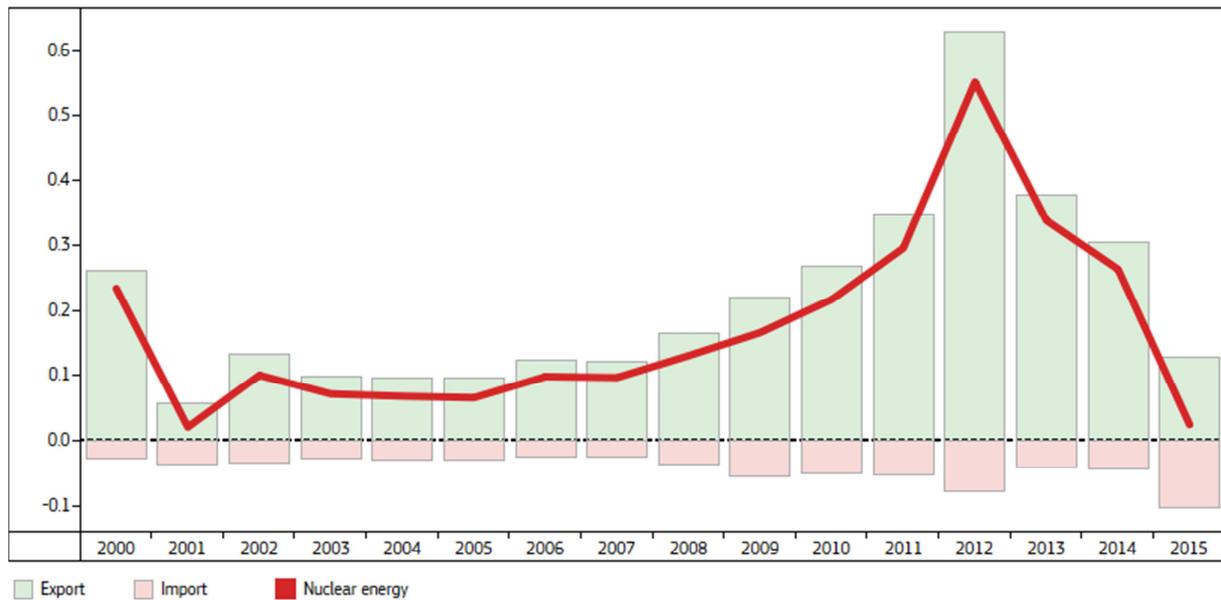
v) Country trade balance (X-M) with Extra-EU28 and Intra-EU28 [EUR Bn]: Insulation



9 Nuclear energy

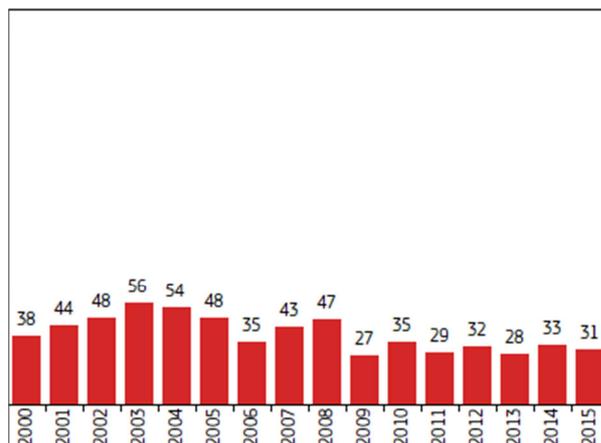
The EU trade balance in the nuclear sector is always positive, with a peak in 2012, followed by a rapid decrease. The number of commercial partners is very low for both export and import. In particular, the number of countries to which the EU exports decreases in the last years, compared with 2003. Apart from the first period, 2000-2003, the EU has a positive trade balance with all regions worldwide, in particular with northern America and eastern Asia. China and the United States are the two most important commercial partners for both import and export. France is the Member State with the highest positive trade balance with extra-EU28. In contrast, it has the lowest trade balance with intra-EU28, while Germany has the highest balance with intra-EU28.

i) EU28 - Technology trade balance (X-M) with Extra-EU28 [EUR Bn]: Nuclear energy

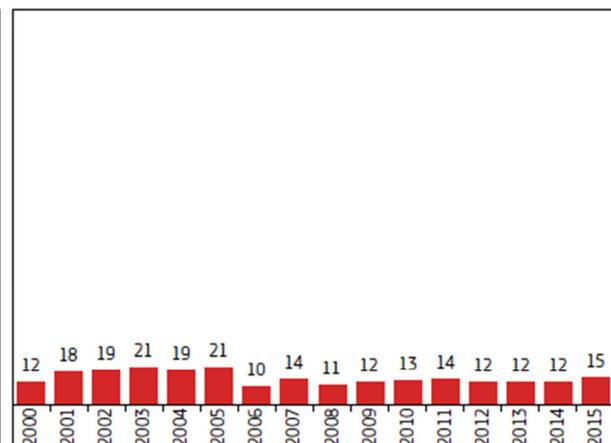


ii) Number of Extra-EU trading countries: Nuclear energy

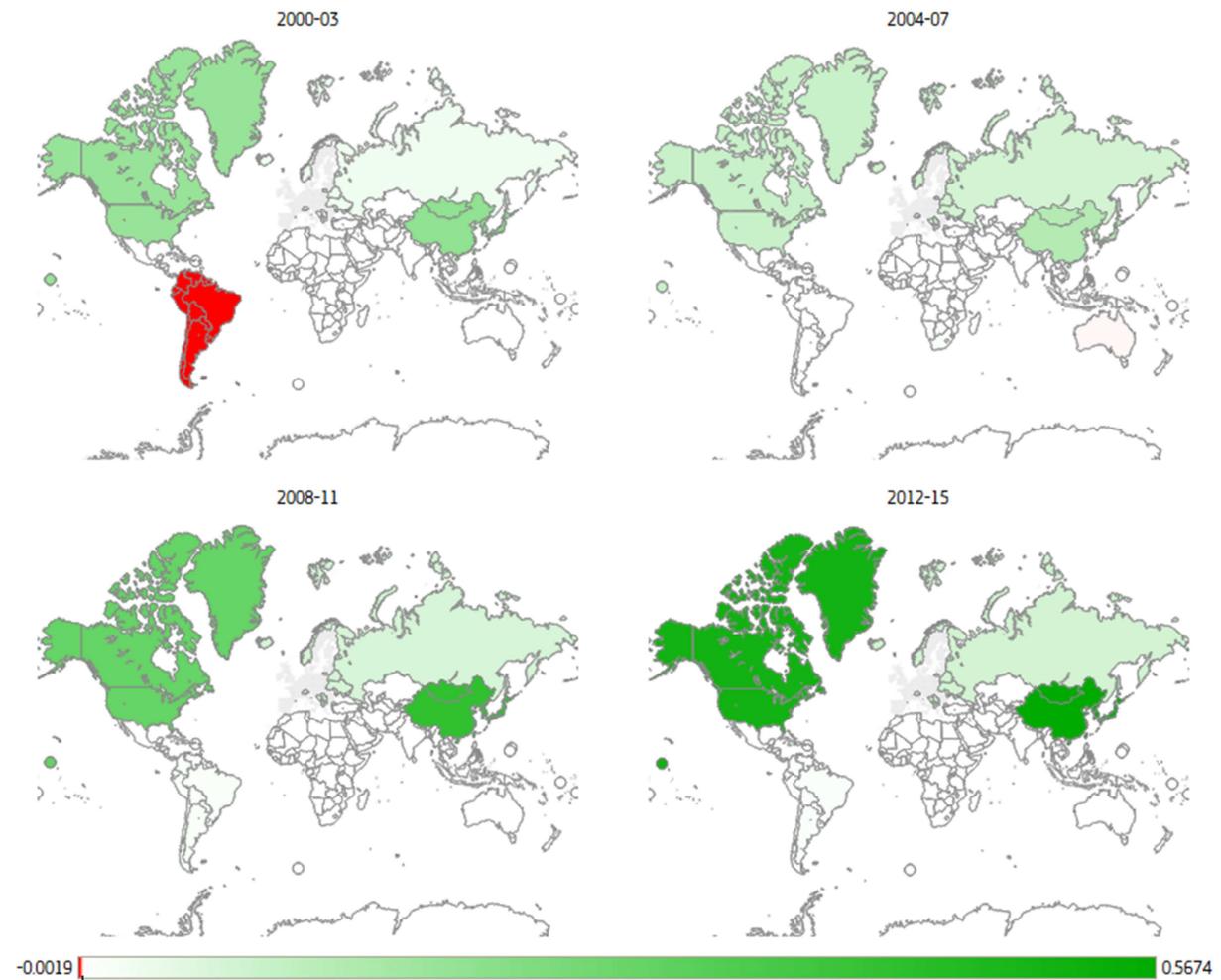
Export



Import



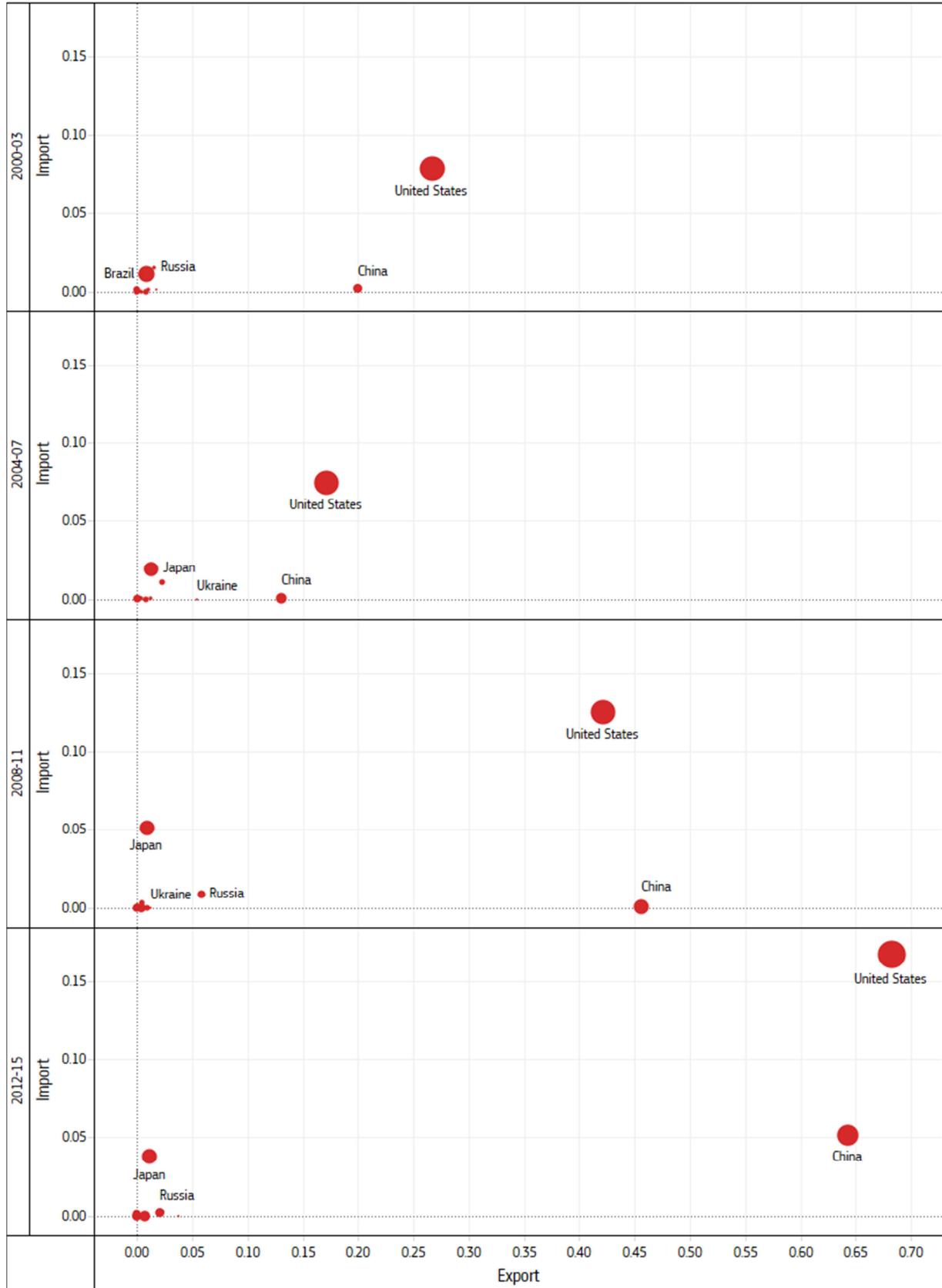
iii) EU28 - Trade balance (X-M) with world regions outside EU28 [EUR Bn]: Nuclear energy



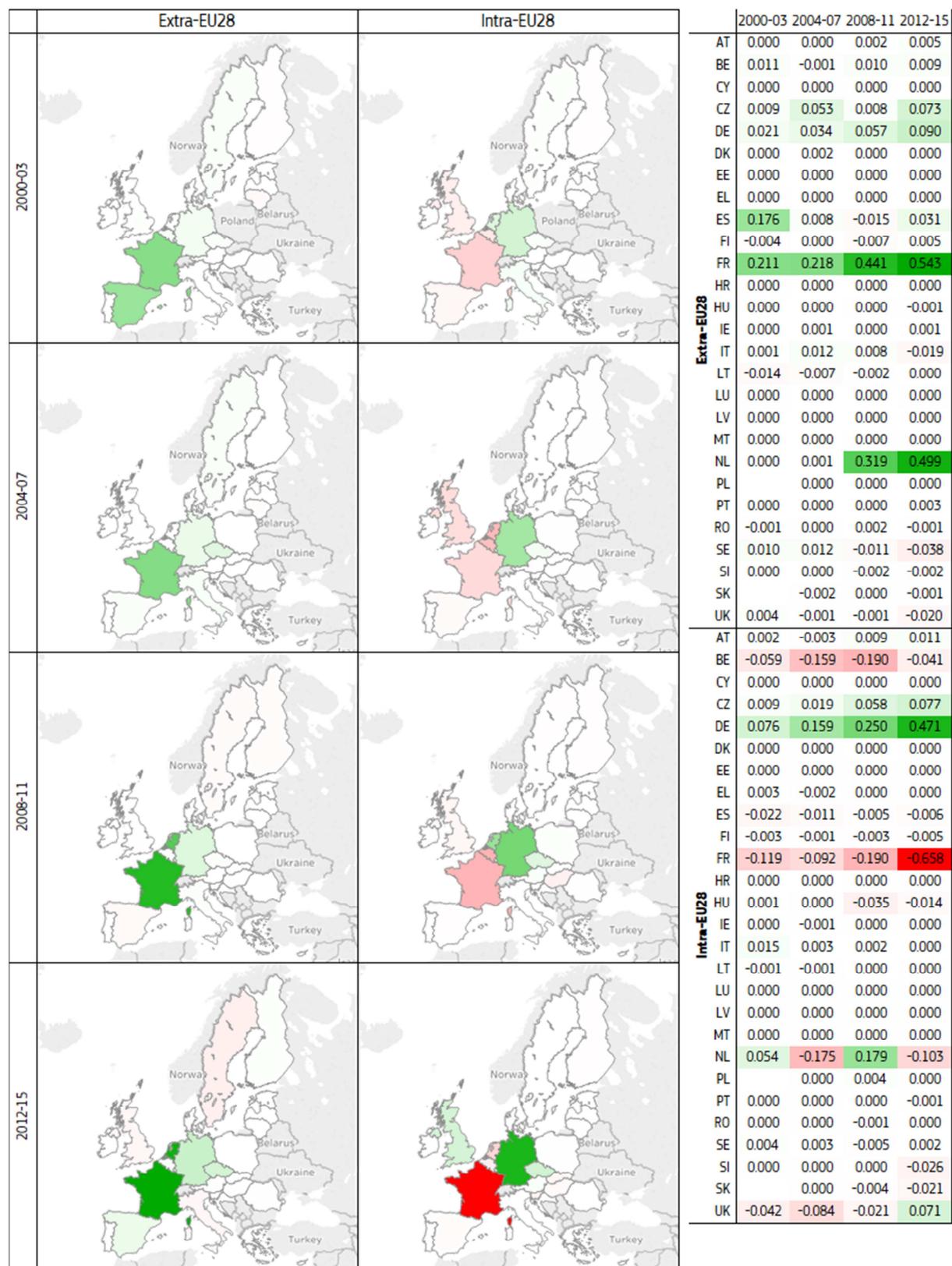
Region	2000-03				2004-07				2008-11				2012-15			
	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15
Africa, Eastern	0.0002	0.0001	0.0000	0.0000												
Africa, Middle	0.0000	0.0000	0.0000	0.0001												
Africa, Northern	0.0016	0.0003	0.0001	0.0010												
Africa, Southern	0.0055	0.0114	0.0017	0.0030												
Africa, Western	0.0001	0.0003	0.0000	0.0002												
America, Caribbean	0.0000	0.0000	0.0001	0.0000												
America, Central	0.0000	0.0010	0.0000	0.0000												
America, Northern	0.1870	0.0957	0.2968	0.5149												
America, South	-0.0019	0.0023	0.0107	0.0088												
Antarctica	0.0000	0.0000	0.0000	0.0000												
Asia, Central	0.0000	0.0000	0.0000	0.0010												
Asia, Eastern	0.2049	0.1340	0.4263	0.5674												
Asia, South-Eastern	0.0010	0.0016	0.0017	0.0000												
Asia, Southern	0.0003	0.0025	0.0001	0.0000												
Asia, Western	0.0014	0.0019	0.0001	0.0029												
Oceania, Australia & NewZealand	0.0002	-0.0001	0.0003	0.0000												
Oceania, Melanesia	0.0000	0.0000	0.0000	0.0000												
Oceania, Micronesia	0.0000	0.0000	0.0000	0.0000												
Oceania, Polynesia	0.0000	0.0000	0.0000	0.0000												
Rest of Europe	0.0262	0.0783	0.0703	0.0772												

Top 10 Extra-EU28					
	2000-03	2004-07	2008-11	2012-15	
Export	1	United States	United States	China	United States
	2	China	China	United States	China
	3	Ukraine	Ukraine	Russia	Ukraine
	4	Russia	Russia	Ukraine	Switzerland
	5	Switzerland	Japan	South Korea	Russia
	6	Japan	South Africa	Japan	Japan
	7	South Korea	Norway	Norway	Brazil
	8	Argentina	South Korea	Argentina	South Africa
	9	Brazil	Switzerland	Switzerland	Israel
	10	South Africa	Iran	Brazil	Argentina
Import	1	United States	United States	United States	United States
	2	Russia	Japan	Japan	China
	3	Japan	Russia	Russia	Japan
	4	Brazil	Switzerland	Switzerland	Switzerland
	5	China	China	China	Russia
	6	Ukraine	Canada	Turkey	Canada
	7	Canada	South Africa	South Africa	Turkey
	8	Switzerland	Australia	Canada	South Korea
	9	South Africa	UA Emirates	Norway	Norway
	10	Australia	Turkey	South Korea	Mexico

iv) EU28 - Sum of export vs. sum of import with Extra-EU28. Bubble size: Avg.GDP [EUR Bn]: Nuclear energy



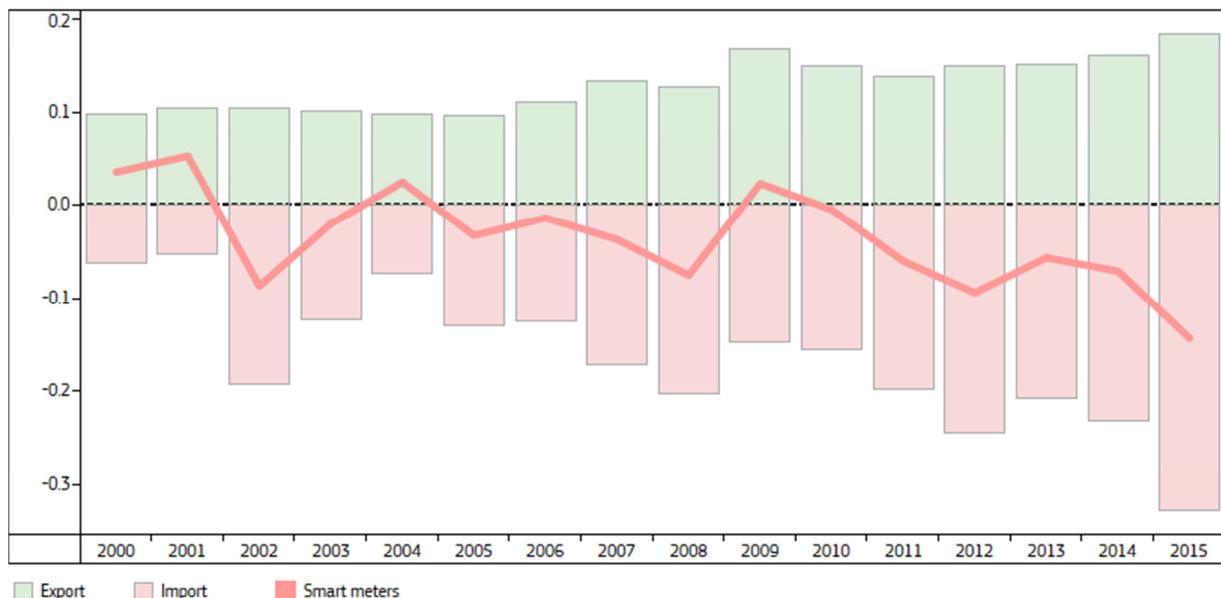
v) Country trade balance (X-M) with Extra-EU28 and Intra-EU28 [EUR Bn]: Nuclear energy



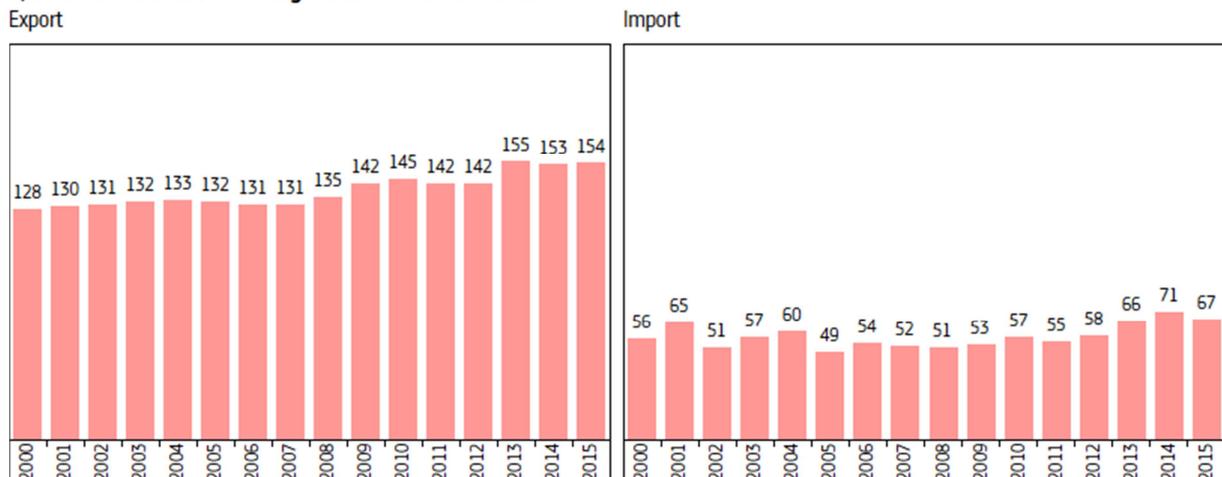
10 Smart meters

The EU trade balance in the smart meter sector is positive in 2000 and then it becomes negative along the years, with sporadic positive peaks in 2004 and 2009. On average, the number of commercial partners increases for both export and import. Eastern Asia is the geographic area with which the EU has the largest level of negative balance, while the balance is positive with western Asia and southern America. At country level, the EU imports mostly from China, Switzerland and Tunisia, while it exports more to Norway, Saudi Arabia, Switzerland and the United Arab Emirates, although the individual Member States perform differently. Italy has a negative trade balance with extra-EU28 over the periods, while France shifts from having a positive balance to a negative balance in the last period. This is the opposite trend with intra-EU28: France has a constant positive trade balance within the EU, while Italy shifts from being negative to positive in the last period. In contrast, the United Kingdom shows positive trade balances with both extra-EU28 and intra-EU28, while for Spain both are always negative.

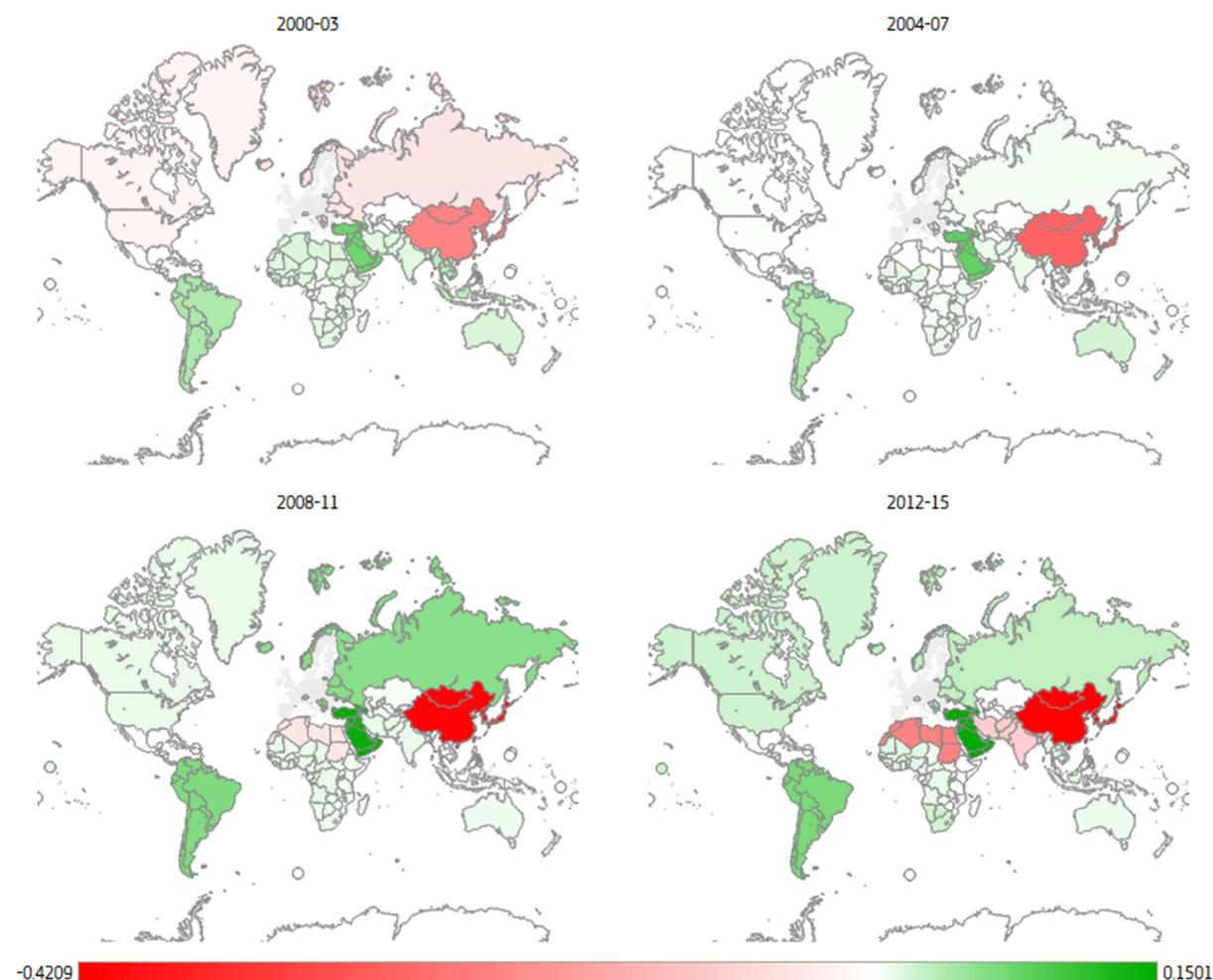
i) EU28 - Technology trade balance (X-M) with Extra-EU28 [EUR Bn]: Smart meters



ii) Number of Extra-EU trading countries: Smart meters



iii) EU28 - Trade balance (X-M) with world regions outside EU28 [EUR Bn]: Smart meters



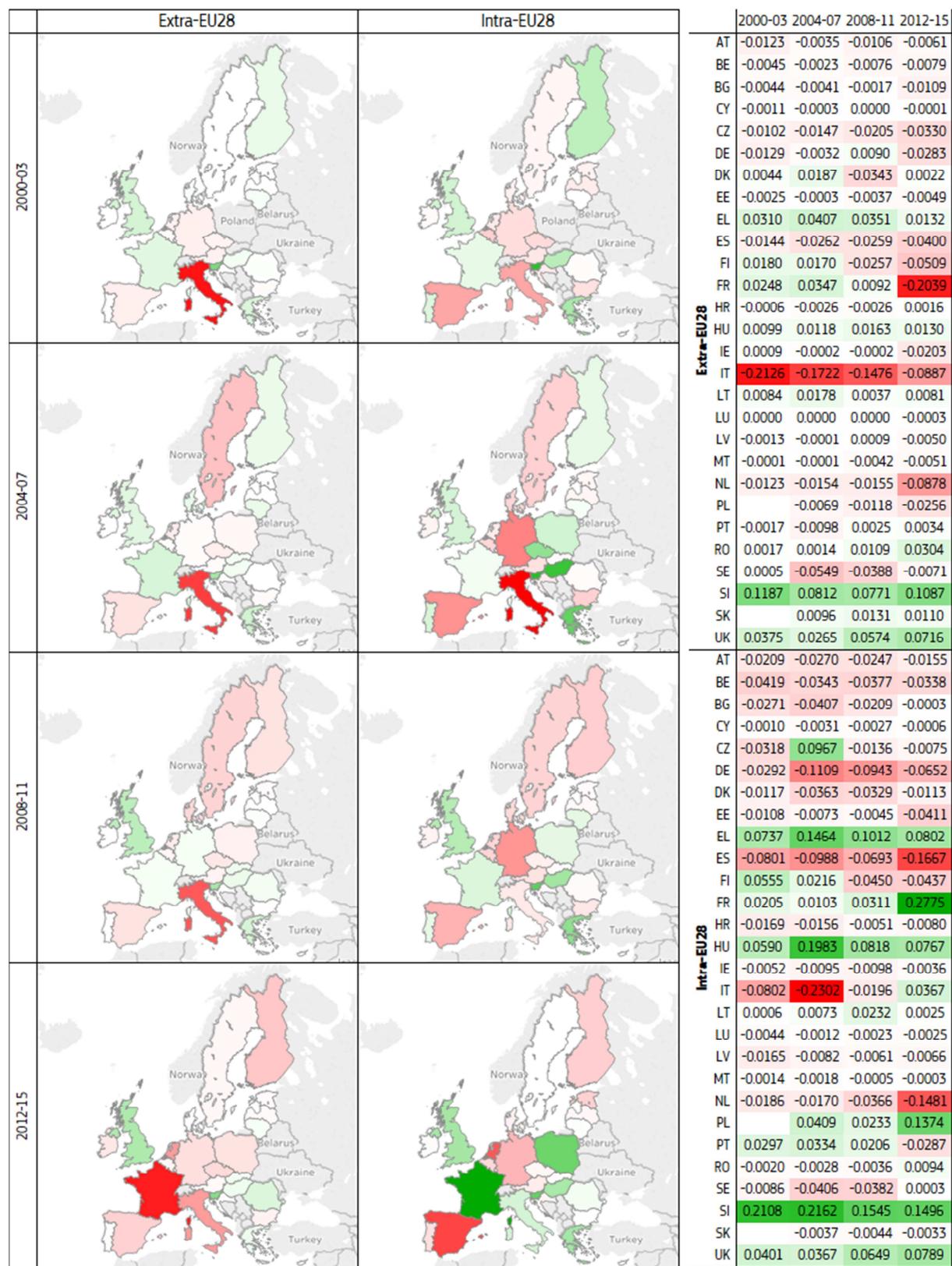
Region	2000-03				2004-07				2008-11				2012-15			
	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15
Africa, Eastern	0.0126	0.0070	0.0068	0.0032												
Africa, Middle	0.0045	0.0048	0.0102	0.0083												
Africa, Northern	0.0164	0.0015	-0.0403	-0.2038												
Africa, Southern	0.0139	0.0086	0.0087	0.0205												
Africa, Western	0.0144	0.0107	0.0089	0.0134												
America, Caribbean	0.0029	0.0033	0.0031	0.0017												
America, Central	0.0010	-0.0002	0.0026	0.0041												
America, Northern	-0.0171	0.0011	0.0096	0.0225												
America, South	0.0392	0.0380	0.0619	0.0660												
Antarctica	0.0000	0.0000	0.0000	0.0000												
Asia, Central	0.0004	0.0009	0.0049	0.0013												
Asia, Eastern	-0.2010	-0.2527	-0.4115	-0.4209												
Asia, South-Eastern	0.0304	0.0023	-0.0024	0.0123												
Asia, Southern	0.0141	0.0090	0.0098	-0.0791												
Asia, Western	0.0732	0.0802	0.1452	0.1501												
Oceania, Australia & NewZealand	0.0172	0.0199	0.0072	0.0077												
Oceania, Melanesia	0.0008	0.0009	0.0010	0.0011												
Oceania, Micronesia	0.0000	0.0000	0.0000	0.0000												
Oceania, Polynesia	0.0007	0.0008	0.0011	0.0008												
Rest of Europe	-0.0411	0.0063	0.0574	0.0282												

Top 10 Extra-EU28					
	2000-03	2004-07	2008-11	2012-15	
Export	1	Switzerland	Switzerland	UA Emirates	Switzerland
	2	Norway	Norway	Switzerland	United States
	3	India	Saudi Arabia	Norway	Saudi Arabia
	4	Israel	UA Emirates	Saudi Arabia	UA Emirates
	5	Hong Kong	China	United States	Norway
	6	Colombia	Colombia	Colombia	South Africa
	7	Saudi Arabia	Israel	Russia	Turkey
	8	South Africa	Libya	Former Yugoslav R.	Russia
	9	Australia	Hong Kong	Iran	Bosnia-Herzegovina
	10	Malaysia	United States	China	Colombia
Import	1	China	China	China	China
	2	Switzerland	Switzerland	Switzerland	Tunisia
	3	United States	Tunisia	Tunisia	Switzerland
	4	India	Hong Kong	Indonesia	India
	5	Tunisia	India	United States	Moldova
	6	Japan	Indonesia	India	United States
	7	Turkey	Japan	Moldova	Indonesia
	8	Norway	United States	Singapore	Hong Kong
	9	Taiwan	Moldova	Hong Kong	Egypt
	10	Russia	Singapore	South Korea	Singapore

iv) EU28 - Sum of export vs. sum of import with Extra-EU28. Bubble size: Avg.GDP [EUR Bn]: Smart meters



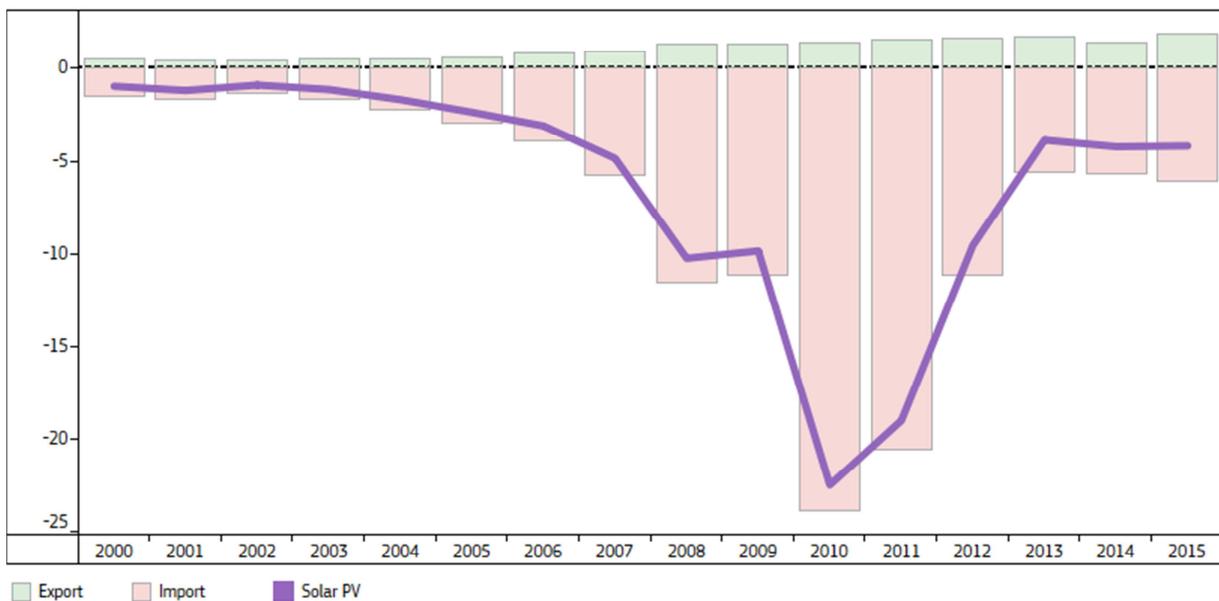
v) Country trade balance (X-M) with Extra-EU28 and Intra-EU28 [EUR Bn]: Smart meters



11 Solar PV

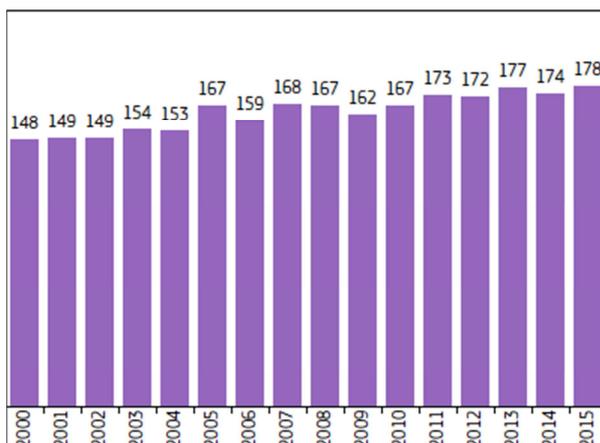
The EU trade balance in the solar PV sector is negative in all the years, with a rapid decrease, starting from 2007, that reaches its lowest value in 2010, followed by a reverse tendency. On average, over the years, the number of commercial partners increases almost constantly for export while it changes often for import. In the period 2008-2011, the EU has a very negative trade balance with countries in eastern Asia, in particular with China (see Box 1). The recovery of the trade balance experienced in the following period is due mainly to increasing export to other European countries, such as Russia and Switzerland, and to northern America. Among the Member States, which all show a negative balance, Germany has the largest negative trade balance in the period 2008-2011 with extra-EU28, and one of the highest positive balances in the same period with intra-EU28, second only to the Netherlands.

i) EU28 - Technology trade balance (X-M) with Extra-EU28 [EUR Bn]: Solar PV

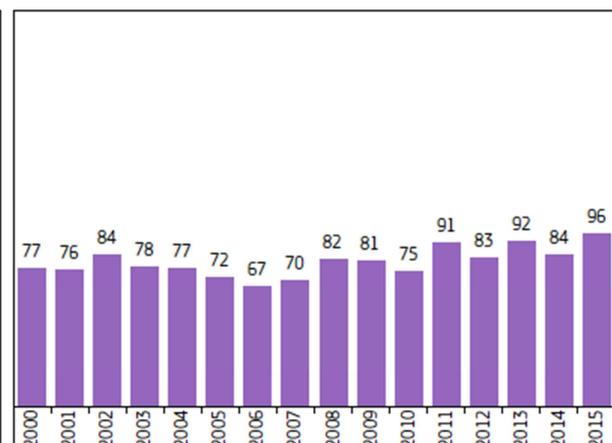


ii) Number of Extra-EU trading countries: Solar PV

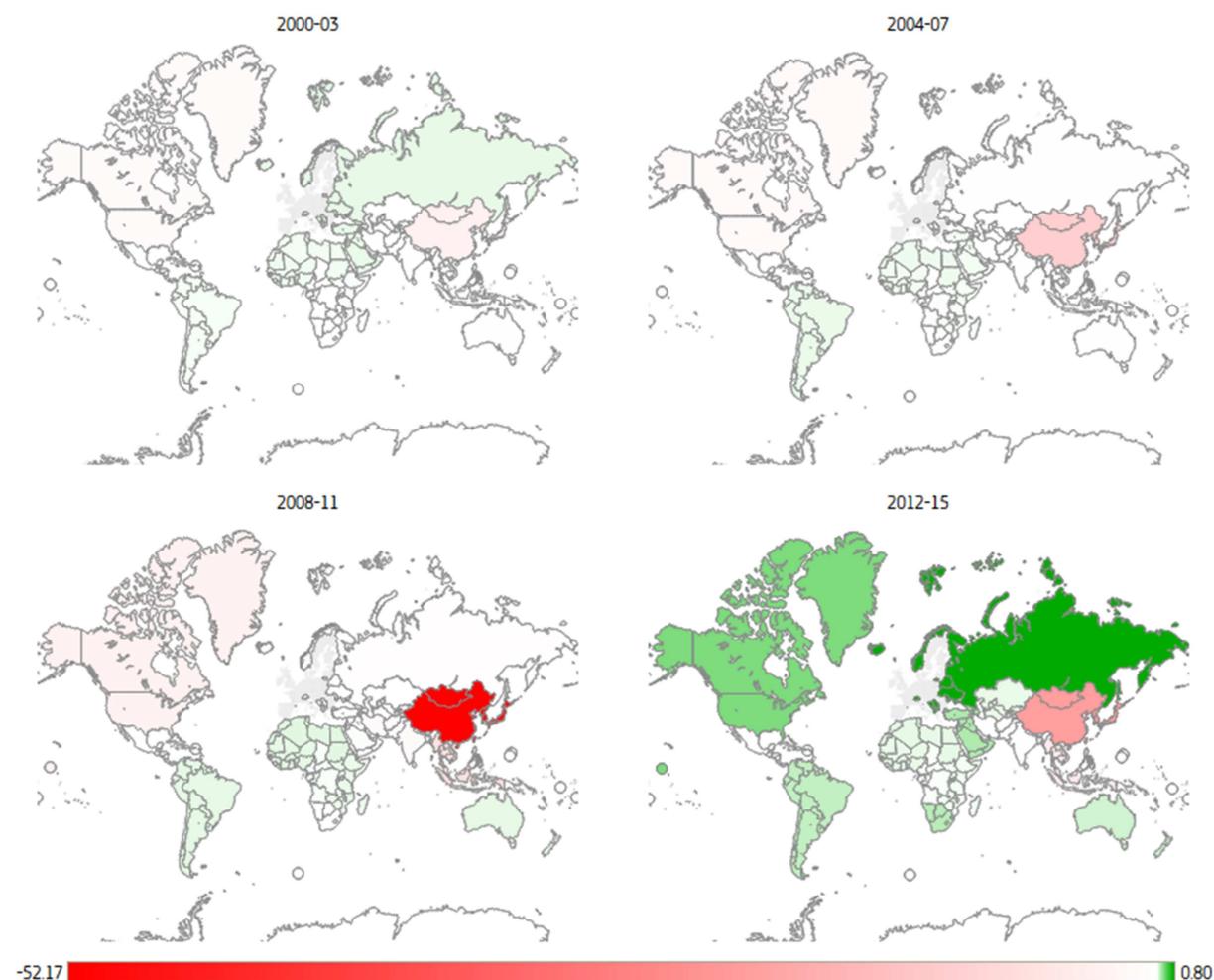
Export



Import



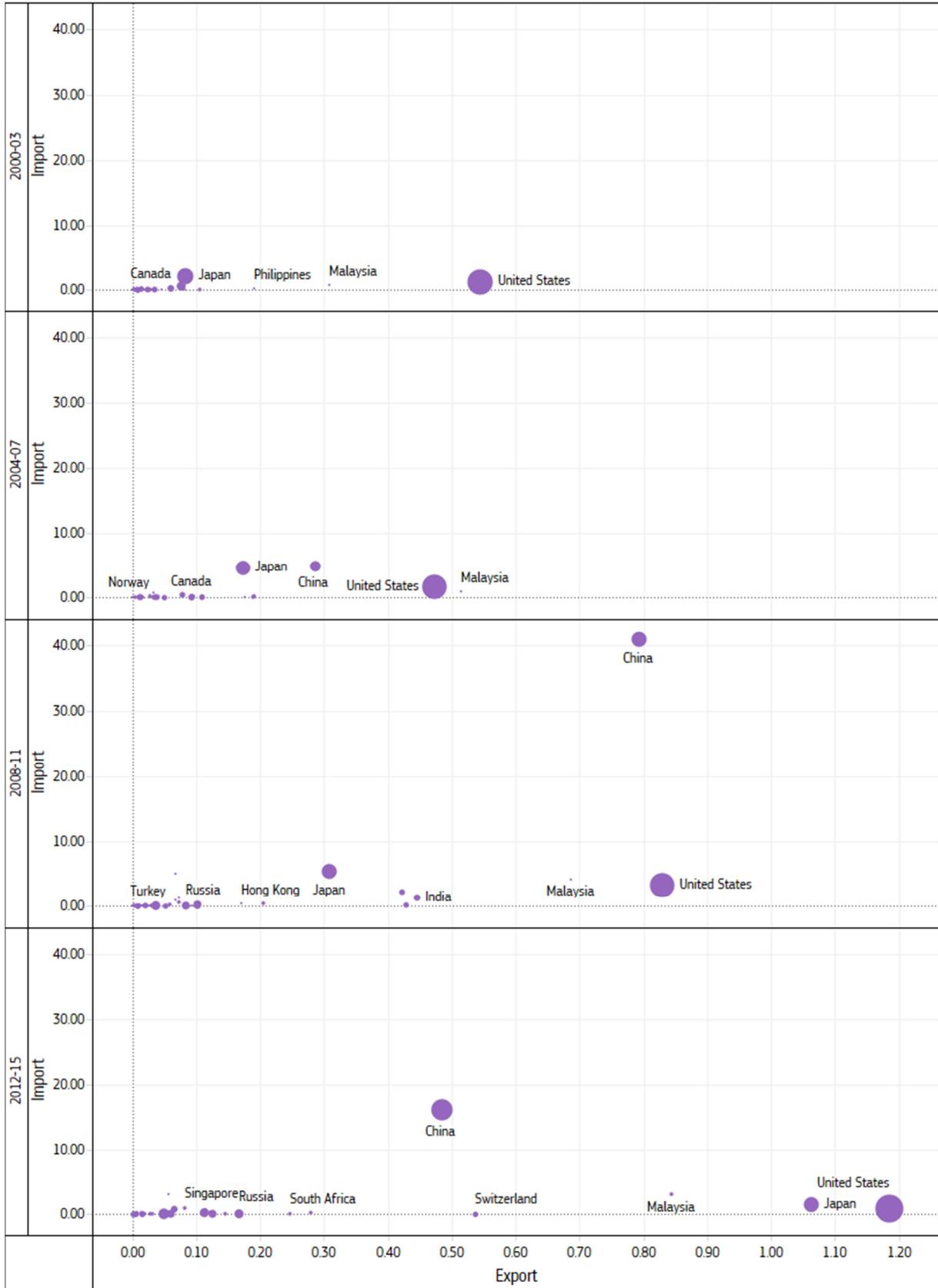
iii) EU28 - Trade balance (X-M) with world regions outside EU28 [EUR Bn]: Solar PV



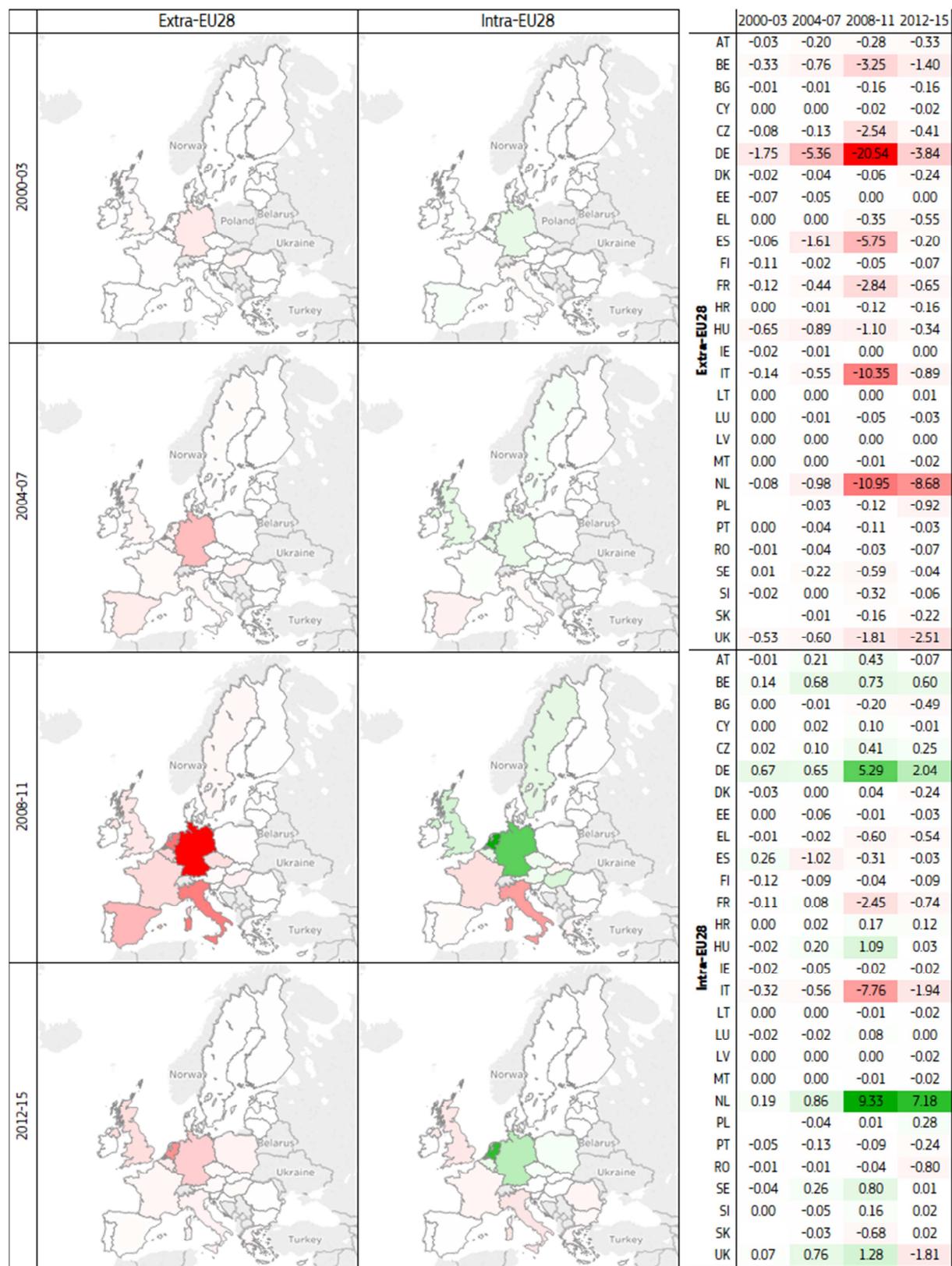
Region	2000-03				2004-07				2008-11				2012-15			
	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15
Africa, Eastern	0.01	0.02	0.05	0.03												
Africa, Middle	0.00	0.01	0.02	0.02												
Africa, Northern	0.03	0.04	0.07	0.06												
Africa, Southern	-0.01	-0.09	-0.22	0.18												
Africa, Western	0.04	0.03	0.07	0.05												
America, Caribbean	0.01	0.01	0.00	0.01												
America, Central	-0.02	-0.04	-0.10	-0.04												
America, Northern	-0.89	-1.22	-2.49	0.34												
America, South	0.02	0.05	0.06	0.15												
Antarctica	0.00	0.00	0.00	0.00												
Asia, Central	0.00	0.00	0.00	0.05												
Asia, Eastern	-2.76	-9.62	-52.17	-19.82												
Asia, South-Eastern	-0.62	-0.77	-5.82	-3.85												
Asia, Southern	-0.08	-0.28	-0.90	-0.15												
Asia, Western	0.05	0.03	0.01	0.20												
Oceania, Australia & NewZealand	-0.03	-0.05	0.06	0.12												
Oceania, Melanesia	0.00	0.00	0.01	0.00												
Oceania, Micronesia	-0.01	0.00	0.00	0.00												
Oceania, Polynesia	0.00	0.01	0.01	0.00												
Rest of Europe	0.06	-0.12	-0.21	0.80												

Top 10 Extra-EU28					
	2000-03	2004-07	2008-11	2012-15	
Export	1	United States	Malaysia	United States	United States
	2	Malaysia	United States	China	Japan
	3	Philippines	China	Malaysia	Malaysia
	4	Switzerland	South Africa	India	Switzerland
	5	Japan	Switzerland	Switzerland	China
	6	Hong Kong	Hong Kong	South Korea	Hong Kong
	7	China	Japan	Japan	South Africa
	8	Canada	South Korea	South Africa	Russia
	9	South Africa	Philippines	Hong Kong	Turkey
	10	South Korea	Canada	Canada	Israel
Import	1	Japan	China	China	China
	2	United States	Japan	Japan	Taiwan
	3	Malaysia	United States	Taiwan	Malaysia
	4	China	Malaysia	Malaysia	Japan
	5	Philippines	Taiwan	United States	Singapore
	6	Canada	India	South Korea	South Korea
	7	Taiwan	Philippines	India	United States
	8	India	South Africa	Philippines	Philippines
	9	Singapore	Norway	Singapore	Hong Kong
	10	Switzerland	Thailand	Norway	India

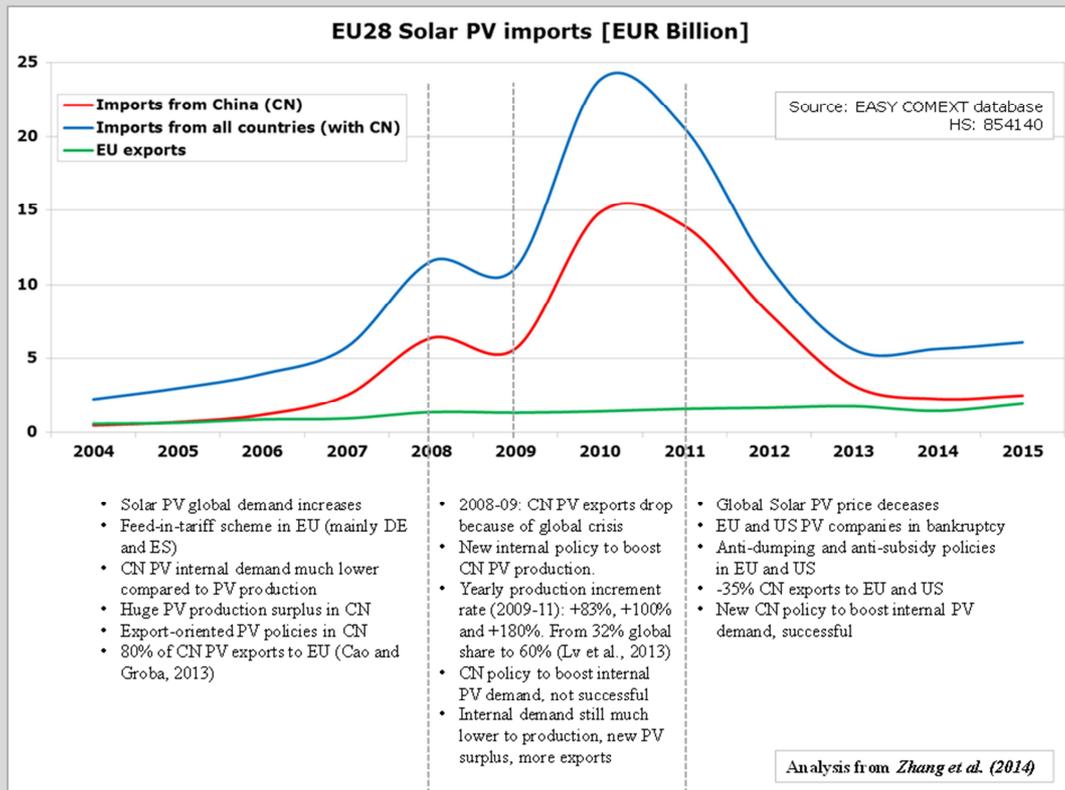
iv) EU28 - Sum of export vs. sum of import with Extra-EU28. Bubble size: Avg.GDP [EUR Bn]: Solar PV



v) Country trade balance (X-M) with Extra-EU28 and Intra-EU28 [EUR Bn]: Solar PV



Box 1. EU solar PV trade with China

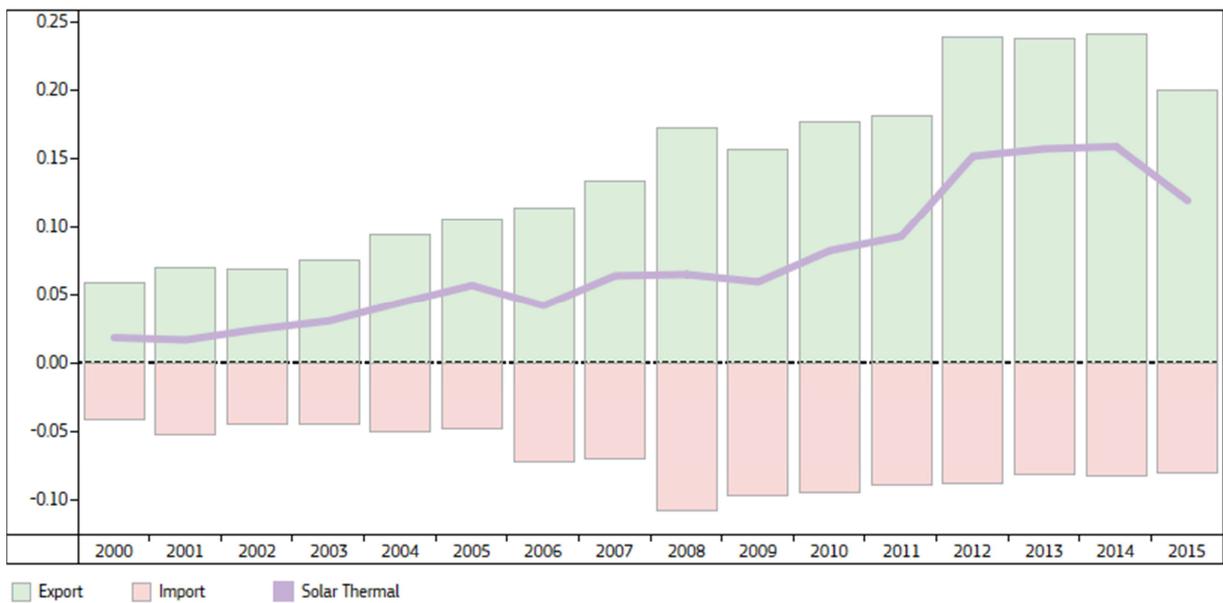


The European trade balance of solar PV is totally influenced and skewed by imports rather than exports, which are almost constant over the years. In particular, the total EU solar PV imports are clearly dependent on imports from China. The peak in 2009-2011 is due to the concurrent effect of both the global financial crisis and the internal Chinese policies related to the solar PV sector (Cao and Groba, 2013; Lv et al., 2013; Zhang et al., 2014).

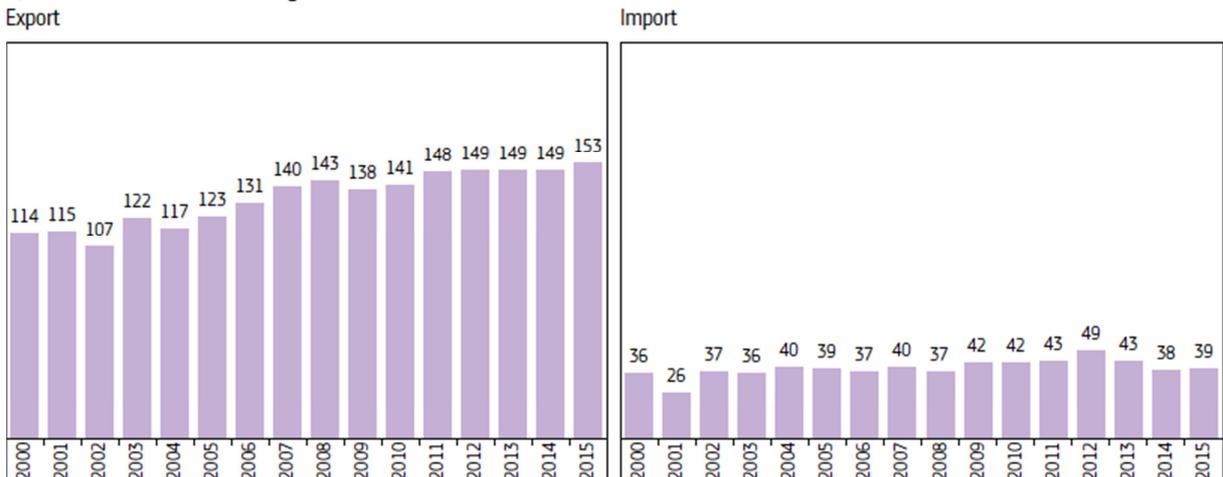
12 Solar thermal

The EU trade balance in the solar thermal sector is positive in all the years studied, showing an increasing trend from 2009 to 2012. On average, the number of commercial partners increases for export, while it remains almost constant for import. From the period 2008-2011, eastern Asia is the region of the world with which the EU has the largest level of negative balance, while the balance is positive with the remaining areas of the world, particularly with the rest of European countries. The EU imports mostly from China, Switzerland and United States, while it exports more to Russia, Switzerland and the United States. Germany is the Member State with the highest positive trade balance with extra-EU28 countries, while, at the same time, it has the largest negative balance within the EU. Austria, France, the Netherlands and Poland are the European countries with the highest positive trade balance with intra-EU28.

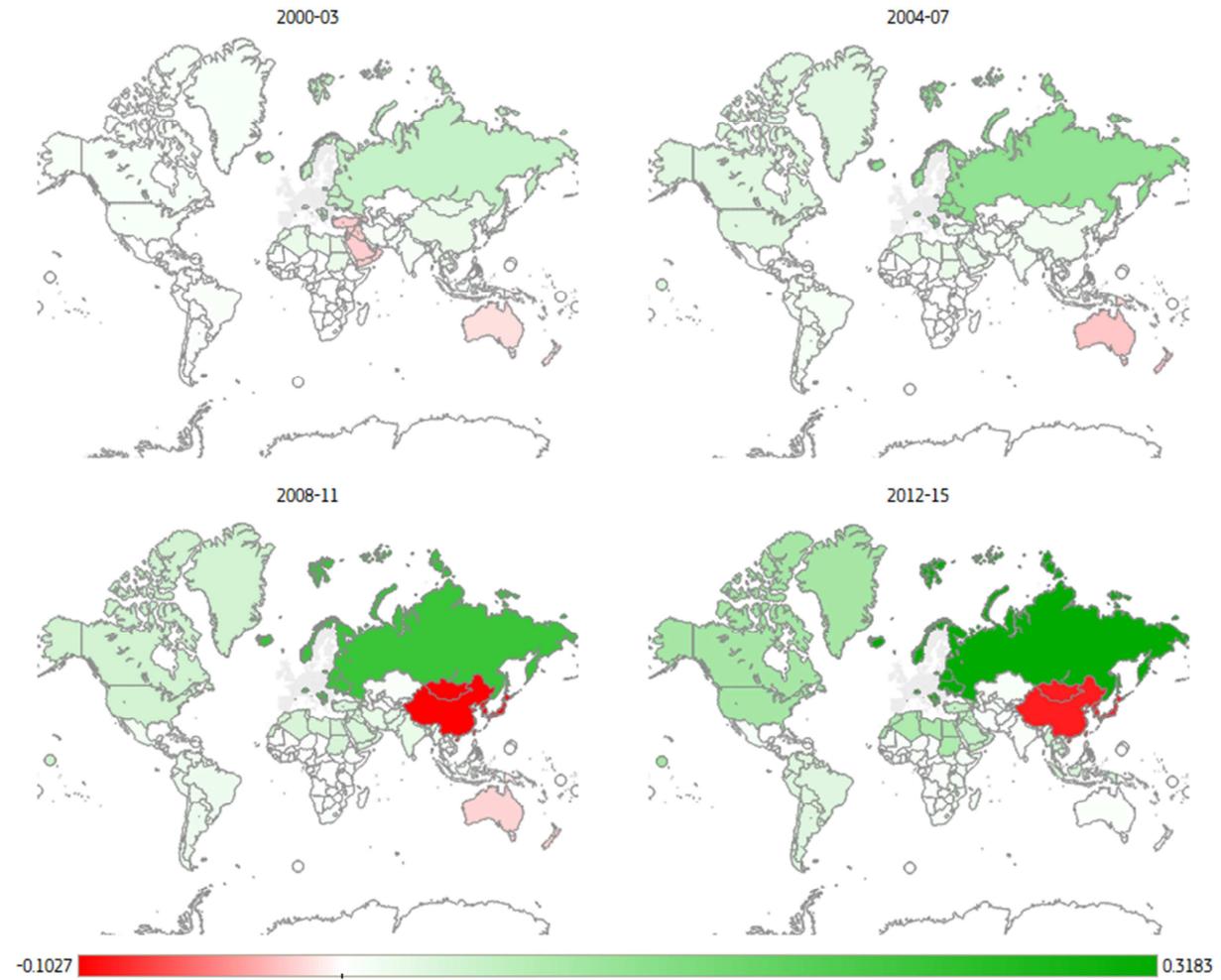
i) EU28 - Technology trade balance (X-M) with Extra-EU28 [EUR Bn]: Solar Thermal



ii) Number of Extra-EU trading countries: Solar Thermal



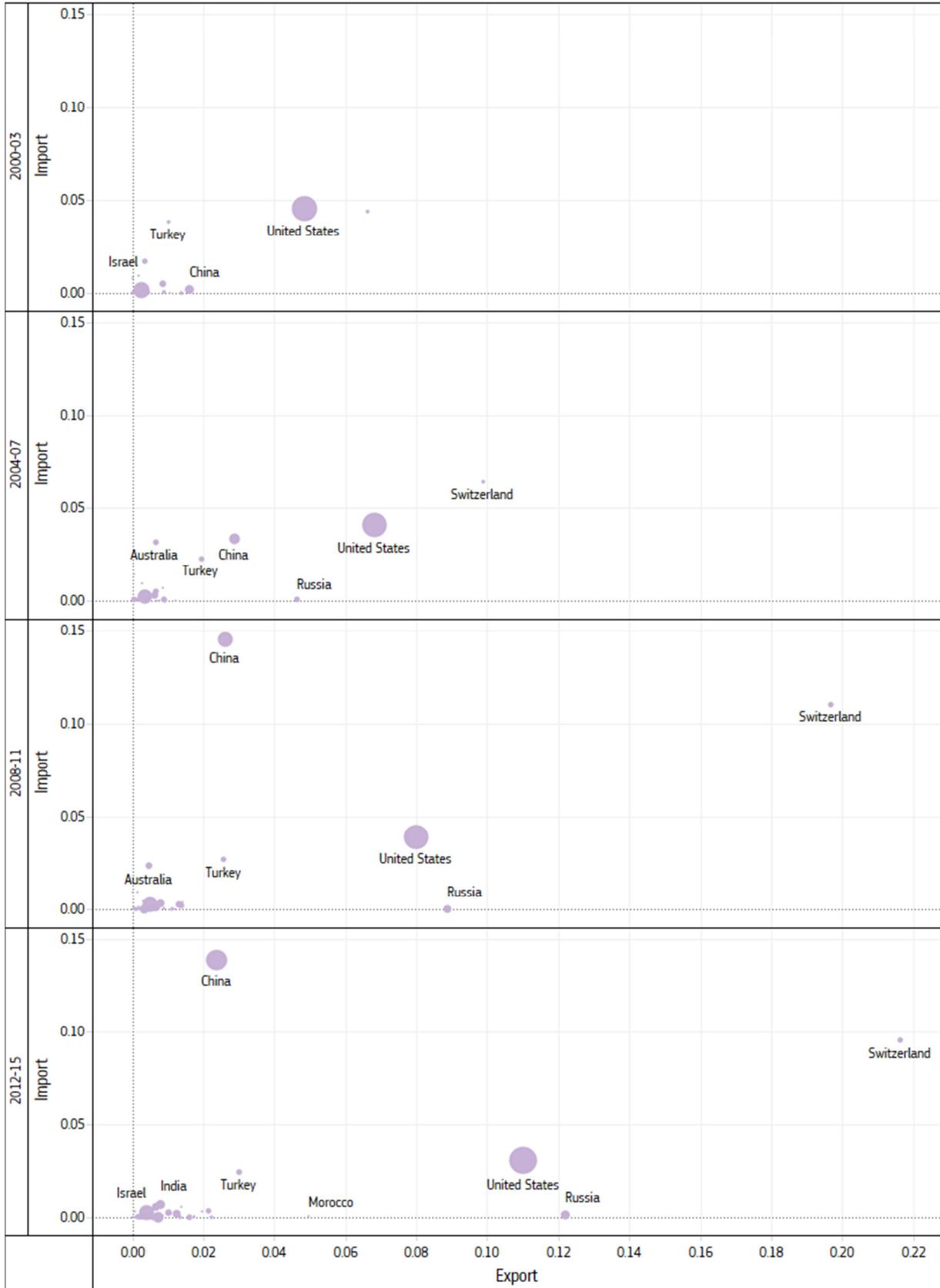
iii) EU28 - Trade balance (X-M) with world regions outside EU28 [EUR Bn]: Solar Thermal



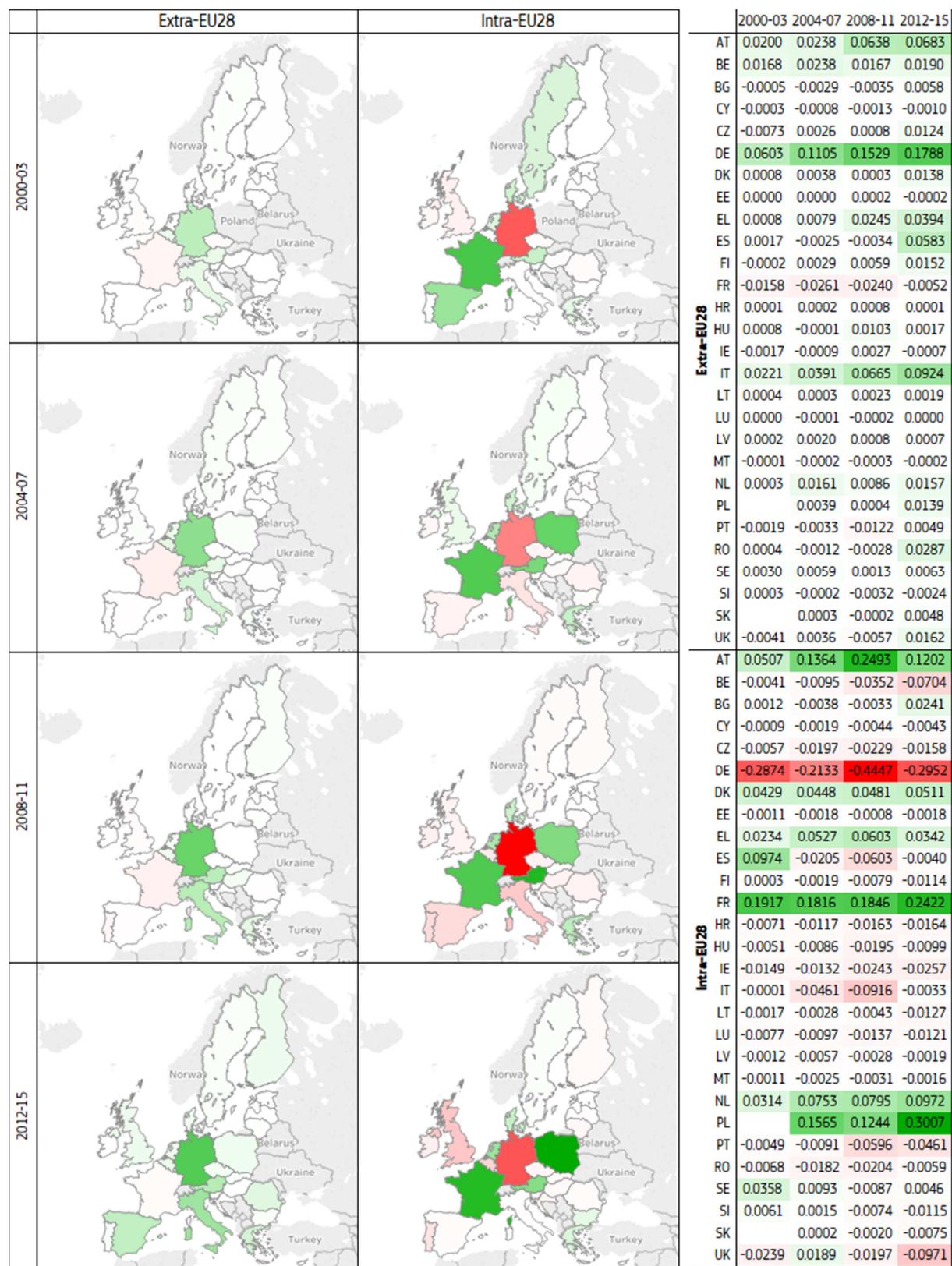
Region	2000-03				2004-07				2008-11				2012-15			
	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15
Africa, Eastern	0.0019	0.0030	0.0056	0.0109												
Africa, Middle	0.0005	0.0019	0.0022	0.0051												
Africa, Northern	0.0205	0.0177	0.0379	0.0810												
Africa, Southern	0.0009	0.0027	0.0049	0.0066												
Africa, Western	0.0015	0.0040	0.0043	0.0077												
America, Caribbean	0.0009	0.0016	0.0021	0.0059												
America, Central	-0.0007	0.0044	0.0132	0.0099												
America, Northern	0.0073	0.0311	0.0460	0.0906												
America, South	0.0045	0.0102	0.0155	0.0319												
Antarctica	0.0000	0.0001	0.0000	0.0000												
Asia, Central	0.0019	0.0037	0.0056	0.0071												
Asia, Eastern	0.0192	0.0130	-0.1027	-0.0911												
Asia, South-Eastern	0.0100	0.0094	0.0092	0.0378												
Asia, Southern	0.0076	0.0104	0.0217	0.0054												
Asia, Western	-0.0191	0.0172	0.0362	0.0566												
Oceania, Australia & NewZealand	-0.0123	-0.0229	-0.0170	0.0031												
Oceania, Melanesia	-0.0078	-0.0140	-0.0091	-0.0015												
Oceania, Micronesia	0.0000	0.0000	0.0001	0.0001												
Oceania, Polynesia	0.0004	0.0002	0.0006	0.0001												
Rest of Europe	0.0549	0.1147	0.2243	0.3183												

Top 10 Extra-EU28					
	2000-03	2004-07	2008-11	2012-15	
Export	1	Switzerland	Switzerland	Switzerland	Switzerland
	2	United States	United States	Russia	Russia
	3	China	Russia	United States	United States
	4	Russia	China	China	Morocco
	5	Egypt	Turkey	Turkey	Turkey
	6	Turkey	Ukraine	Liechtenstein	China
	7	Saudi Arabia	Saudi Arabia	Mexico	UA Emirates
	8	Canada	South Korea	Tunisia	Norway
	9	Ukraine	Liechtenstein	India	Liechtenstein
	10	Liechtenstein	Morocco	Ukraine	Ukraine
Import	1	United States	Switzerland	China	China
	2	Switzerland	United States	Switzerland	Switzerland
	3	Turkey	China	United States	United States
	4	Australia	Australia	Turkey	Turkey
	5	Israel	Turkey	Australia	India
	6	New Caledonia	New Caledonia	New Caledonia	Tunisia
	7	Canada	Israel	Vietnam	Australia
	8	Taiwan	Liechtenstein	Israel	Israel
	9	Mexico	India	Liechtenstein	Norway
	10	China	Canada	Canada	Liechtenstein

iv) EU28 - Sum of export vs. sum of import with Extra-EU28. Bubble size: Avg.GDP [EUR Bn]: Solar Thermal



v) Country trade balance (X-M) with Extra-EU28 and Intra-EU28 [EUR Bn]: Solar Thermal

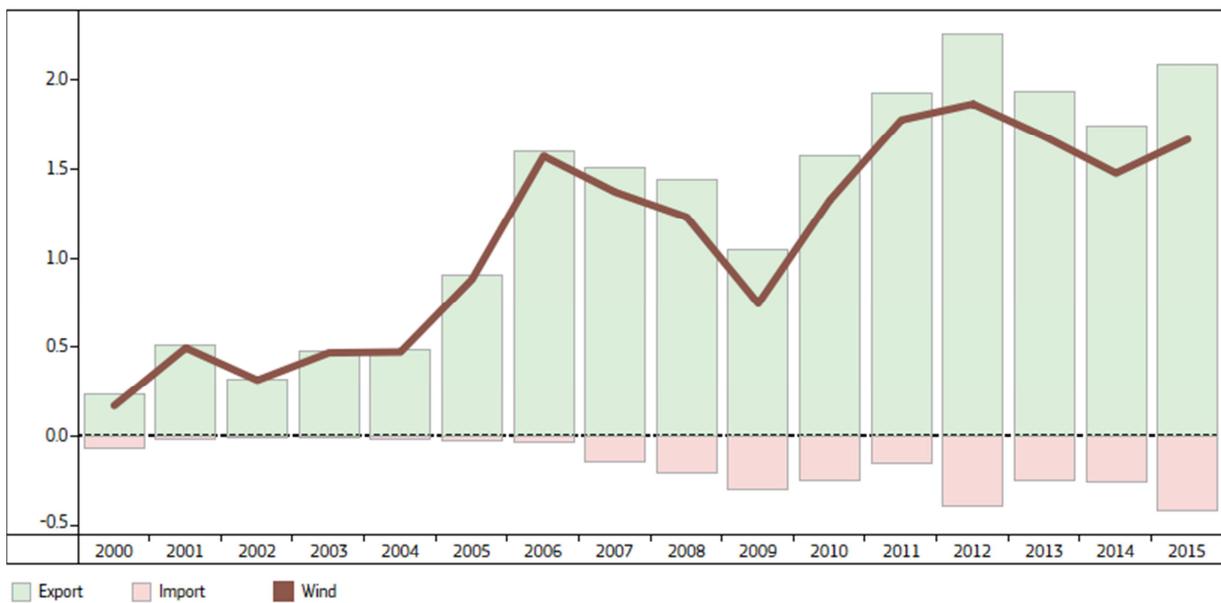


-0.4447 0.3007

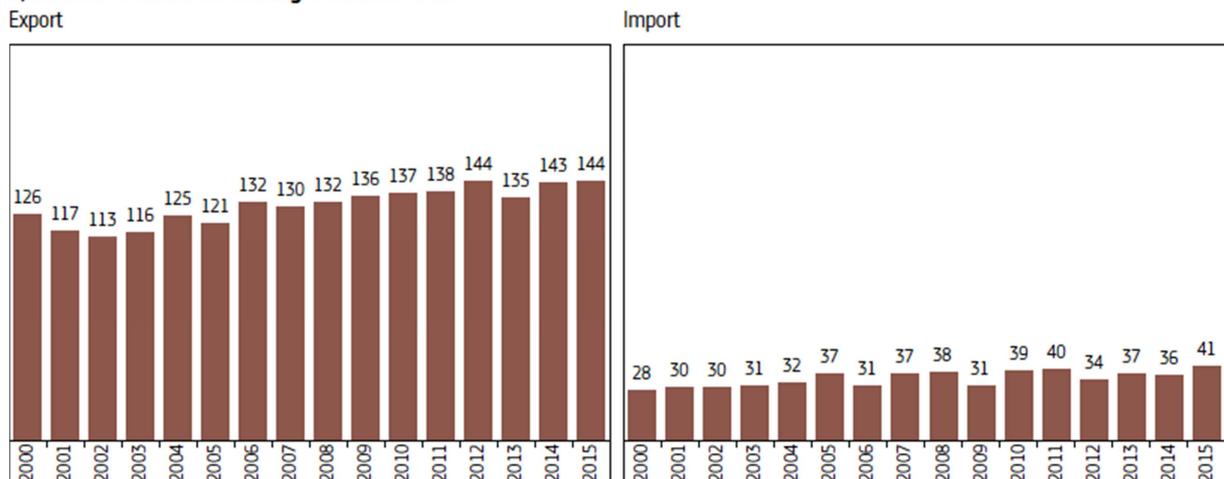
13 Wind

The EU trade balance in the wind sector is positive in all the years studied, showing a decreasing tendency from 2006 to 2009 and from 2012 to 2014. On average, the number of commercial partners increases for both export and import. Northern America is the region of the world with which the EU has the highest level of positive trade balance, while the balance, in the last two periods (2008-2011 and 2012-2015) becomes negative with eastern Asia. At country level, the EU imports mostly from China and South Korea, while it exports more to Canada and the United States. Denmark, Germany and Spain are the three Member States with the highest positive trade balance with extra-EU28 countries. In the last two periods, these three countries have also the highest positive balance with intra-EU28, while it is negative for all the other Member States. The United Kingdom has the largest negative balance with intra-EU28.

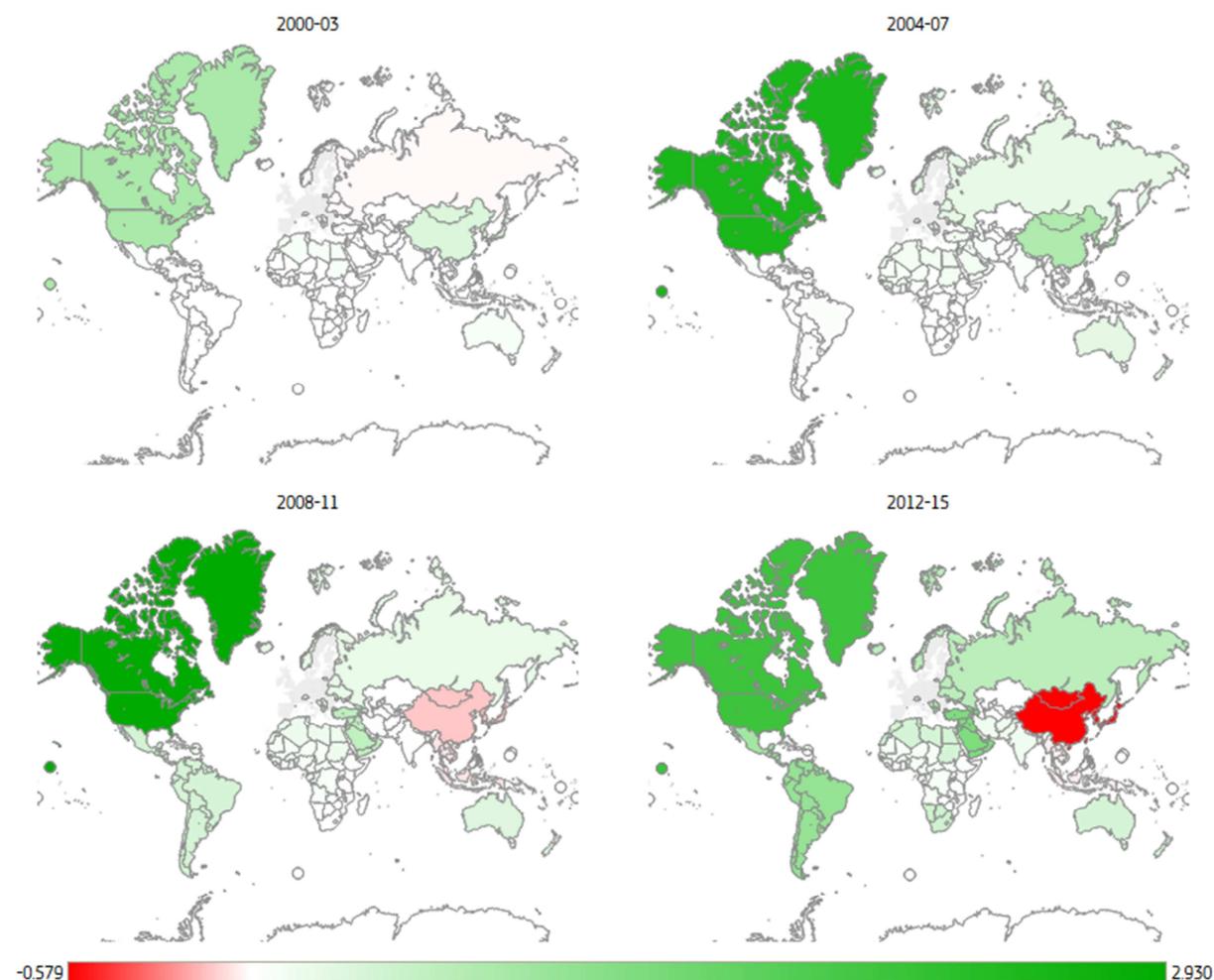
i) EU28 - Technology trade balance (X-M) with Extra-EU28 [EUR Bn]: Wind



ii) Number of Extra-EU trading countries: Wind



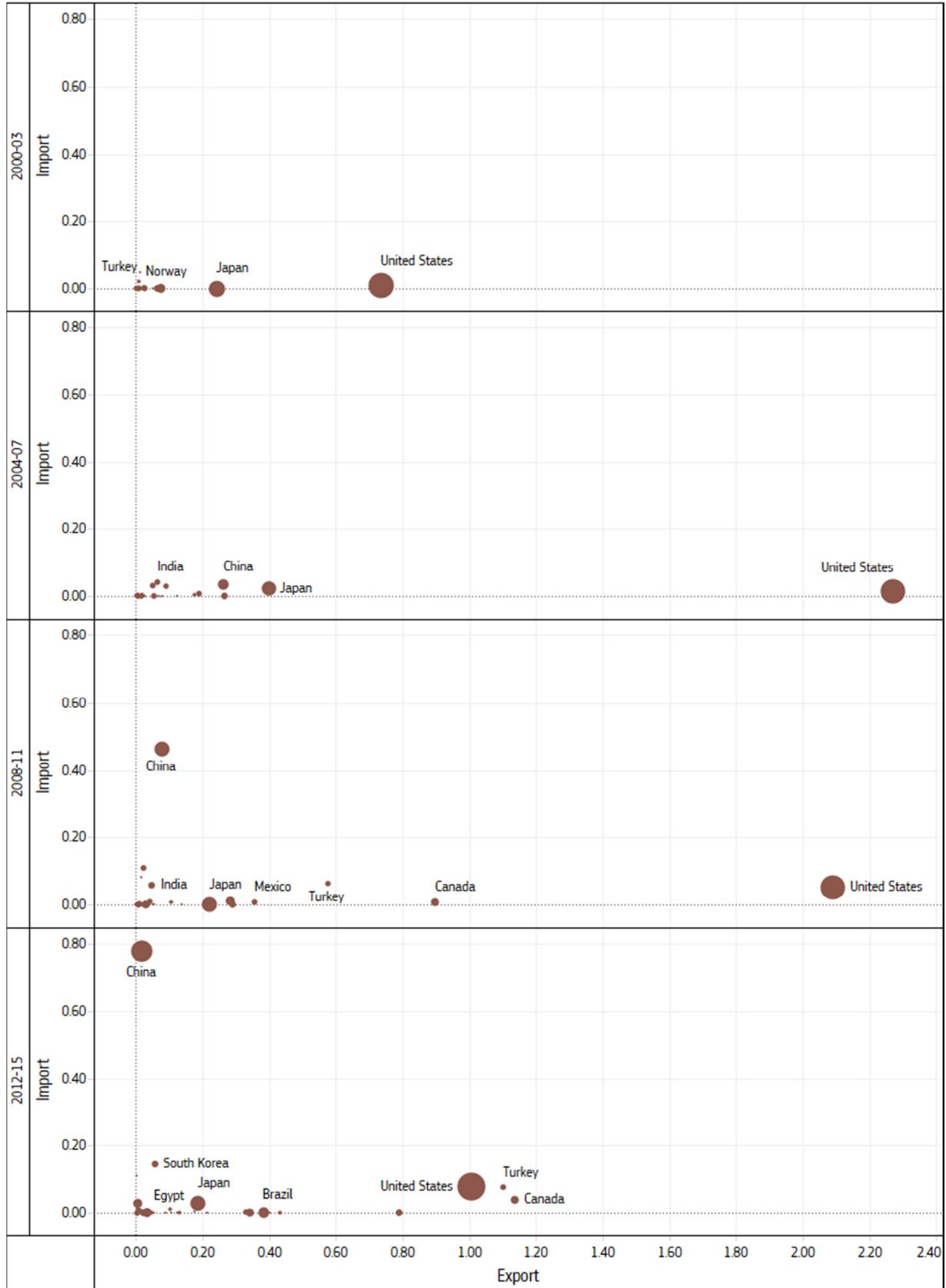
iii) EU28 - Trade balance (X-M) with world regions outside EU28 [EUR Bn]: Wind



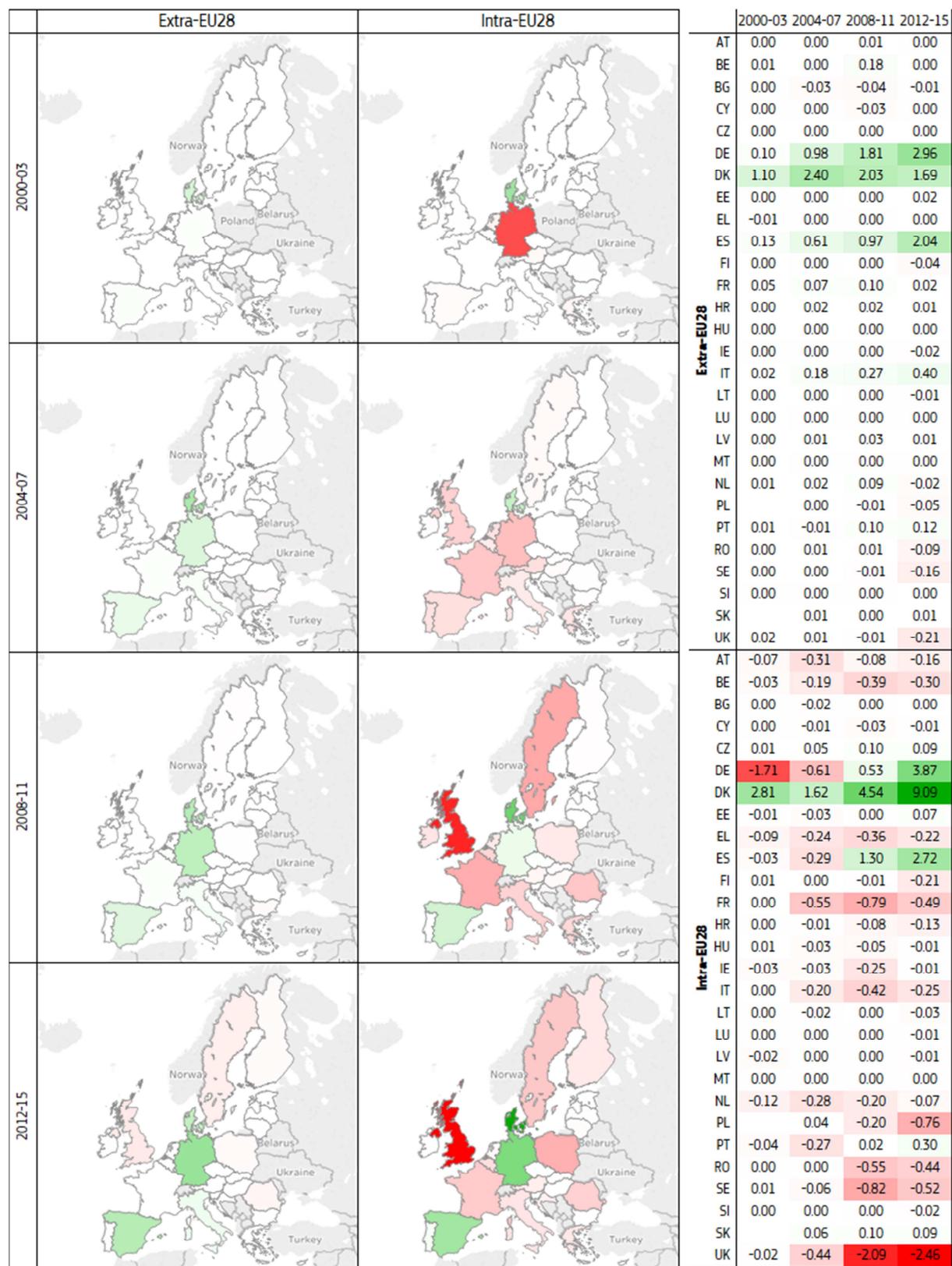
Region	2000-03				2004-07				2008-11				2012-15			
	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15	2000-03	2004-07	2008-11	2012-15
Africa, Eastern	0.007	0.007	0.037	0.054												
Africa, Middle	0.012	0.029	0.067	0.075												
Africa, Northern	0.080	0.123	0.150	0.375												
Africa, Southern	0.001	0.000	0.002	0.433												
Africa, Western	0.033	0.069	0.084	0.075												
America, Caribbean	0.023	0.043	0.095	0.048												
America, Central	0.049	0.058	0.393	0.856												
America, Northern	0.791	2.520	2.930	2.028												
America, South	0.014	0.035	0.378	0.993												
Antarctica	0.000	0.000	0.001	0.000												
Asia, Central	0.001	0.002	0.005	0.009												
Asia, Eastern	0.331	0.748	-0.125	-0.579												
Asia, South-Eastern	0.012	0.015	-0.055	-0.035												
Asia, Southern	0.026	0.048	0.022	0.130												
Asia, Western	0.005	0.122	0.572	1.239												
Oceania, Australia & New Zealand	0.077	0.251	0.314	0.370												
Oceania, Melanesia	0.003	0.004	0.004	0.002												
Oceania, Micronesia	0.000	0.000	0.000	0.000												
Oceania, Polynesia	0.002	0.001	0.002	0.002												
Rest of Europe	-0.013	0.221	0.199	0.611												

Top 10 Extra-EU28					
	2000-03	2004-07	2008-11	2012-15	
Export	1	United States	United States	United States	Canada
	2	Japan	Japan	Canada	Turkey
	3	China	Canada	Turkey	United States
	4	Australia	China	Mexico	Mexico
	5	Canada	Australia	Australia	South Africa
	6	Egypt	Norway	Brazil	Uruguay
	7	Mexico	Taiwan	Japan	Brazil
	8	India	Turkey	Taiwan	Australia
	9	Costa Rica	Egypt	Norway	Norway
	10	Morocco	New Zealand	Egypt	Morocco
Import	1	Norway	India	China	China
	2	Turkey	China	South Korea	South Korea
	3	United States	South Korea	Vietnam	Vietnam
	4	Former Yugoslav R.	Turkey	Turkey	United States
	5	Israel	Japan	India	Turkey
	6	Egypt	United States	United States	Canada
	7	Switzerland	Australia	Brazil	Japan
	8	China	Ukraine	Switzerland	India
	9	South Africa	Switzerland	Egypt	Bosnia-Herzegovina
	10	Saudi Arabia	Norway	Tunisia	Egypt

iv) EU28 - Sum of export vs. sum of import with Extra-EU28. Bubble size: Avg.GDP [EUR Bn]: Wind



v) Country trade balance (X-M) with Extra-EU28 and Intra-EU28 [EUR Bn]: Wind



14 Conclusions

This report, by means of graphical representations, analyses international trade in the sector of low-carbon energy technologies (LCETs) and in particular it focuses on performance of the European Member States, individually and collectively.

The main findings are summarised below.

- European Union trade flows in the energy sector have increased over time. In 2015, the sum of import and export was more than two times than it was in 2000, with an average increase of 7% each year. This is particularly due to the growing relationship with China and other countries in western Asia and northern Africa. These trade links complement the already established partnerships with the United States and the other European countries, mainly Russia and Switzerland.
- In 2015, import from China accounted for 29% of the total European import in the energy sector. Its share was 3% in 2000. During the same time period, the share of import from the United States decreased from 51% to 23%. In the period 2010-2012, while the Chinese share reached its maximum, accounting for 52% of the total import, the share of import from the United States showed its lowest value, 14% of the total.
- Over the years, European imports in the energy sector have changed in origin. While in 2000 80% of total EU imports came from the United States, Canada, Japan, Switzerland and Norway, in 2015 these five countries accounted for only 36% of the total. In contrast, in 2015 48% of the total European imports came from China, Malaysia, Taiwan, South Korea and India, while in 2000 they accounted for 9% of the total.
- The share of the European exports in the energy sector to destination-countries has also changed over time. Between 2000 and 2015, it decreased by 32% for countries in northern America; in particular it changed from 29% to 19% in the United States. In contrast, in the same period, the share of European export increased by 35% to countries in western Asia and in northern Africa.
- In 2015 only 10 origin-countries accounted for more than 80% of the total European import in the energy sector, while 24 destination-countries accounted for 80% of European export in this sector. In 2015, Russia became the third most important country for European exports, after the United States and Switzerland. It was 13th in 2000. Similarly, Turkey moved from 12th position in 2000 to 5th in 2015.
- The European trade flows in the energy sector are technology-dependent. From 2000 to 2015 the European trade balance was always positive in respect to clean coal and gas, wind and heating systems. In contrast, the balance was always negative for biofuels and solar PV. Over the years the balance accentuated its value. For example, in 2015, the positive trade balance in wind was almost ten times bigger than it was in 2000, while the negative balance in solar PV was more than four times bigger in 2015 than its value in 2000.
- In the period 2000-2015 exports related to clean coal and gas had the highest share; the yearly average accounted for 49% over the total exports in the energy sector. However, its value in 2015 was 21% less than it was in 2000. This reduction was related to the simultaneous increase in the share of export of other technologies. For example, the share of export in wind accounted for 3% of the total in 2000 and it increased to 11% in 2015. Similarly, the share of exports in solar PV, in the same timeframe, changed from 6% to 10%.
- The total EU import in the energy sector is strongly influenced by solar PV imports. In 2015, they accounted for 40% of the total. Almost all European imports of solar PV come from eastern Asia and in particular from China. In 2012, the share of solar PV imports from China accounted for 72% of the total import

from the whole world, while its value was only 2% in 2000. In the period 2009-2012, the massive Chinese influence in the European solar PV sector was due to the effect of both the global financial crisis and the internal Chinese policies in this sector. The latter has pushed production despite the low internal demand. This, in turn, has increased export over the world, in particular to Europe where green policies have incentivised diffusion of solar PV.

- Over the years studied, the total internal European trade flow in the energy sector has always been higher compared with the total trade with countries outside the EU. On average, each year trade flow between the 28 Member States was 41% higher than trade between the EU and international partners. However, this figure differs among technologies. The total trade flow of clean coal and gas with countries outside the EU was always bigger than the total flow intra-EU28 (50%, on average). In contrast, other sectors show the reverse tendency: they had the total internal trade flow bigger than the external flow: seven times bigger for biofuels, five times for insulation and three times for energy storage and wind.

References

- APEC, 2012. APEC List of Environmental Goods. Annex C of 20th APEC Economic Leaders' Declaration. Asia-Pacific Economic Cooperation, Vladivostok, Russia. From: http://www.apec.org/~media/Files/LeadersDeclarations/2012/2012_AELM_Declaration_AnnexC.pdf. Access on: 5 May 2017
- Bucher, H., Drake-Brockman, J., Kasterine, A., Sugathan, M., 2014. Trade in Environmental Goods and Services: Opportunities and Challenges. International Trade Centre Technical Paper, Geneva, Switzerland. From: <http://www.intracen.org/publication/Trade-in-environmental-goods-and-services-Opportunities-and-challenges/>. Access on: 5 May 2017
- Cao, J., Groba, F., 2013. Chinese Renewable Energy Technology Exports: The Role of Policy, Innovation and Markets. DIW Berlin - German Institute for Economic Research, Berlin. From: http://www.diw.de/sixcms/detail.php?id=diw_01.c.414424.de. Access on: 12 September 2016
- Dee, P., Hardin, A., Schuele, M., 1998. APEC Early Voluntary Sectoral Liberalisation. Productivity Commission. Staff Research Paper. AusInfo, Canberra, From: <http://www.pc.gov.au/research/supporting/apec-liberalisation/apec.pdf>. Access on: 4 May 2017
- European Commission, 2000. COM(2000) 87 final. Green Paper on greenhouse gas emissions trading within the European Union, 8.3.2000, Brussels.
- European Commission, 2001. COM(2001) 264 final. A Sustainable Europe for a Better World: A European Union Strategy for Sustainable Development, 15.5.2001, Brussels.
- European Commission, 2014. Joint Statement Regarding Trade in Environmental Goods. 24 January 2014. Davos, Switzerland. From: http://trade.ec.europa.eu/doclib/docs/2014/january/tradoc_152095.pdf. Access on: 5 May 2017
- European Commission, 2015a. COM(2015) 80 final. A framework strategy for a resilient Energy Union with a forward-looking climate change policy, 25.02.2015, Brussels.
- European Commission, 2015b. COM(2015) 6317 final. Towards an Integrated Strategic Energy Technology (SET) Plan: Accelerating the European Energy System Transformation, 15.09.2015.
- Eurostat, 2015. User Guide On European Statistics On International Trade In Goods. From: <http://ec.europa.eu/eurostat/web/ess/-/user-guide-on-european-statistics-on-international-trade-in-goods>. Access on: 01 December, 2016
- Eurostat, 2016a. Glossary: PRODCOM. From: <http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:PRODCOM>. Access on: 01 December, 2016
- Eurostat, 2016b. Glossary: Statistical classification of economic activities in the European Community (NACE). From: [http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Statistical_classification_of_economic_activities_in_the_European_Community_\(NACE\)](http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Statistical_classification_of_economic_activities_in_the_European_Community_(NACE)). Access on: 01 December, 2016
- Eurostat, 2016c. Glossary: Statistical classification of products by activity (CPA). From: [http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Statistical_classification_of_products_by_activity_\(CPA\)](http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Statistical_classification_of_products_by_activity_(CPA)). Access on: 01 December, 2016
- Glachant, M., Dussaux, D., Ménière, Y., Dechezleprêtre, A., 2013. Promoting International Technology Transfer of Low-Carbon Technologies: Evidence and Policy Perspectives. Report for the Commissariat général à la stratégie et à la prospective (French Center for Policy Planning). MINES ParisTech, From: http://personal.lse.ac.uk/dechezle/Promoting_the_international_transfer_of_low_carbon_techs.pdf. Access on: 5 January 2016

International Trade Centre, 2014. Trade Map User Guide. Trade statistics for international business development. From: <http://www.trademap.org/Docs/TradeMap-Userguide-EN.pdf>. Access on: 01 December, 2016

Jha, V., 2009. Trade Flows, Barriers and Market Drivers in Renewable Energy Supply Goods: The Need to Level the Playing Field. ICTSD Trade and Environment Issue Paper 10. International Centre for Trade and Sustainable Development (ICTSD), Geneva, Switzerland. From: <http://www.ictsd.org/downloads/2011/12/trade-flows-barriers-and-market-drivers-in-renewable-energy-supply-goods.pdf>. Access on: 30 November 2016

Krugman, P., 1994. Competitiveness: a dangerous obsession. Foreign affairs, pp. 28-44.

Lv, F., Xu, H., Wang, S., 2013. National Survey Report of PV Power Applications in China 2012. International Energy Agency (IEA) - Co-operative programme on photovoltaic power systems. Task 1: Exchange and dissemination of information on PV power systems. IEA, From: <http://www.iea-pvps.org/index.php?id=93>. Access on: 16 September 2016

Moinuddin, M., Bhattacharya, A., 2013. Towards an Integrated Renewable Energy Market in the EAS Region: Renewable Energy Equipment Trade, Market Barriers and Drivers, in: Kimura, S., Phoumin, H., Jacobs, B. (Eds.), Energy Market Integration in East Asia: Renewable Energy and its Deployment into the Power System. ERIA, Jakarta, pp. 131-162.

OECD, 1999a. The environmental goods & services industry. Manual for Data Collection and Analysis. OECD Publishing, Paris. From: http://unstats.un.org/unsd/envaccounting/ceea/archive/EPEA/EnvIndustry_Manual_for_data_collection.PDF. Access on: 13 September 2016

OECD, 1999b. Future Liberalisation of Trade in Environmental Goods and Services: Ensuring Environmental Protection as well as Economic Benefits. OECD Publishing, Paris. From: [http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=COM/TD/ENV\(98\)37/FINAL&docLanguage=En](http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=COM/TD/ENV(98)37/FINAL&docLanguage=En). Access on: 4 May 2017

OECD/Eurostat, 1999. The Environmental Goods and Services Industry: Manual on Data Collection and Analysis. OECD Publishing, Paris. From: http://unstats.un.org/UNSD/envAccounting/ceea/archive/EPEA/EnvIndustry_Manual_for_data_collection.PDF. Access on: 4 May 2017

Rudyk, I., Owens, G., Volpe, A., Ondhowe, R., 2015. Climate change mitigation technologies in Europe – evidence from patent and economic data. The United Nations Environment Programme (UNEP) and the European Patent Office (EPO), From: <http://www.epo.org/news-issues/technology/sustainable-technologies/clean-energy/europe.html>. Access on: 5 January 2016

Steenblik, R., 2005. Environmental Goods: A Comparison of the APEC and OECD Lists. OECD Trade and Environment Working Paper No. 2005-04. OECD Publishing, Paris. From: <http://www.oecd.org/trade/envtrade/35837840.pdf>. Access on: 4 May 2017

Sugathan, M., 2013a. Lists of Environmental Goods: An Overview. International Centre for Trade and Sustainable Development (ICTSD), Geneva, Switzerland. From: http://www.ictsd.org/downloads/2013/12/info_note_list-of-environmental-goods_sugathan.pdf. Access on: 5 January 2016

Sugathan, M., 2013b. Winds of Change and Rays of Hope: How can the Multilateral Trading System Facilitate Trade in Clean Energy Technologies and Services? The E15Initiative. Clean Energy Technologies and the Trade System: Proposals and Analysis. International Centre for Trade and Sustainable Development (ICTSD) and World Economic Forum (WEF), Geneva. From: <http://e15initiative.org/wp-content/uploads/2015/09/E15-Clean-Energy-Technologies-Compilation-Report-FINAL.pdf>. Access on: 24 March 2017

United Nations, 2008. International Standard Industrial Classification of All Economic Activities. Revision 4. Series M No. 4/Rev.4. United Nations, Department of Economic and Social Affairs, Statistics Division, New York. From: http://unstats.un.org/unsd/publication/seriesM/seriesm_4rev4e.pdf. Access on: 4 November 2016

United Nations, 2012. Request for 2011 Annual and 2012 Monthly Trade Data. From: [http://unstats.un.org/unsd/trade/imts/IMTS%20data%20request%202012%20\(English\).pdf](http://unstats.un.org/unsd/trade/imts/IMTS%20data%20request%202012%20(English).pdf). Access on: 01 December, 2016

United Nations, 2015. Central Product Classification (CPC). Version 2.1. Series M No. 77, Ver.2.1. United Nations, Department of Economic and Social Affairs, Statistics Division, New York. From: <http://unstats.un.org/unsd/cr/registry/cpc-21.asp>. Access on: 4 November 2016

United Nations, 2016a. Commodity Trade Statistics Database. From: <http://data.un.org/DataMartInfo.aspx>. Access on: 01 December, 2016

United Nations, 2016b. Detailed structure and explanatory notes, SITC Rev.4 (Standard International Trade Classification, Rev.4). From: <http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=28>. Access on: 01 December, 2016

United Nations, 2016c. Read Me First (Disclaimer). Every User of UN Comtrade should know the coverage and limitations of the data. From: <http://comtrade.un.org/db/help/uReadMeFirst.aspx>. Access on: 01 December, 2016

United Nations, 2016d. Standard International Trade Classification Revision 3. From: <http://unstats.un.org/unsd/trade/kb/Knowledgebase/Standard-International-Trade-Classification-Revision-3>. Access on: 01 December, 2016

Vossenaar, R., 2013. The APEC List of Environmental Goods. An Analysis of the Outcome & Expected Impact. ICTSD Programme on Trade and Environment. Issue Paper No. 18. International Centre for Trade and Sustainable Development (ICTSD), Geneva, Switzerland. From: www.ictsd.org/downloads/2013/06/the-apec-list-of-environmental-goods.pdf. Access on: 24 March 2017

Vossenaar, R., 2014. Identifying Products with Climate and Development Benefits for an Environmental Goods Agreement. Environment. Issue Paper No. 19. International Centre for Trade and Sustainable Development (ICTSD), Geneva, Switzerland. From: <http://www.ictsd.org/sites/default/files/research/Identifying%20Products%20with%20Climate%20and%20Development%20Benefits%20for%20an%20Environmental%20Goods%20Agreement.pdf>. Access on: 24 March 2017

Vossenaar, R., 2016. Recent Developments in Trade and Tariffs in Renewable Energy Goods in Latin America and the Caribbean. International Centre for Trade and Sustainable Development (ICTSD), Geneva, Switzerland. From: http://www.ictsd.org/sites/default/files/research/recent_developments_in_trade_and_tariffs_in_renewable_energy_re_goods_in_latin_america_and_the_caribbean_lac_v1.pdf. Access on: 24 March 2017

Wind, I., 2008. HS Codes and the Renewable Energy Sector. ICTSD Programme on Trade and Environment. International Centre for Trade and Sustainable Development (ICTSD), Geneva, Switzerland. From: <http://www.ictsd.org/downloads/2010/01/hs-codes-and-the-renewable-energy-sector.pdf>. Access on: 13 September 2016

World Bank, 2008. International Trade and Climate Change: Economic, Legal and Institutional Perspectives. The World Bank, Washington, DC. From: <http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2007/11/15/00031060720071115153905/Rendered/PDF/41453optmzd0PA101OFFICIALOUSE0ONLY1.pdf>. Access on: 4 May 2017

World Customs Organization, 2016. HS Nomenclature 2017 Edition. From: <http://www.wcoomd.org/en/topics/nomenclature/instrument-and-tools/hs-nomenclature-2017-edition.aspx>. Access on: 01 December, 2016

World Energy Council, 2015. World Energy Perspective. Catalysing the low-carbon economy. World Energy Council, London, UK. From: <https://www.worldenergy.org/publications/2015/wec-rules-of-trade-and-investment-catalysing-the-low-carbon-economy/>. Access on: 5 May 2017

WTO, 2005. Synthesis of Submissions on Environmental Goods - Informal Note by the Secretariat. . Committee on Trade and Environment Special Session. TN/TE/W/63. World Trade Organization, From: http://docs.wto.org/dol2fe/Pages/FE_Search/FE_S_S005.aspx. Access on: 4 May 2017

Zhang, S., Andrews-Speed, P., Ji, M., 2014. The erratic path of the low-carbon transition in China: Evolution of solar PV policy. Energy Policy 67, 903–912.

List of abbreviations and definitions

APEC	Asia-Pacific Economic Cooperation
BvD	Bureau van Dijk
CCMT	Climate change mitigation technologies
CN	Combined Nomenclature
CPC	Central product classification
EGS	Environmental goods and services
EPO	European Patent Office
EU	European Union
EUR	euros (ISO code)
FOB	free on board
HS	Harmonized System
ICTSD	International Centre for Trade and Sustainable Development
ISIC	International Standard Industrial Classification
ITC	International Trade Centre
ITGS	International trade in goods statistics
JRC	Joint Research Centre
LAC	Latin America and the Caribbean
LCETs	Low-carbon energy technologies
NACE	Nomenclature statistique des activités économiques dans la Communauté européenne
PV	photovoltaic
RIC	Research, innovation and competitiveness
SETIS	Strategic Energy Technologies Information System
SITC	Standard international trade classification
UNEP	United Nations Environment Programme
UNSD	United Nations Statistics Division
US	United States
WCO	World Customs Organization
WEF	World Economic Forum
WTO	World Trade Organization

List of boxes

Box 1. EU solar PV trade with China45

Box 2. Data accuracy and mirror statistics77

List of figures

Figure 1: Product classifications65
Figure 2: UN Comtrade coverage. Updated on 3 November 201672

List of tables

Table 1: Examples of HS and CN: smart meters64

Table 2: Concordance between HS codes and energy technologies.....66

Table 3: UN Comtrade and Easy Comext, summary74

Table 4: Currency conversion example74

Table 5: Number of trading companies per product category.....75

Table 6: List of exporting companies in Spain for solar photovoltaic cells75

Table 7: Data example in Trade Catalyst76

Table 8: List of countries and codes78

Annexes

Annex 1. Identification of low-carbon energy technologies (LCETs)

International nomenclatures

International trade is registered and monitored by using a common product codification. The Harmonized System (HS)⁽¹⁾ is the international nomenclature for the classification of traded products, and it is maintained by the World Customs Organization (WCO) and revised every five years. It classifies about 5300 products⁽²⁾. It consists on a two-, four- or six-digits codes: the two-digit codes identify the "chapter", the four-digit codes the "headings" and the six-digits the "subheading".

To this international nomenclature, each national authority might add two or more digits, in order to define the so-called National Tariff Line. The EU Member States add two digits to the HS codes for the collection of detailed data on the European internal traded goods. This is the Combined Nomenclature (CN) and it is useful to track imports and exports of European countries. It includes around 9400 eight-digit codes and is subject to annual revisions to be up to date in the light of changes in technology or patterns of international trade in goods⁽³⁾.

Table 1 presents an example of the classification of smart meters, and how CN complements HS with more detailed information.

Table 1: Examples of HS and CN: smart meters

Classification	Code	Description
HS	90	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instrument & accessories
HS	90-28	Gas, liquid or electricity supply or production meters, including calibrating meters
HS	90-28-30	Electricity meters
HS+CN	90-28-30-11	Electricity meters, for alternating current, for single-phase
HS+CN	90-28-30-19	Electricity meters, for alternating current, for multiphase
HS+CN	90-28-30-90	Electricity meters, for continuous current

In summary, the use of the HS nomenclature allows comparisons at world level, meaning that it is possible to compare EU with other major international players, such as, for example, China and the United States. Whereas the CN classification can only be applied to analysis restricted to commercial exchanges among European countries.

Product classification

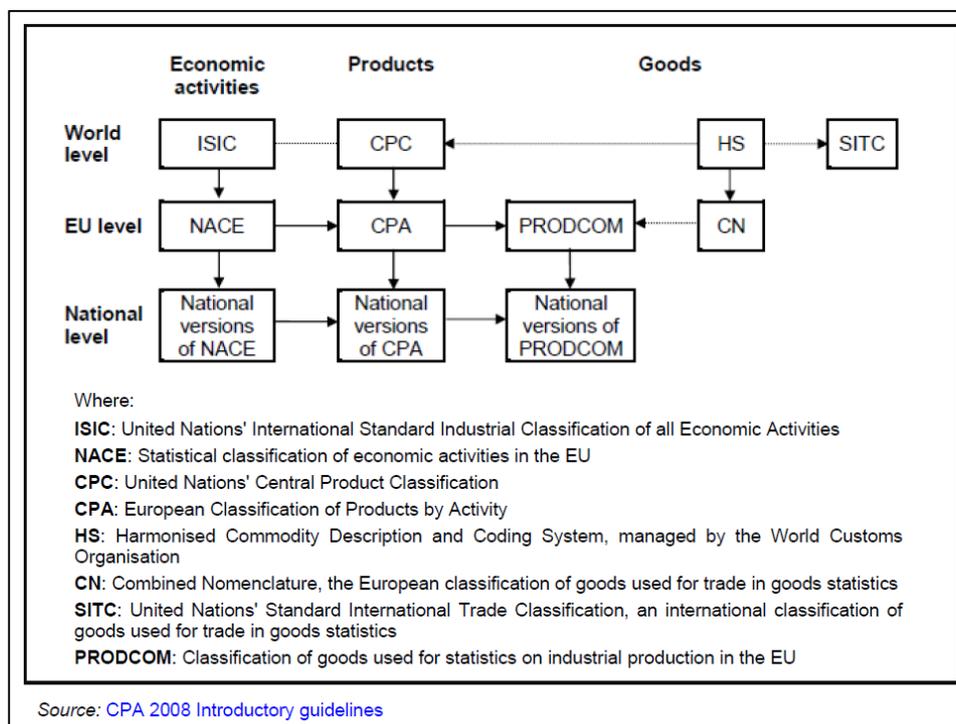
The HS and the CN classifications only define individual products. However, in order facilitate trade analysis regarding broader classes of products and/or entire economic activities, different types of classification have been arranged. These are described below and summarised in Figure 1.

⁽¹⁾ From 1 January 2017 the new HS nomenclature has been adopted (World Customs Organization, 2016).

⁽²⁾ The full list here: http://www.wcoomd.org/en/topics/nomenclature/instrument-and-tools/hs_nomenclature_2012/hs_nomenclature_table_2012.aspx.

⁽³⁾ The full list here: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:C:2015:076:FULL&from=EN>.

Figure 1: Product classifications



Source: Eurostat (2015)

The Standard International Trade Classification (SITC), maintained by the United Nations, is based on the HS nomenclature and is a classification of goods that aims at promoting and enabling international comparability of trade statistics (United Nations, 2016d). The older version SITC Rev.3 is now replaced with the latest revision SITC Rev.4 (United Nations, 2016b).

The International Standard Industrial Classification of All Economic Activities (ISIC) is the international reference classification of productive activities. Its main purpose is to provide a set of activity categories that can be used for the scope of collecting and reporting statistics according to such activities (United Nations, 2008).

The general industrial classification of economic activities in the European Union, abbreviated as NACE (*nomenclature statistique des activités économiques dans la Communauté européenne*), is the classification of economic activities in the European Union. It is a four-digit classification built in order to represent economic activities for the purpose to compose economic statistics (Eurostat, 2016b).

The Central Product Classification (CPC) is another product classification covering both goods and services. Based on HS nomenclature, it serves as an international standard for a harmonised comparison of various types of statistics related to goods and services (United Nations, 2015).

The statistical Classification of Products by Activity (CPA), is the classification of products (goods as well as services) at the level of the European Union. Product classification is designed to categorise products that have common characteristics. Moreover, one CPA product category is assigned to one single NACE activity. This system makes it possible to compare statistics across countries and in different product domains (Eurostat, 2016c).

PRODCOM (*PRODUCTION COMMUNAUTAIRE*) is an annual survey aiming to collect and disseminate statistics on the production of industrial (mainly manufactured) goods in the

European Union. The PRODCOM list comprises about 4000 headings relating to industrial products and some industrial services. These products are detailed at an eight-digit level. The first four digits are the NACE codes, the next two are the CPA classification, and the last two specify the product in more detail. Most PRODCOM headings correspond to one or more CN codes (Eurostat, 2016a).

The shortcoming of the previous classifications is that none of them is suitable for the definition of the low-carbon energy technologies (LCETs). Consequently, it is necessary to identify specific codes and aggregate them in order to obtain groups of products which are representative of LCETs.

LCETs classification

There are many attempts to define low-carbon energy technologies through the HS or CN classifications, as explained in Annex 2 below. These contributions provide *ad-hoc* aggregations of the HS codes that are needed to analyse trade related to energy technologies. Based on the examination of these previous works and with a closer correspondence to Rudyk et al. (2015), the concordance between LCETs and HS codes is summarised in Table 2.

Table 2: Concordance between HS codes and energy technologies

Technology	HS Code	HS code description
Biofuels	220710	Ethyl Alcohol (Alcoholic Strength 80 degrees or More)
	220720	Ethyl Alcohol, Other Spirits (Denatured)
Clean coal & gas	840420	Condensers for Steam or Other Vapour Power Units
	841181	Other Gas Turbines of a Power Not Exceeding 5,000kw
	841182	Other Gas Turbines of a Power Exceeding 5,000kw
	841199	Parts of Other Gas Turbines
Energy Storage	850710	Lead-acid Accumulators, of a Kind Used for Starting Piston Engines
	850720	Other Lead-acid Accumulators
	850730	Nickel-cadmium Accumulators
	850740	Nickel-iron Accumulators
Heating	841861	Compression Type Units Whose Condensers Are Heat Exchangers
	841950	Heat Exchanger Units
Hydropower	841011	Hydraulic Turbines, Water Wheels, of a Power Not Exceeding, 1,000kw
	841012	Hydraulic Turbines and Water Wheels, Power 1,000-10,000kw
	841013	Hydraulic Turbines, Water Wheels, of a Power Exceeding 10,000kw
	841090	Parts of Hydraulic Turbines and Water Wheels, Including Regulators
Insulation	680610	Slag wool, rock wool and similar mineral wools (incl. intermixtures thereof), in bulk, sheets or rolls
	680690	Other: Articles of Heat-insulating, Sound-insulating Mineral Materials
	700800	Multiple-walled insulating units of glass
	701939	Webs, Mattresses, Boards and Similar Nonwoven Products, of Glass Fibres
Nuclear energy	840110	Nuclear reactors
	840120	Machinery and apparatus; for isotopic separation, and parts thereof
	840140	Nuclear reactors; parts thereof
Smart meters	902830	Electricity meters
Solar PV	854140	Diodes, transistors and similar semiconductor devices; photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light-emitting diodes; mounted piezoelectric crystals
Solar Thermal	841919	Instantaneous or storage water heaters, non-electric (excl. instantaneous gas water heaters and boilers or water heaters for central heating)
Wind	730820	Towers and lattice masts, of Iron or Steel
	850231	Generating Sets, Electric, Wind-powered

Contrarily to the other technologies, biofuel is characterised by the final products (liquid fuels) rather than by the technologies needed to produce it. In fact, gas turbines and condensers are the technologies defining the clean gas and coal sector, just as hydraulic turbines define the hydropower sector. Energy storage is composed by different types of accumulators (not including lithium-ion batteries), while heat exchangers characterise the heating-technology sector. Materials related to insulation belong to the same technology. Nuclear reactors and connected technologies are assigned to the nuclear sector, while electricity meters are associated with smart meters. The solar PV sector is characterised mainly by semiconductor devices (including photovoltaic cells), while water heaters are associated with solar thermal. Lastly, towers and wind generators belong to wind-technology sector.

Annex 2. Background

The initial interest in import and export of environmental goods and services (EGS) has been driven by the conviction that the elimination of EGS trade barriers may facilitate the achievement of environmental goals. Interest has also been motivated by the willingness to evaluate policies and industrial competitiveness in the environmental sector. However, the process needed to define EGS started few decades ago and it has not yet been finalised.

At the end of the 1990s both the Asia-Pacific Economic Cooperation (APEC) and the OECD/Eurostat Informal Working Group endeavoured to define environmental goods and services through the HS (Harmonized System) international nomenclature (Dee et al., 1998; OECD, 1999b; OECD/Eurostat, 1999). Both organisations provide a list of environmental goods, showing both commonalities and differences (Steenblik, 2005). Later the World Trade Organization (WTO) (WTO, 2005), the World Bank (2008) and the International Centre for Trade and Sustainable Development (ICTSD) (Wind, 2008) also contributed to this line of research. A few years later, in September 2012, APEC proposed a new list of 54 HS subheadings for the identification of environmental goods. Based on this list, APEC commits to "reduce applied tariff rates to 5 per cent or less by the end of 2015" in order to facilitate trade of and investments in environmental goods (APEC, 2012). Following this first agreement reached between several countries, in 2014, 14 members of the WTO (Australia, Canada, China, Costa Rica, the European Union, Hong Kong, Japan, New Zealand, Norway, Singapore, South Korea, Switzerland, Chinese Taipei, and the United States) declared to adopt the APEC list in order to further liberalise import tariffs and to achieve "global free trade in environmental goods", necessary for green growth and sustainable development (European Commission, 2014). More recently, the World Energy Council has also proposed a list of codes to be included in the agreement on tariffs on trade of environmental goods (World Energy Council, 2015).

As explained above, the classification of environmental goods through the use of HS codes is still an ongoing process. In fact, discussion on this front is continuously fuelled by changes and additions in the concordance (Cao and Groba, 2013; Glachant et al., 2013; Jha, 2009; Moinuddin and Bhattacharya, 2013; OECD, 1999a; Rudyk et al., 2015; Sugathan, 2013a; Vossenaar, 2013, 2014; Wind, 2008). Nevertheless, even if this process is not yet finalised and will require further consultations, several studies have already been published. This is because of the growing interest in international trade concerning environmental technologies and in countries' performances on import and export. Some of these studies are reviewed below and mainly present results related to European performances in international trade.

Chapter 3 of the World Bank report (2008) analyses the import-export ratio in four main technologies: clean coal, wind, solar PV and energy-efficiency lighting. The comparison is done between high- and low-middle- income countries. Regarding the first two technologies, developed countries show a tendency to be the main exporters, compared with developing countries, which are mostly importers. This relationship is similar for the solar PV case, but from 2000 to 2005 there was a convergence among the two groups of countries, due to the increasing Chinese relevance in this sector. However, this relationship does not hold for the case of fluorescent lamps, where low- and middle-income countries, mostly China, were the main exporters (World Bank, 2008).

In 2012, the International Centre for Trade and Sustainable Development (ICTSD) and the World Economic Forum (WEF) implemented the E15 Initiative in order to generate analysis and recommendations on global trade of energy technologies. One of the studies published in the joint report (Sugathan, 2013b) shows the growing trend in international trade of energy technologies. In particular, it reports figures on import and export related to solar PV and wind. The European Union is in the top 10 list of major world players. In 2010, Asian countries (China, Japan, South Korea and Taiwan) were the main exporters of solar PV, while the EU was the main importer. These peculiarities started in 2008 and persisted until the last year analysed, 2011. In contrast, in the case of trade of wind technology, the EU is the main exporter and China and the United States are the main

importers. This, which is different from the solar PV case, was a constant feature over the period 2004-2011.

The International Trade Centre (ITC) also proposed a study on trade in environmental goods and services (Bucher et al., 2014). Figures representing the annual global exports of environmental goods show an increasing trend in the period 2001-2012. This study also provides a country analysis, based on the period 2008-2013. Germany is the country with the highest value of the yearly average of export related to environmental goods, followed by China and the United States. The same countries, with lower values of yearly average, are the top three importing countries, with United States first, China second and Germany third. It is important to notice that three more European Member States are in the top 10 list of major players in import and export of environmental goods. These are France, Italy and the United Kingdom.

The combined effort of the United Nations Environment Programme (UNEP) and the European Patent Office (EPO) produced a very interesting report on climate change mitigation technologies (CCMT) in Europe (Rudyk et al., 2015). In the section regarding the analysis of international trade, the authors compare performances on import and export of five major world players: Europe, China, Japan, South Korea and the United States. From 1995 to 2007, Europe was, almost constantly over the years, the first exporter of energy-related technologies. However, from 2008, China took its place, becoming the most important exporter in the world. The huge impact of the Chinese industry in international trade has forced other countries to import more. In fact, starting from 2008, Europe and other countries substantially increased their import of CCMT. The consequences of these changes in import and export can be seen in the trade balance: after 2008, China showed an increasingly positive trade balance, while Europe had a negative balance.

In 2016, another relevant report was published by the International Centre for Trade and Sustainable Development (ICTSD) (Vossenaar, 2016). It deals with trade and tariffs in renewable energy goods in Latin America and the Caribbean (LAC). The interesting part of this study regards the different impact, in terms of import and export, of the commercial relationship between the EU and LAC. In fact, the EU is the most important partner for these countries in trade related to wind technologies. Denmark, Germany and Spain are the three European countries exporting more to this region of the world. Contrarily, when the analysis examines partnerships in the solar PV sector, China is almost the only exporting country. The EU is also the most important exporter of hydro turbines, and more broadly, it has a considerable impact on the hydro power sector. In fact, in the period 2012-2014, about half of the total import in LAC arrived from the European Member States.

Annex 3. Available dataset

The two main sources of trade data are the European Commission, through the Eurostat Easy Comext database, and the United Nations Statistics Division (UNSD), through the UN Comtrade database. Both receive data directly from the national authorities and both are the main data source for other available online tools. In addition to these two databases, trade data can also be retrieved via two other sources: the Trade Map developed by the International Trade Centre (ITC) and the Trade Catalyst, which is a Bureau van Dijk (BvD) product. The following subsections describe these four databases.

There are other international organisations that provide trade data. However, the data provision has some shortcoming. The World Trade Organization (WTO)⁽⁴⁾ does not allow searches via HS codes, and it focuses mainly on trade tariffs rather than trade values. The International Monetary Fund (IMF)⁽⁵⁾ offers an online tool that facilitates analysis at a higher level, but it does not give the opportunity to select data at product level. The World Bank gives access to the United Nations Conference on Trade and Development (UNCTAD) - Trade Analysis Information System (TRAINS)⁽⁶⁾. It is based on the UN Comtrade database and it mainly focuses on tariff indicators.

Easy Comext

Eurostat, through the Easy Comext database, provides international trade in goods statistics (ITGS). It gives access to raw data and to the complete range of detailed ITGS, based on around 9400 products, classified through both the HS and the CN.

Eurostat receives trade information directly from the EU Member States, which are obliged to compile European trade in goods in line with the established rules⁽⁷⁾. Eurostat is therefore in charge only of data collection and data dissemination.

National statistical authorities have the responsibility to report data to Eurostat and to ensure data accuracy. For this reason, when necessary, Member States can revise data in order to correct erroneous data, to improve data completeness (by limiting data omissions) and to complete the dataset with late declarations. Member States also have the task to produce estimates in order to ensure full trade coverage; estimates can be replaced by collected data later. Revised results need to be transmitted no later than the month after they become available. However, Member States should provide Eurostat with final detailed data at the latest by the October following the reference year. At that time data become 'final' and should not be revised further except in exceptional and well-justified cases (Eurostat, 2015).

Data sent to Eurostat regard trade in all goods which add to or subtract from the stock of material resources of a country by entering (imports) or leaving (exports) its economic territory⁽⁸⁾. Among other information, Member States report the following main data:

- Reference period
- Import or export
- Partner country
- Product code
- Trade in monetary value

⁽⁴⁾ <http://stat.wto.org/CountryProfile/WSDBCountryPFHome.aspx?Language=E>.

⁽⁵⁾ <http://data.imf.org/regular.aspx?key=60998127>.

⁽⁶⁾ [http://databank.worldbank.org/data/reports.aspx?source=unctad-~trade-analysis-information-system-\(trains\)](http://databank.worldbank.org/data/reports.aspx?source=unctad-~trade-analysis-information-system-(trains)).

⁽⁷⁾ The rules governing the European ITGS are set out in EU regulations. Intrastat legislation: (EC) No 638/2004, (EC) No 222/2009, (EU) No 1093/2013, (EC) No 659/2014, (EC) No 1982/2004, (EC) No 1915/2005, (EU) No 91/2010, (EU) No 96/2010, (EU) No 1093/2013. Extrastat legislation: (EC) No 471/2009, (EU) No 113/2010, (EU) No 92/2010.

⁽⁸⁾ There are different definitions and procedural steps regarding "Community" or "non-Community" goods, those "in free circulation", "in transit", "in simple transit" and "in quasi-transit". For more details consult Eurostat (2015).

— Quantity in kilograms (kg)

Data provided by Member States to Eurostat are in current prices, which are prices relevant to the reference period concerned. However, ITGS estimates a set of deflators which are then used to calculate unit value indices and derive estimates of volumes. The published indices are based on reference years that are normally changed every 5 years. The current reference year for the unit value and volume indices is 2010.

Data can be downloaded via the Easy Comext database. It allows for the selection of imports and exports of an EU Member State and it also gives information on whether the trade of a Member State is with another Member State or not. In other words, it is possible to analyse intra-EU and/or extra-EU commercial trade. However, since the only countries reporting to Eurostat are the EU Member States, direct data on other international countries are not available. They can be estimated indirectly, by evaluating the EU Member States exports/imports in/from these foreign countries. These are defined as mirror statistics and they might have some inconsistencies, as explained in Box 2. Furthermore, some asymmetries might be noticed when data downloaded from Easy Comext are compared to data from national authorities. This happens because national data can be revised and time is necessary to communicate these changes to Eurostat.

UN Comtrade

The United Nations (UN) through the Department of Economic and Social Affairs (DESA) and the Statistics Division (UNSD), receives trade data from over 200 reporter countries. The UNSD has the mandate to collect data and, subsequently, to release the information via the United Nations Commodity Trade Statistics Database (UN Comtrade), which has both a free access and a Premium Access Service. The first one only allows downloads of maximum 50000 records at once, but there is no limitation on the number of download repetitions. Premium Access is not free of charge and can be activated via subscription⁽⁹⁾.

Each country reports data of national imports and exports to UNSD. The data regards all goods entering or leaving the economic territory of this country. The most relevant information (United Nations, 2012) provided to the UNSD are the following:

- Reference period: annual or monthly period identification.
- Trade flow: Imports, Re-imports, Exports and Re-exports. Re-imports are goods imported into the same state as that from which they were previously exported, and Re-exports are exports of foreign goods from the same state as that into which they were previously imported.
- Commodity code: according to the Harmonized System (HS) at the most detailed commodity level available (6-digit HS).
- Partner country or area: country of origin for imports and country of last known destination for exports.
- Value: monetary, in national currency or US dollars (USD).
- Net weight: physical quantity (in kg).

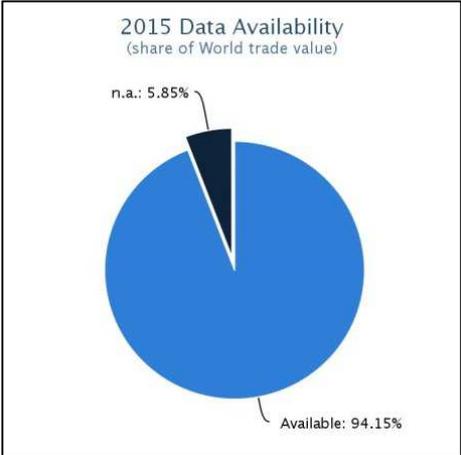
The data received are first processed using the UN/OECD common processing application (CoprA) (United Nations, 2016a) in order to have a harmonised set of data in terms of HS nomenclature, currency (USD), net weight and standard quantity units, as recommended by the World Customs Organization (WCO). The data are then made available.

The UNSD requests monthly data from each country and the database is continuously updated. Whenever trade data are received from the national authorities, they are standardised by the UN Statistics Division and then added to UN Comtrade (United

⁽⁹⁾ For further information on UN Comtrade subscription, see: <http://unstats.un.org/unsd/tradekb/Knowledgebase/50339/Free-Access-to-UN-Comtrade>.

Nations, 2016c). However, it is not clearly stated what the exact timeline is that countries have to follow. Based on Figure 2, it is possible to say that the complete dataset for a maximum of the 2 years previous to the reporting year can be available. However, when lower data coverage is accepted, analysis can also be performed up to the year before.

Figure 2: UN Comtrade coverage. Updated on 3 November 2016



There are limitations on the data provided by UN Comtrade, as is stated in their methodological note (United Nations, 2016c).

- Because of confidentiality, countries may not report trade data to the lowest granular level (six-digit code). The UNSD reports these values aggregated at higher commodity level (e.g. two or four-digit codes).
- Countries may not report trade statistics every year and this cannot be noted when data for a geographic area are aggregated. UN Comtrade, moreover, does not provide estimates for missing data.
- UN Comtrade does not contain estimates for the data of countries which do not report in the most recent HS classification.
- Imports reported by one country do not coincide with exports reported by its trading partner (the so-called mirror statistics, see Box 2). Differences are due to various factors including valuation, differences in inclusions/exclusions of particular commodities, timing etc.
- Almost all countries report as the partner country for imports the country which is determined by the rules of origin established by each country. Hence, the term 'partner country' in the case of imports does not necessarily imply any direct trading relationship.

Table **3** below summarises some differences between UN Comtrade and Easy Comext.

Table 3: UN Comtrade and Easy Comext, summary

	UN Comtrade		Easy Comext
Data coverage	- 100% complete, up to 2 years back - 1 year back, not fully complete		- 100% complete, up to 2 years back - 1 year back, not fully complete
Data update	Continuously		Continuously
Data source	All countries		EU Member States
Access type	Free access	Subscription	Free via ECAS
Download	50000 records each	Unlimited	Unlimited
Classification	HS		CN and HS
Currency	USD		EUR
Strengths	All countries report		- Unlimited download - Intra-Extra type of trade
Weaknesses	- Download limitations - Currency USD	Currency USD	Only EU Member States report

Trade Map

Trade Map⁽¹⁰⁾ has been developed by the International Trade Centre (ITC). It is a web-based application and allows access to trade data. Trade Map reports data extracted from different sources: Eurostat, UN Comtrade and National Authorities. Complete access is possible only after subscription, though some sections of the database can be visited free of charge.

The 6-digit HS code is the lowest common level of analysis. Nevertheless, since some countries report trade information up to 8-digit level, analysis can be done at a more detailed level, depending on data availability (for example, the CN classification is available for European countries). In order to facilitate analysis of a cluster of codes, Trade Map gives the option of aggregating HS codes and to create groups of products. Trade Map also provides mirror statistics. These are used in order to reduce the quantity of missing data, despite its well-known shortcomings (see Box 2).

Downloading trade data is possible via Trade Map. However, this feature is not suitable for downloading a huge amount of data since it only permits the user to get historical data one country at a time and only for exports or imports. On the other hand, it gives users the opportunity to generate and to export graphs and maps.

Trade Map uses currency exchange rates⁽¹¹⁾ to convert data to a common currency. Consequently, it is possible to have information either in EUR or in USD. However, currency conversion creates some inconsistencies when data are compared between different data sources. Table 4 shows an example of Spanish imports of solar PV panels (defined through the code HS 854140) from China in 2009. When the monetary value of this exchange is checked in USD, the amount corresponds to that of the UN Comtrade. In contrast, the value in EUR is not consistent with that one disclosed by the Easy Comext.

Table 4: Currency conversion example

Reporter	Partner	HS Code	Type	Year	Value	Data source	
Spain	China	854140	Import	2009	312266	M€	Easy Comext
					330435		Trade Map in M€
					460835	M\$	UN Comtrade
					460835		Trade Map in M\$

Another relevant feature of Trade Map is the company search. It identifies the companies that import or export a specific product in a country. This feature has been implemented thanks to inputs deriving from Kompass International⁽¹²⁾, a company specialised in business information. It provides Trade Map with the data regarding companies. Kompass International assigns HS codes to one or more products based on its own

⁽¹⁰⁾ Complete description in International Trade Centre (2014).

⁽¹¹⁾ Exchange rates are taken from <http://fxtop.com> website.

⁽¹²⁾ Visit <http://www.kompass-international.com/> for further details.

concordance⁽¹³⁾, which is not disclosed on the website. An example of this component is shown below.

Table 5 shows the number of exporting companies in Spain for different product categories. There are several categories relevant to the selected code (in this example HS 854140), since the concordance defined by Kompass allows the association of one HS code to one or more products. Then, by deepening the search, another list is shown. Table 6 displays the name of these trading companies with information on how many products have been traded plus other company details. Even though these data are valuable, there is no information on the value of the trade, neither at product nor at company level.

Table 5: Number of trading companies per product category

Number of exporting companies in Spain by product categories for the following product - HS code: 854140	
Product category	Number of exporting companies available in Trade Map
Importers-exporters, audio-visual (AV) equipment	2
Photoconductive cells	3
Photoelectric cells	4
Photoemissive cells, gas filled	1
Photoemissive cells, vacuum	1
Photovoltaic modules, thin film	1
Semiconductor diodes, light emitting (LED)	8
Semiconductors NES	7
Solar photovoltaic (PV) cells	6

Table 6: List of exporting companies in Spain for solar photovoltaic cells

Company name	N. of product traded	N. employees	City	Website
Ariston Electronica, SA	114	10-19	Barcelona	http://www.ariston.es
Bester Generación, SLU	20	100-249	Camas	http://www.bester.es
Norvento Enerxia, SL	31	20-49	Lugo	http://www.norvento.com
Sistemas Técnicos Aislamientos, SA	483	50-99	Valle de Trápaga-Trapagaran	http://www.sta-aislamientos.com
Sniace, SA	9	50-99	Madrid	http://www.sniace.com
Telvent Energia, SA	1,705	250-499	Alcobendas	http://www.gruposchneiderelectric.com

Trade Catalyst

The Trade Catalyst is a Bureau van Dijk (BvD) product⁽¹⁴⁾. It makes it possible to analyse market opportunities and competitiveness using different tools. There are three interfaces: Map opportunity landscape, Map competitive landscape and Strategy.

The Map Competitive landscape analyses one specific sector and identifies key companies active in this sector. Many variables can be selected in order to define the most suitable sample for the analysis. For example, sectors can be selected through different industrial classifications: NACE, US SIC or BvD. For the BvD classification no description is provided explaining the methodological approach used to define it.

Once the company sample is defined, the Map Competitive landscape shows five sections and others subsections that facilitate a results analysis. These sections are as follow:

⁽¹³⁾ It is available at: <http://nl.kompass.com/showNomenclature/>.

⁽¹⁴⁾ <https://tradecatalyst.bvdinfo.com/version-2016617/home.serv?product=tradecatalyst>. Access is allowed via JRC subscription.

- Sector analysis: list of companies active in the sector, and an aggregate analysis by selected countries and sectors.
- Competitive positioning: company comparison by sector, country and group, where the group is defined as the total company sample selected previously.
- Innovation degree: at company, country and sector levels and top 30 patents and trademarks. It is important to note that these indicators/proxies are not calculated in absolute terms, but they are based on the sample of companies selected. This means that if the sample changes also the final values of the indicator changes.
- Internationalization and attractiveness degree: it lists those companies that have foreign subsidiaries or foreign ultimate owner. It provides the level of attractiveness of sector and country, and analyses international companies by sector and country.
- Distributors: this option currently is not retrieving information, and it only shows blank records⁽¹⁵⁾.

The Map opportunity landscape provides information regarding trade between countries for selected products. Products are defined by the HS nomenclature, and it is possible to select products at the 6-digit level. Several countries can be selected both as reporters and/or as partners. However, trade values, and the deriving measurements (indicators/proxies), are shown only for the last four available years. This section analyses different aspects:

- Exchange flows analysis: commercial trade is reported for the last four years, both in monetary and quantity terms. However, the retrieved data are slightly different from those available in Easy Comext. Table 7 gives an example of this issue.

Table 7: Data example in Trade Catalyst

Reporter	Partner	HS Code	Type	Trade	Data source	2011	2012	2013	2014
ES	CN	854140	Import	Value in M€	Easy Comext	311864	149382	38519	18562
					Trade Catalyst	278655	143497	30297	22186
				Quantity in 100KG	Easy Comext	221546	185029	57903	17481
					Trade Catalyst	208731	187857	46029	17118

- Opportunity dashboard by product: this analysis provides indicators/proxies regarding product opportunities, such as share of exports, trends and others. However, many of these measurements are based on the sample selected, so they might change when different searches are performed.
- Opportunity dashboard by country: this analysis provides indicators/proxies regarding county opportunities, such as share of exports, trends and others. However, many of these measurements are based on the sample selected, so they might change when different searches are performed.
- Rival country analysis: this section produces a comparison between countries, based on the products and the countries selected.

The Strategy interface is the combination of the first two tools and it aims at providing key messages regarding international market strategies. NACE sectors can be selected together with exporting and importing countries or regions. This tool enables sector analysis, both at country and regional levels. Different sections are available for different purposes of analysis. Based on the selection made at the beginning, it summarises the export structure, the innovation degree, the attractiveness degree and the internationalisation degree at NACE level. It also provides a sector overview and it suggests which is the best product to be exported and where.

⁽¹⁵⁾ Information updated on 09 December 2016.

Box 2. Data accuracy and mirror statistics

As described above, national authorities collect data and then report them to both Eurostat and United Nations. However, there is not one unique data collection procedure, therefore countries are allowed to use different currencies, different levels of product aggregation (HS and/or the National Tariff Line), and, furthermore, data might be provided at different times. For these reasons, the value of exports from country A to country B often does not equal the value of imports of country B from country A. This type of data comparison is defined as mirror technique.

Mirror statistics have a double functionality. On the one hand, they make it possible to check data differences between two reporting countries, and, on the other hand, they are often used to fill data missing for those countries that have not reported complete trade information. Obviously, mirror statistics cannot be used to fill a country data gap with the respective trade information of another non-reporting country. Further, the use of mirror statistics invert the reporting standards by valuing exports in terms of cost, insurance or freight (CIF) and imports in terms of free on board (FOB). CIF unit values rely on importer declarations while the FOB unit value relies on exporter declarations.

Annex 4. List of countries

The list of countries below is identified by commercial trading. If a country has traded at least once with one of the 28 Member States in the period 2000-2015, and the relative information is reported by Easy Comext, this country is present in the list. Further, countries are grouped by geographic regions, following the classification given by the United Nations⁽¹⁶⁾. This classification is based on continental regions and, consequently, it does not refer to any political affiliation of countries. For instance, although Ceuta and Melilla are two Spanish autonomous cities, in this report, they are grouped within the region northern Africa, because of their geographic location. Nevertheless, since the focus of this report is on the European Union, the 28 Members States are grouped together in one single region. All the remaining countries are labelled as Rest of Europe, without considering their geographic distribution, such as eastern, northern, southern or western Europe. Lastly, it is possible that countries are associated with an identification code which might have changed over the timeframe of this report. Where necessary, this information is given in brackets after the name⁽¹⁷⁾.

Table 8: List of countries and codes

	Region	Code	Country
Extra-EU28	Africa, Eastern	BI	Burundi
		DJ	Djibouti
		ER	Eritrea
		ET	Ethiopia
		KE	Kenya
		KM	Comoros
		MG	Madagascar
		MU	Mauritius
		MW	Malawi
		MZ	Mozambique
		RW	Rwanda
		SC	Seychelles
		SO	Somalia
		SS	South Sudan (since 2013)
		TF	French Southern and Antarctic Lands
		TZ	Tanzania
		UG	Uganda
	YT	Mayotte	
	ZM	Zambia	
	ZW	Zimbabwe	
	Africa, Middle	AO	Angola
		CD	Democratic Republic of the Congo
		CF	Central African Republic
		CG	Republic of Congo
		CM	Cameroon
		GA	Gabon
		GQ	Equatorial Guinea
		ST	Sao Tome and Principe
	Africa, Northern	TD	Chad
		DZ	Algeria
		EG	Egypt
		EH	Western Sahara (since 2013)
		LY	Libya
MA		Morocco	
SD		Sudan	
TN		Tunisia	
XC	Ceuta		
XL	Melilla		

⁽¹⁶⁾ Source: <https://unstats.un.org/unsd/methodology/m49/>

⁽¹⁷⁾ Information on names and data availability often rely upon those present in Easy Comext

	Africa, Southern	BW	Botswana
		LS	Lesotho
		NA	Namibia
		SZ	Swaziland
		ZA	South Africa
	Africa, Western	BF	Burkina Faso
		BJ	Benin
		CI	Cote d'Ivoire
		CV	Cape Verde
		GH	Ghana
		GM	Gambia
		GN	Guinea
		GW	Guinea-Bissau
		LR	Liberia
		ML	Mali
		MR	Mauritania
		NE	Niger
		NG	Nigeria
		SH	Saint Helena
		SL	Sierra Leone
	SN	Senegal	
	TG	Togo	
	America, Caribbean	AG	Antigua and Barbuda
		AI	Anguilla
		AN	Netherlands Antilles (until 2012)
		AW	Aruba
		BB	Barbados
		BL	Saint Barthélemy (since 2013)
		BQ	Bonaire (since 2013)
		BS	Bahamas
		CU	Cuba
		CW	Curacao (since 2013)
		DM	Dominica
		DO	Dominican Republic
		GD	Grenada
		HT	Haiti
		JM	Jamaica
		KN	Saint Kitts and Nevis
		KY	Cayman
		LC	Saint Lucia
		MS	Montserrat
SX		Saint Maarten (Dutch part) (since 2013)	
TC	Turks and Caicos		
TT	Trinidad and Tobago		
VC	St. Vincent and the Grenadines		
VG	British Virgin Islands		
VI	Virgin Islands (US)		
America, Central	BZ	Belize	
	CR	Costa Rica	
	GT	Guatemala	
	HN	Honduras	
	MX	Mexico	
	NI	Nicaragua	
	PA	Panama	
SV	El Salvador		
America, Northern	BM	Bermuda	
	CA	Canada	
	GL	Greenland	
	PM	Saint Pierre and Miquelon	
	UM	United States Minor Outlying Islands	
US	United States		

	America, South	AR	Argentina
		BO	Bolivia
		BR	Brazil
		CL	Chile
		CO	Colombia
		EC	Ecuador
		FK	Falkland Islands
		GS	South Georgia and the South Sandwich Islands
		GY	Guyana
		PE	Peru
		PY	Paraguay
		SR	Suriname
		UY	Uruguay
	VE	Venezuela	
	Antarctica	AQ	Antarctica
		BV	Bouvet Island
	Asia, Central	KG	Kyrgyz
		KZ	Kazakhstan
		TJ	Tajikistan
		TM	Turkmenistan
		UZ	Uzbekistan
	Asia, Eastern	CN	China
		HK	Hong Kong
		JP	Japan
		KP	North Korea
		KR	South Korea
		MN	Mongolia
		MO	Macao
	TW	Taiwan	
	Asia, South-Eastern	BN	Brunei Darussalam
		CC	Cocos
		CX	Christmas Island
		ID	Indonesia
		KH	Cambodia
		LA	Lao PDR
		MM	Myanmar/Burma
		MY	Malaysia
		PH	Philippines
		SG	Singapore
		TH	Thailand
		TL	Timor-Leste (since 2003)
TP	East-Timor (ex Portugese Timor 1976) (2001 and 2002)		
VN	Vietnam		
Asia, Southern	AF	Afghanistan	
	BD	Bangladesh	
	BT	Bhutan	
	IN	India	
	IO	British Indian Ocean Territory	
	IR	Iran	
	LK	Sri Lanka	
	MV	Maldives	
	NP	Nepal	
	PK	Pakistan	
Asia, Western	AE	United Arab (UA) Emirates	
	AM	Armenia	
	AZ	Azerbaijan	
	BH	Bahrain	
	GE	Georgia	
	IL	Israel	
IQ	Iraq		

		JO	Jordan
		KW	Kuwait
		LB	Lebanon
		OM	Oman
		PS	Occupied Palestinian Territory (West Bank – including East Jerusalem and Gaza Strip) (since 2001)
		QA	Qatar
		SA	Saudi Arabia
		SY	Syria
		TR	Turkey
		XP	West Bank and Gaza Strip (2000 only)
		YE	Yemen
	Oceania, Australia & New Zealand	AU	Australia
		HM	Heard Island and McDonald Islands
		NZ	New Zealand
		XZ	New Zealand Oceania (2000 only)
	Oceania, Melanesia	FJ	Fiji
		NC	New Caledonia
		PG	Papua New Guinea
		SB	Solomon Islands
		VU	Vanuatu
	Oceania, Micronesia	FM	Micronesia
		GU	Guam
		KI	Kiribati
		MH	Marshall Islands
		MP	Northern Mariana Islands
		NR	Nauru
		PW	Palau
	Oceania, Polynesia	AS	American Samoa
		CK	Cook Islands
		NU	Niue
		PF	French Polynesia
		PN	Pitcairn Islands
		TK	Tokelau
		TO	Tonga
		TV	Tuvalu
		WF	Wallis and Futuna
	WS	Samoa	
	Rest of Europe	AD	Andorra
		AL	Albania
		BA	Bosnia-Herzegovina
		BY	Belarus
		CH	Switzerland
		CS	Serbia and Montenegro (from January 2004 to May 2005)
		FO	Faroes
		GI	Gibraltar
		IS	Iceland
		LI	Liechtenstein
		MD	Moldova
		ME	Montenegro (since 2007)
		MK	Former Yugoslav Republic of Macedonia
		NO	Norway
		RU	Russia
		SM	San Marino
		UA	Ukraine
	VA	Vatican	
	XK	Kosovo ⁽¹⁸⁾ (since June 2005)	

⁽¹⁸⁾ United Nations Security Council resolution

		XM	Montenegro (from June 2005 to 2006)
		XS	Serbia (since June 2005)
		YU	Yugoslavia (until 2003)
Intra-EU28	EU28	AT	Austria
		BE	Belgium
		BG	Bulgaria
		CY	Cyprus
		CZ	Czech Republic
		DE	Germany
		DK	Denmark
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		SI	Slovenia
		SK	Slovakia
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