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Power Statistics and Trends:

THE FIVE DIMENSIONS OF THE ENERGY UNION

A EURELECTRIC report

December 2015

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ELECTRICITY FOR EUROPE

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- commitment, innovation, pro-activeness

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- transparency, ethics, accountability

December 2015

Contact:
Niina HONKASALO, Advisor,
Energy Policy & Generation Unit
nhonkasalo@eurelectric.org

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This report is based on the latest available industry figures (2014) gathered from EURELECTRIC statistical experts and complemented by publicly available information. The data contained in this report covers 33 countries, namely the 28 EU Member States as well as Norway, Switzerland, Iceland, Turkey and Serbia.

In outlining the new trends and data, the report examines the policy context, the evolution of fundamentals such as production, capacity and demand, and provides a brief outlook of market developments, prices, innovation and environmental performances.

We would like to express our sincere gratitude to all contributing experts in particular country data experts.

Table of Contents

OVERVIEW AND KEY FINDINGS

Implications for the European Climate and Energy Policy

Europe needs to ensure secure, sustainable, affordable and competitive energy for all its citizens and businesses in the midst of the ongoing energy transition. The Energy Union - based on five mutually supportive dimensions - energy security, solidarity and trust; the internal energy market; energy efficiency as a contribution to the moderation of energy demand; decarbonisation of the economy; and research, innovation and competitiveness - is intended to address these challenges.

The European power generation mix is becoming increasingly low carbon with a growing share of renewables. In 2014, 56% of electricity generated in the EU came from low carbon sources. The total power generation in the EU in 2014 was 3,025 TWh, with 27% generated from nuclear, 42% from fossil fuels and 28% from renewable energy sources. At the same time final electricity consumption has been decreasing gradually since 2008. Electricity is on track to becoming a carbon neutral energy carrier and if used more widely to replace fossil fuels in transport, heating and cooling, more electricity can actually mean reductions in greenhouse gas emissions and more energy efficiency.

Renewable power generation increased by 38 TWh from 2013 to 2014, while over the same period fossil fuel fired power generation declined at an even faster rate: 121 TWh decrease from 2013 to 2014. The increase in renewable generation capacity can largely be explained by the use of different types of support schemes, as the EU ETS prices remain relatively low (just above €8), despite the recent price increase trend. The costs of renewable technologies have been falling, but at the same time the wholesale prices have decreased. Thermal generation capacity has been decommissioned due to old age, unprofitability, and the evolution of European environmental legislation. Fossil fuel fired plants face difficulties to remain profitable as a consequence of a decrease in running hours and low wholesale prices.

Regarding security of supply, the share of indigenous energy sources in the power mix has increased, but at the same time the decrease in firm and flexible capacity provided by thermal generation results in challenges for security of supply. Many markets today face a paradox: back-up capacity is needed to secure electricity supply for customers, but the incentives to ensure availability of such capacity are not in place. More flexibility is also needed in the power system to respond to increasingly sharp short-term variations in power generation.

Significant progress has been achieved with the day-ahead market coupling, but a fully integrated internal electricity market is yet to be reached. Further progress is needed to develop of cross-border intraday and balancing markets. Wholesale prices remain at a low level in Europe compared to the cost of most generation and storage technologies. This can have consequences for decarbonisation and security of supply.

The energy transition is bringing unprecedented challenges and important opportunities for the sector and power companies continue to invest in innovation despite the difficult economic circumstances.

- *Progress in the development of fully integrated internal electricity market must be ensured.*
- *Energy, capacity and flexibility should be properly valued in the market.*
- *Strengthened EU ETS and a consistent policy framework are key for the decarbonisation of the power sector. Investments in renewables should be driven by market signals and renewables should be fully integrated into the market.*
- *Stronger commitment by policy makers to electrification is needed to ensure that not only the electricity mix but also heating, cooling and transport will be decarbonised.*

INTRODUCTION

Electricity in the Energy Union

Introduction - **Electricity in the Energy Union**

The European power sector is undergoing one of the most transformative changes in its history. Accelerated technological change, shifting consumer preferences, the application of ICT to link generation and demand, as well as the evolving EU climate and energy policy agenda, provide unprecedented challenges and important opportunities for the power sector. In the midst of the energy transition, Europe needs to ensure secure, sustainable, affordable and competitive energy for all its citizens and businesses.

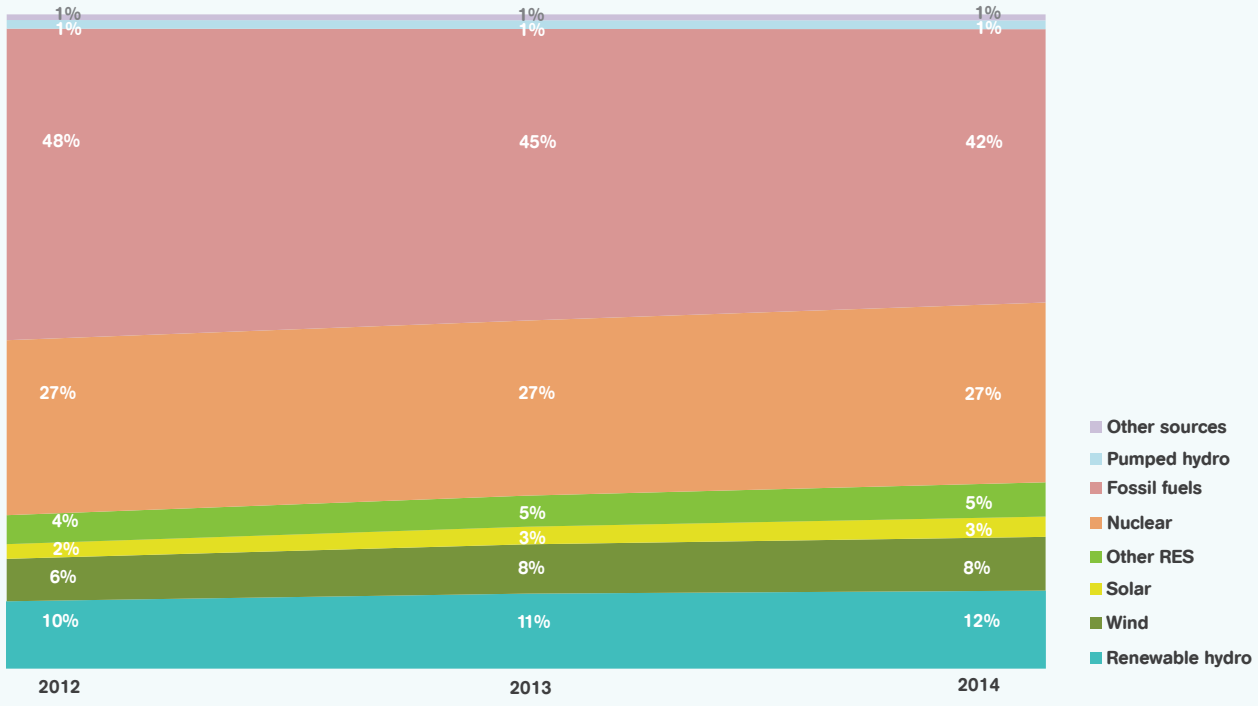
The Energy Union is the EU's response to tackle these challenges, and this publication presents the latest state of play in the power sector in the context of the five pillars of the Energy Union strategy. This chapter presents the developments in power generation, capacity and demand in the years 2012-2014.

Changing power generation mix: 5% increase in RES and 9% decrease in fossil fuels from 2013 to 2014

The total power generation in the EU in 2014 was 3,025 TWh, which represents a 3% decrease from 2013.

Fossil fuel fired generation has declined faster than renewables have increased: Renewables generation increased by 90 TWh from 2012 to 2013 and 38 TWh from 2013 to 2014, while fossil fuel fired generation decreased by 105 TWh from 2012 to 2013 and 121 TWh from 2013 to 2014. As a consequence, the share of RES in the power mix increased with renewable energy sources becoming, for the first time ever, the largest source of low carbon electricity in the EU in 2014, comprising 28% of the total power generation.

Figure 1: EU power generation mix by energy source



Source: EURELECTRIC. **Other RES:** Geothermal, renewable waste, wave, tidal. **Other sources:** peat, shale oil, non-renewable waste and unspecified.

Introduction - **Electricity in the Energy Union**

Table: Power generation in the European Union

EU 28 - TWh	2012	2013	2014	2012-2013 evolution	2013-2014 evolution
Hard coal and lignite	842	812	759	-4%	-7%
Gas	586	523	459	-11%	-12%
Oil	58	49	46	-16%	-6%
Nuclear	839	831	831	-1%	0%
Hydro	322	357	360	11%	1%
Wind	203	234	249	15%	6%
Solar	70	84	94	19%	12%
Other RES	138	148	158	7%	6%
Other Sources	69	70	69	2%	-2%
Total	3,129	3,110	3,025	-1%	-3%

Source: EURELECTRIC, except Slovakia for 2012 and 2013 (ENTSO-E). **Other RES:** Geothermal, renewable waste, wave, tidal.
Other sources: peat, shale oil, non-renewable waste and unspecified.

Within specific technologies, nuclear power (27% of the power mix) continued to be the largest single energy source for the production of low carbon electricity, followed by hydropower (12%), wind power (8%), bioenergy (4%) and solar power (3%). The share of nuclear power in the power mix remained the same between the years 2012 and 2014, while wind power, solar power and bio-energy generation increased by 23%, 33% and 16% respectively from 2012 to 2014. This growth slowed down in 2014 compared to 2013.

Fossil fuel fired generation accounted for 42% of the electricity mix in 2014, compared to its total share of 48% in 2012. Natural gas fired generation has decreased sharply in the EU, by 22% between 2012 and 2014. The decrease took place at a similar pace in 2013 and in 2014, which saw decreases of 11% and 12% respectively. Coal fired generation has also fallen for two consecutive years, but at a slower pace: 4% in 2013 and 7% in 2014.

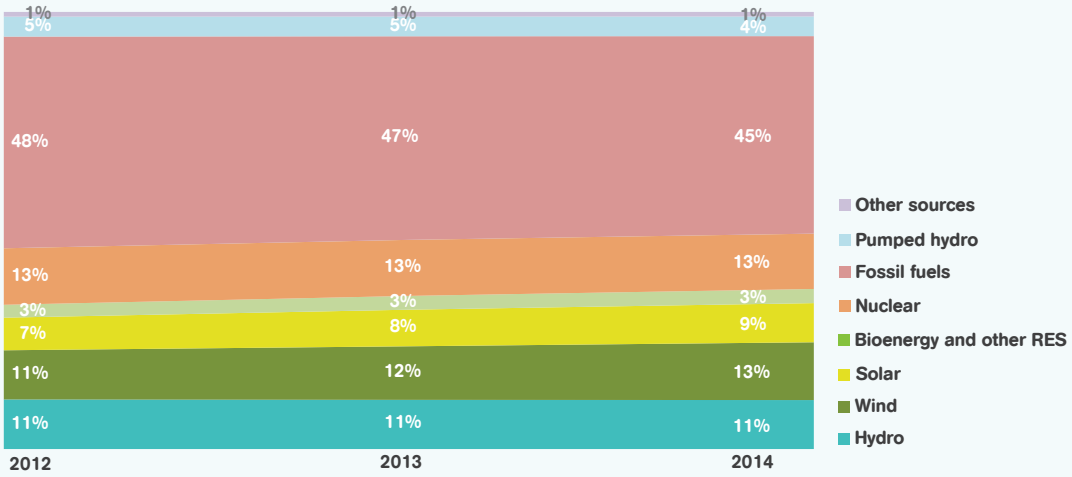
The changes in the generation mix can be attributed to the changes in capacity, characteristics of different technologies and a decrease in demand. Solar and wind power have low marginal costs, and thus they are replacing fossil fuel fired generation during the hours with favourable weather conditions. As a consequence the running hours of fossil fuel fired capacity have decreased.

Wind and solar power capacity increased fastest

The total share of RES in installed capacity increased from 33% in 2012 to 37% in 2014. During the same period, wind and solar power grew at the fastest rate with the share of wind power increasing from 11% to 13% and solar power from 7% to 9%. The total renewable capacities increased by 43GW in the past two years (23GW increase in 2013 and a further 20GW increase in 2014). This has seen wind and solar representing 13% and 9% of installed capacities, and 8% and 3% of generation, respectively, in 2014. The increase in renewable generation capacity can largely be explained by support schemes for renewable generation. The costs of renewable technologies have also been falling, but at the same time the wholesale prices have decreased (see figure 2).

Introduction - **Electricity in the Energy Union**

Figure 2: EU power capacity mix by energy source



Source: EURELECTRIC. **Other RES:** Geothermal, renewable waste, wave, tidal. **Other sources:** peat, shale oil, non-renewable waste and unspecified.

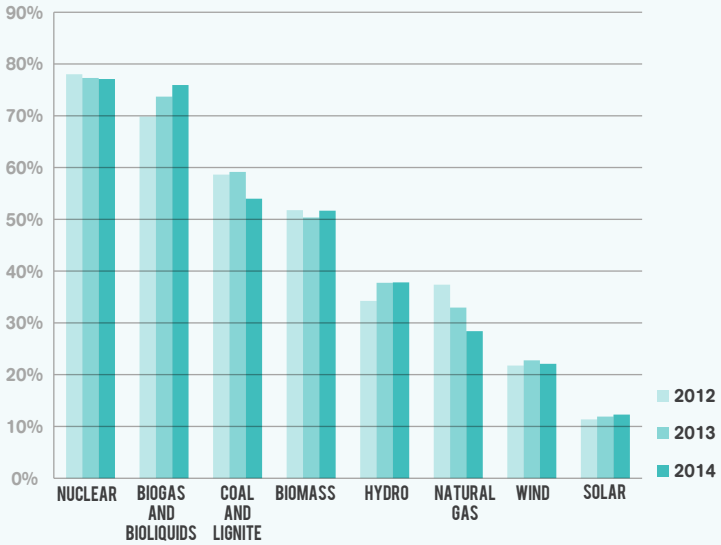
The share of fossil fuel fired capacity in the installed capacity decreased by 3 percentage points the past two years. Thermal generation capacity has been decommissioned due to old age, unprofitability, and the evolution of European environmental legislation. Fossil fuel fired plants face difficulties to remain profitable as a consequence of the decrease in running hours and low wholesale prices. In addition to decommissioning of fossil fuel fired generation, a number of power plants are no longer in operation due to mothballing. The data used in the compilation of this report covers only the decommissioning of power plants.

The capacity from nuclear and hydropower remained stable, representing 13% and 11% of the capacity mix in 2014 respectively.

The total installed capacity in the EU in 2014 was 972GW, an increase of 3% from 2012.

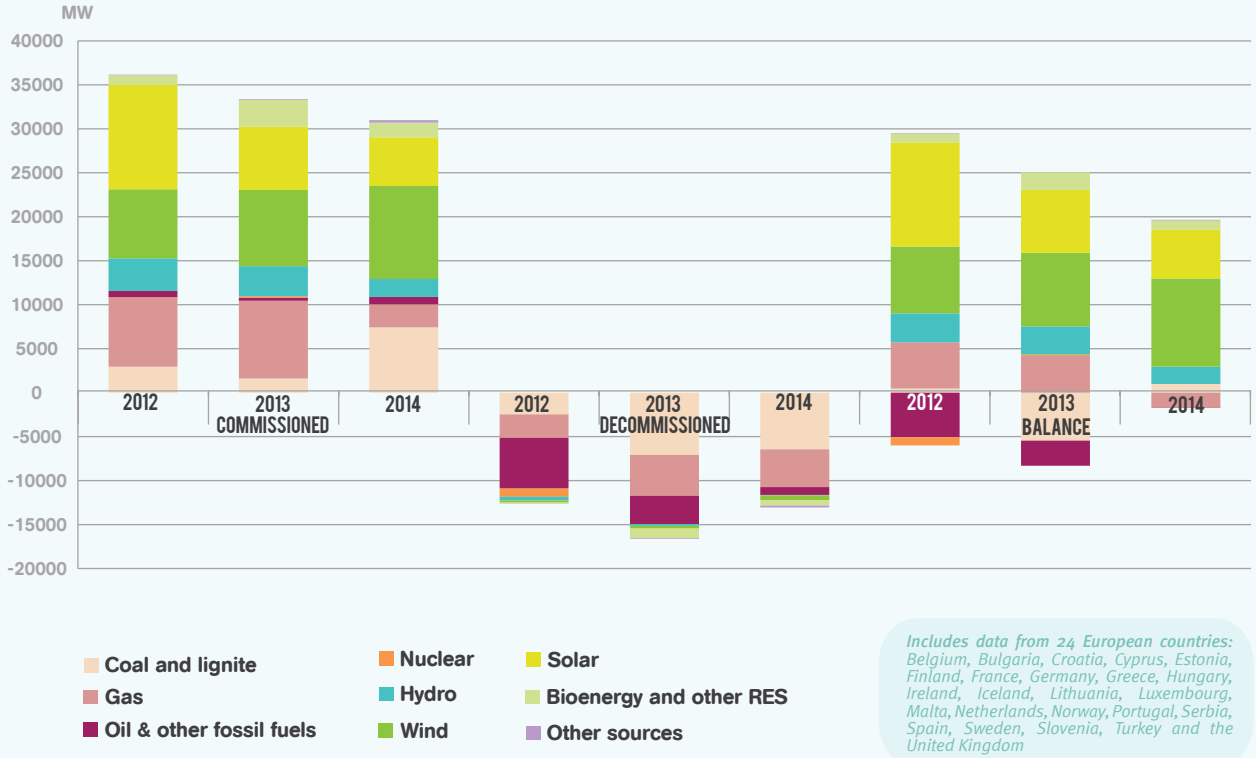
The contribution of technologies in the power system differs, which is also reflected in their output. The average capacity factors presented in the graph below are mainly influenced by the characteristics of the technology, the capacity mix, and wholesale power prices. Higher capacity factor implies more running hours. The graph shows that the average capacity factors of different generation technologies in the EU vary from 12% (solar) to 77% (nuclear).

Figure 3: Capacity factors of generating technologies in the European Union



Source: EURELECTRIC.

Figure 4: Commissioned and decommissioned power plants between 2012 and 2014



Includes data from 24 European countries: Belgium, Bulgaria, Croatia, Cyprus, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Iceland, Lithuania, Luxembourg, Malta, Netherlands, Norway, Portugal, Serbia, Spain, Sweden, Slovenia, Turkey and the United Kingdom

Source: EURELECTRIC.

The commissioned and decommissioned capacity in 24 European countries is illustrated in figure 4.
Renewable electricity capacity continued to be added to the system between 2012 and 2014, but the pace of new renewable capacity investment slowed down in 2014 compared to previous years. The annual additions of wind power generation increased from 2012, while an opposite trend was visible regarding solar power.

A clear shift in trends emerged regarding gas fired capacity between the years 2012 and 2014. In 2012 and 2013 a significant number of new gas fired plants were added to the system as a result of investment decisions made before 2010, while in 2014 the share of gas in the commissioned capacity was significantly reduced. Decommissioning of gas fired capacity continued, and in 2014 more capacity was decommissioned than was added to the system.

Decommissioning of coal plants peaked in 2013, however in 2014 more coal fired capacity was added to the power system than was decommissioned.

1

Security of Supply

Chapter 1 - Security of Supply

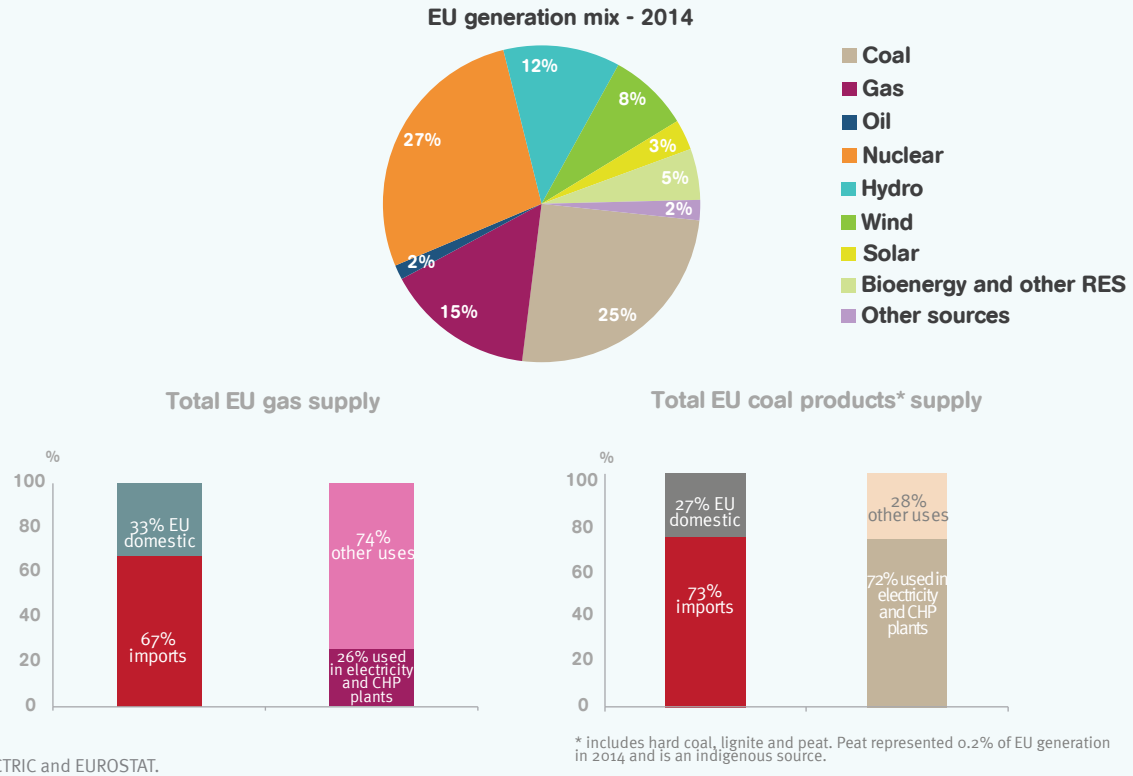
A combination of factors influences the security of electricity supply. These factors include the origin of fuels and their availability on the market, the integration and functioning of the electricity market, as well as the available power generation capacity, storage and demand response.

The increasing share of solar and wind power (which are dependent on weather conditions) as well as the decrease in firm and dispatchable generation capacity, imply profound changes and new challenges for security of supply in the power system.

Domestic energy sources increased, but firm and flexible capacity provided by thermal generation is decreasing

The share of fossil fuels in the European Union power generation mix has decreased by 6 percentage points between 2012 and 2014, while the share of indigenous renewable energy sources has increased by 5 percentage points over the same period.

Figure 5: Energy sources and their relative share in the generation mix



Sources: EURELECTRIC and EUROSTAT.

* includes hard coal, lignite and peat. Peat represented 0.2% of EU generation in 2014 and is an indigenous source.

Security of supply aspects of different fuels

Coal, comprising 25% of the power mix in 2014, is both produced in the EU (27%) and imported (73%). Coal is readily available from a wide variety of sources in a worldwide market. On average, 53% of total EU coal consumption is imported coal used by electricity and CHP plants.

The share of gas in the EU power mix stood at 15% in 2014. In total, 67% of the natural gas consumed in the EU is imported.[1] Security of gas supply in the EU has improved in the last five years: significant achievements have been made in strengthening the gas infrastructure and in diversifying suppliers. However, the integration of internal market for gas is not yet completed. On average, 18% of total gas consumption in the EU is imported gas used by electricity and CHP plants.

Uranium, required to produce nuclear power (comprising 27% of electricity generation in 2014), is imported into the EU. European companies rank among the world's major producers of nuclear fuel. It is common practice for nuclear operators to store sufficient uranium fuel assemblies on-site for a number of years of operation.

93% of the biomass used to produce electricity, heating and cooling in 2012 came from domestic sources.[2] The share of imports is expected to increase as a result of the growing share of bioenergy.

[1] Data on imports: EUROSTAT (2013).

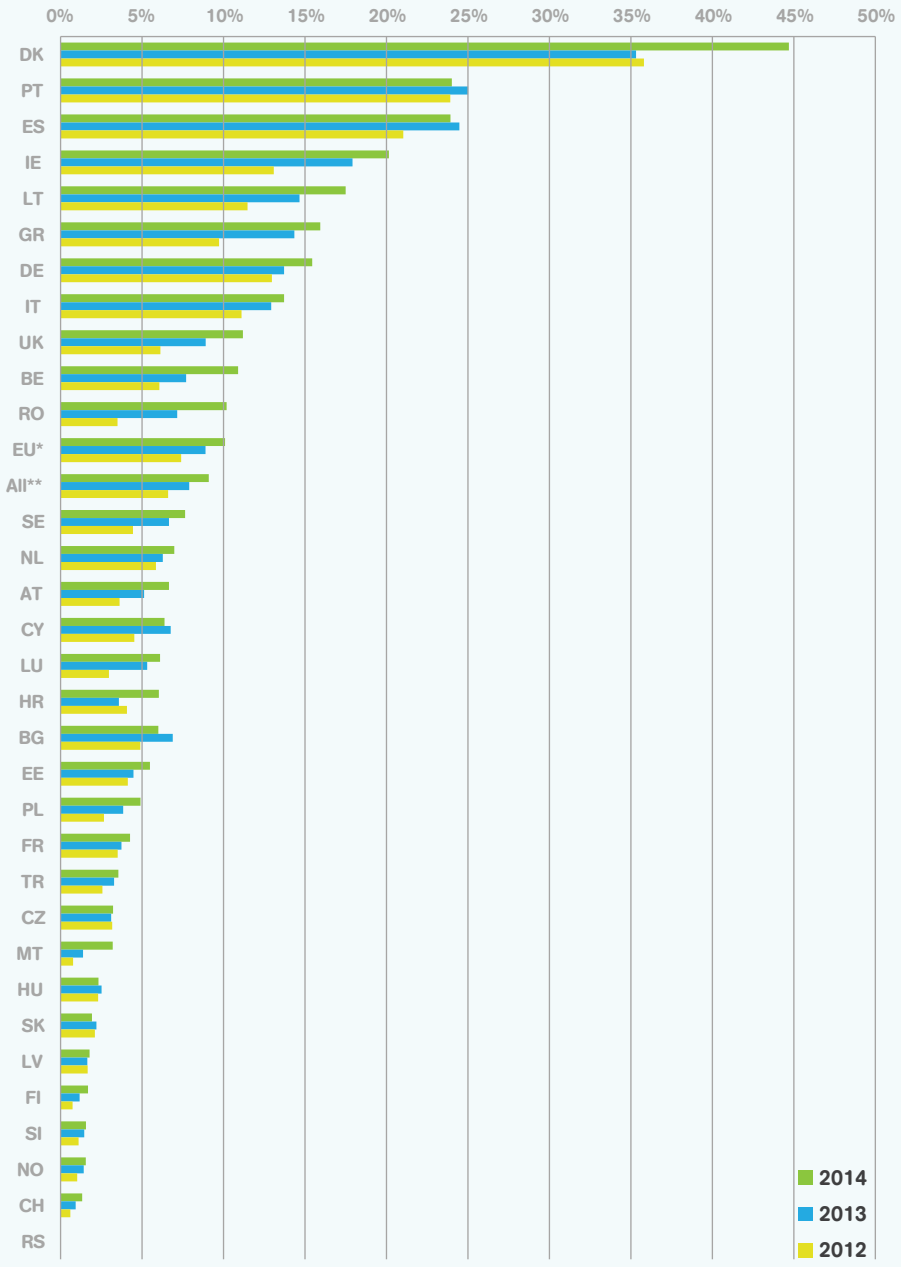
[2] Commission Staff Working Document "State of play on the sustainability of solid and gaseous biomass used for electricity, heating and cooling in the EU", European Commission, 28 July 2014.

Four countries produce over 20% of their electricity from variable renewables

The variable renewable capacity has been increasing: the share of solar power and wind power comprised more than 20% of the power mix in four European countries in 2014: Denmark (45%), Portugal (24%), Spain (24%) and Ireland (20%).

On average, the share of variable RES in the power mix for EURELECTRIC's members increased by 2.5 percentage points between 2012 and 2014.

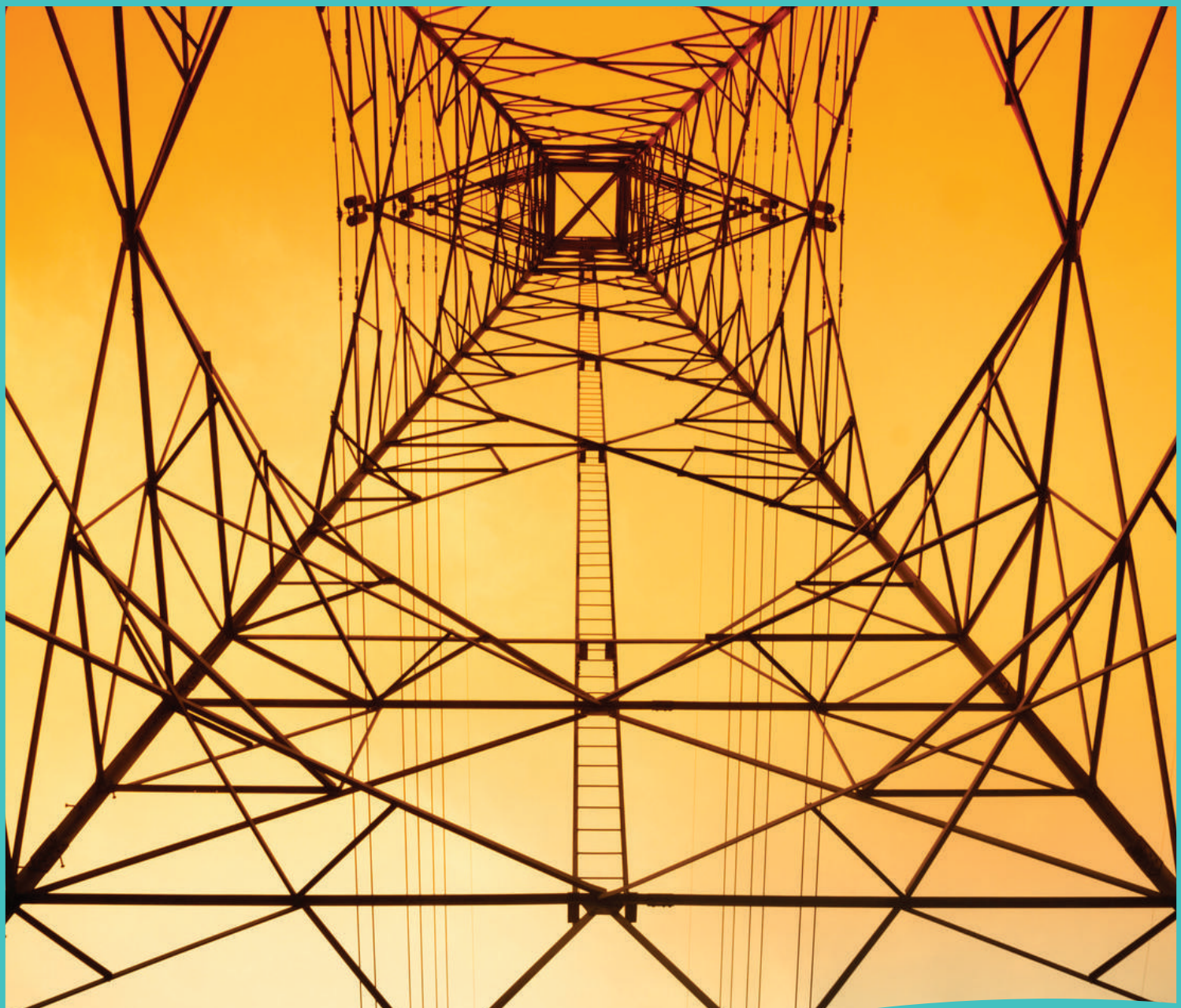
Figure 6: Share of variable RES in the generation mix



*EU: European Union average

** All: EURELECTRIC members average

Source: EURELECTRIC.



2

Internal Energy Market

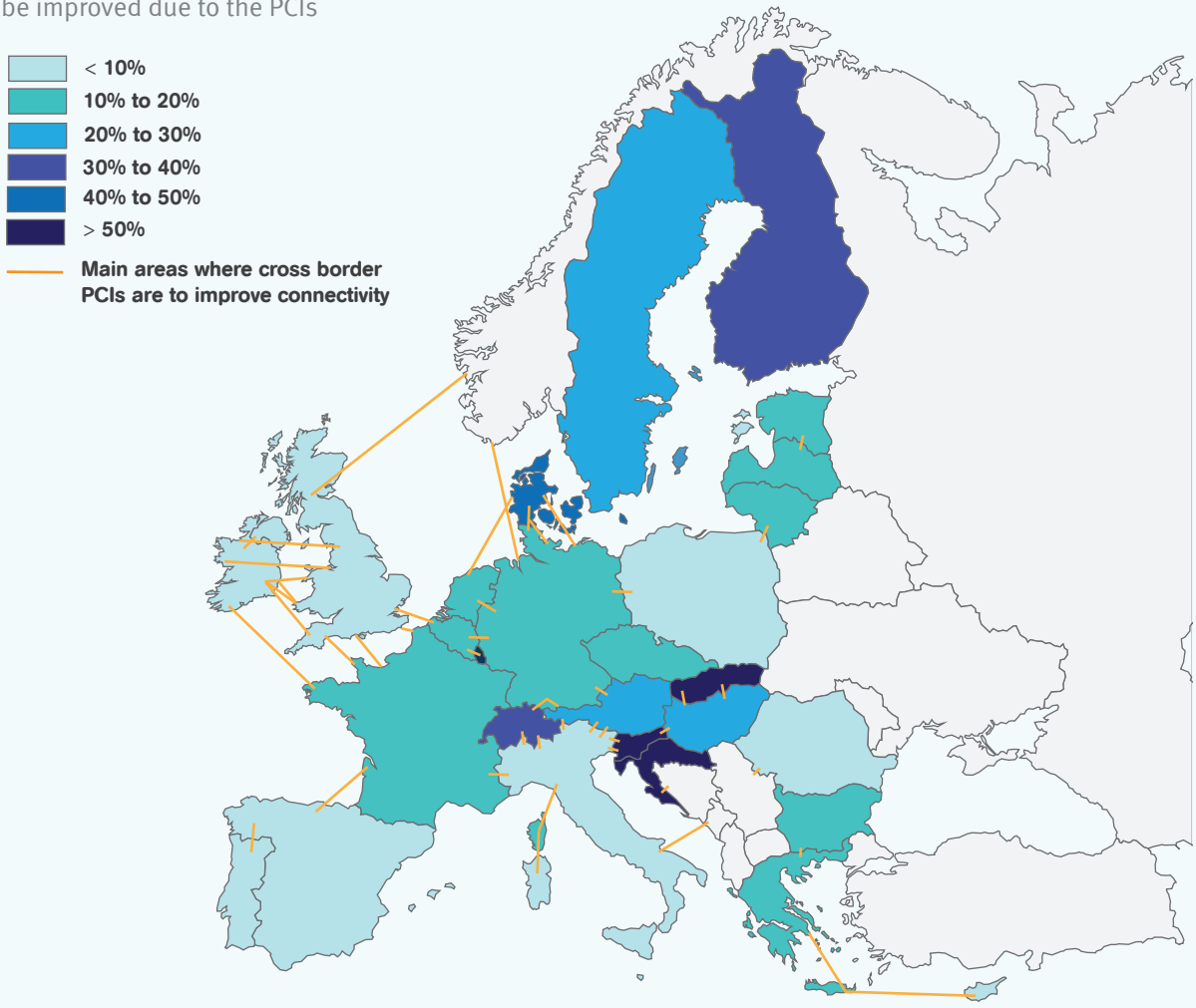
Chapter 2 - Internal Energy Market

The integration of electricity markets optimises the use of assets across Europe. This leads to more efficient market participation by all agents and ultimately to more cost-efficient energy delivery to consumers. The efficient operation of existing interconnections and adequate interconnection capacity facilitates the integration of power markets, the integration of renewables to the market, and contributes to security of supply.

Progress made in market integration and interconnections

At the end of 2014, 13 European countries had interconnection levels ranging between 10-30%; 3 countries had interconnection levels ranging between 30-50% and a further 4 countries had interconnection levels above 50%. Some countries (e.g. Spain, Portugal, Italy, Poland, Romania, UK, Ireland, Cyprus and Malta) still have interconnection levels below 10%. With the implementation of the Projects of Common Interest (PCI) across the EU, interconnectivity is expected to be improved by 2020, especially in regions which are currently less connected, such as the Baltic and Balkan regions. Some projects have already been completed since the end of 2014, for instance the France/Spain interconnection through the Pyrenees and the connection of Malta to European electricity grid.

Figure 7: Interconnections levels at the end of 2014* and main areas where the interconnectivity is expected to be improved due to the PCIs



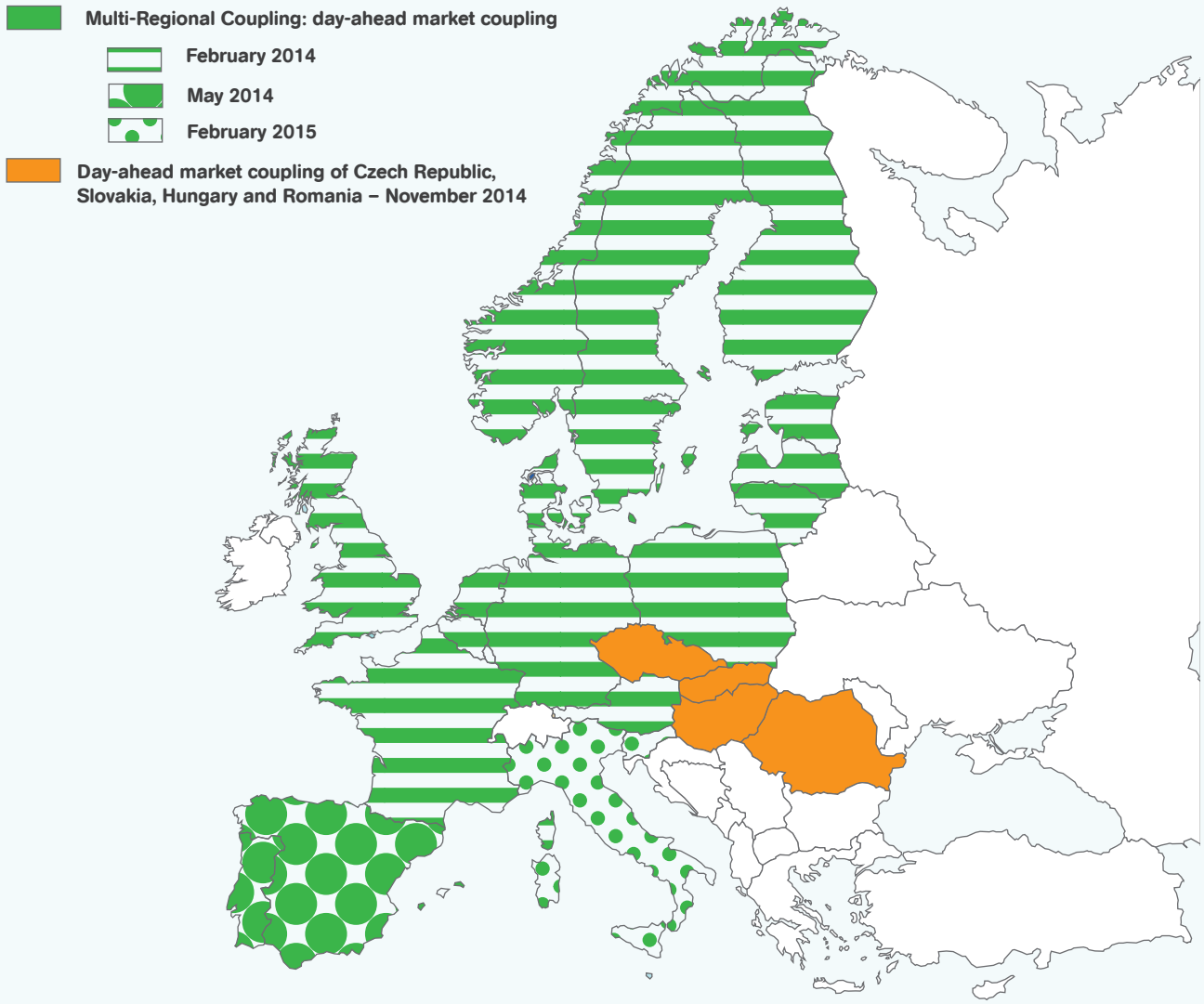
*Interconnection capacities compared to the total capacity installed.

Source: ENTSO-E via European Commission Communication "Achieving the 10% electricity interconnection target" (COM(2015) 82).

Day-ahead markets were further coupled in 2014 and 2015. The Multi-Regional Coupling (MRC) now covers 19 countries, representing around 85% of European power consumption.

Along with interconnections and market couplings, the operation of networks and the management of the capacity influence the feasibility of cross-border trade.

Figure 8: Progress in market couplings in 2014 and 2015



Sources: ACER and ENTSO-E.

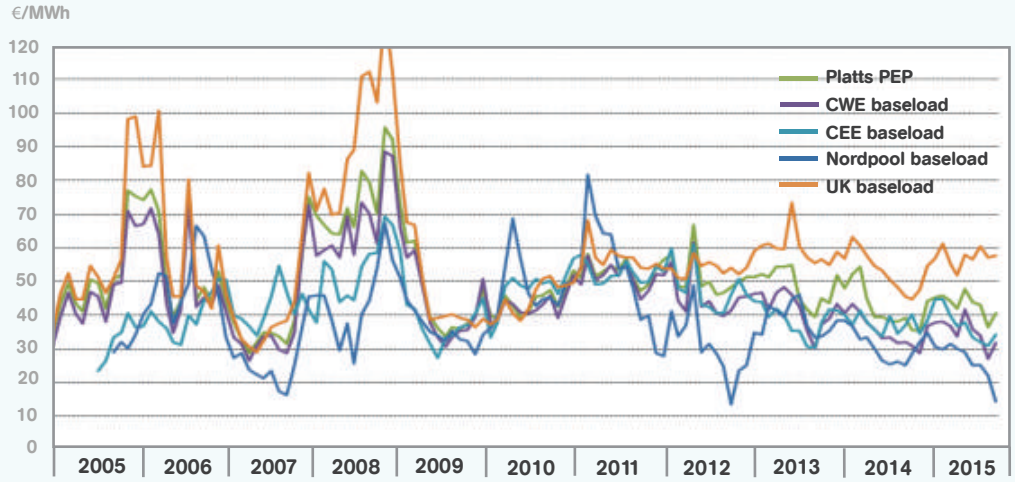
Chapter 2 - Internal Energy Market

Wholesale prices remain low compared to costs of technologies

Wholesale prices continued to linger at a low level in comparison with the costs of power generation technologies and storage. The combination of several factors has led to the decrease in power prices: decrease in demand, subsidies to build new generation capacity at a time when demand is not increasing and larger share of variable power generation.

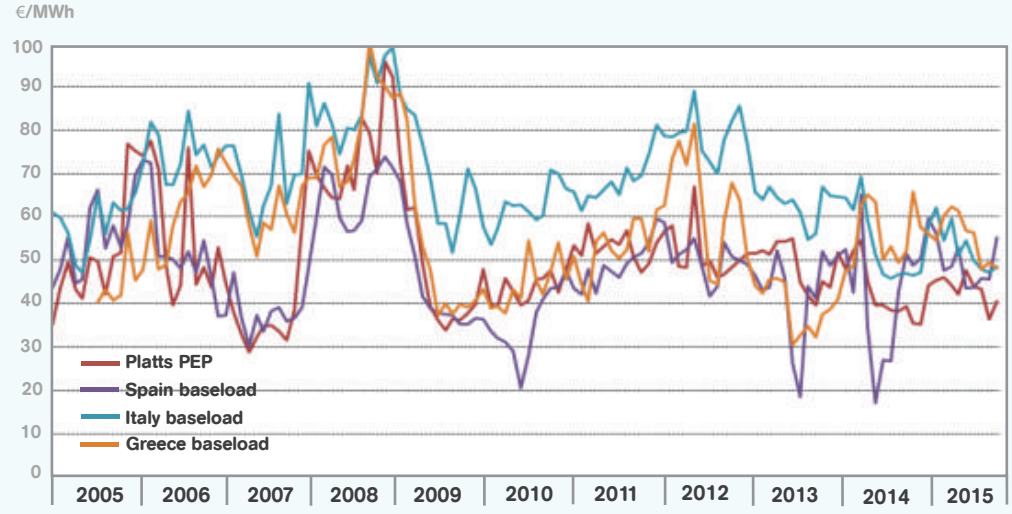
The Platts Pan-European Power (PEP) Index[3] which indicates wholesale price trend for the European market as a whole, varied between €35 and €48 since January 2014, and the Nordpool monthly average price has not exceeded €35 since November 2013. At the same time, the LCOE[4] of power generation technologies and storage is below €50/MWh only in rare cases in Europe.

Figure 9: Comparisons of the Platts PEP and monthly electricity baseload prices in regional electricity markets (CWE, CEE, Nordpool and the UK)



Sources: Platts and European power exchanges, via the European Commission's "Quarterly report on European Electricity Markets", Q2 2015.

Figure 10: Comparisons of the Platts PEP and monthly electricity baseload prices in regional electricity markets (Spain, Italy and Greece)



Sources: Platts and European power exchanges, via the European Commission's "Quarterly report on European Electricity Markets", Q2 2015.

[3]Platts Pan-European Power (PEP) Index is demand-weighted day-ahead baseload index indicating price trends for Europe's free electricity markets as a whole.
[4]IEA: Projected Costs of Generating Electricity (2015 Edition).

3

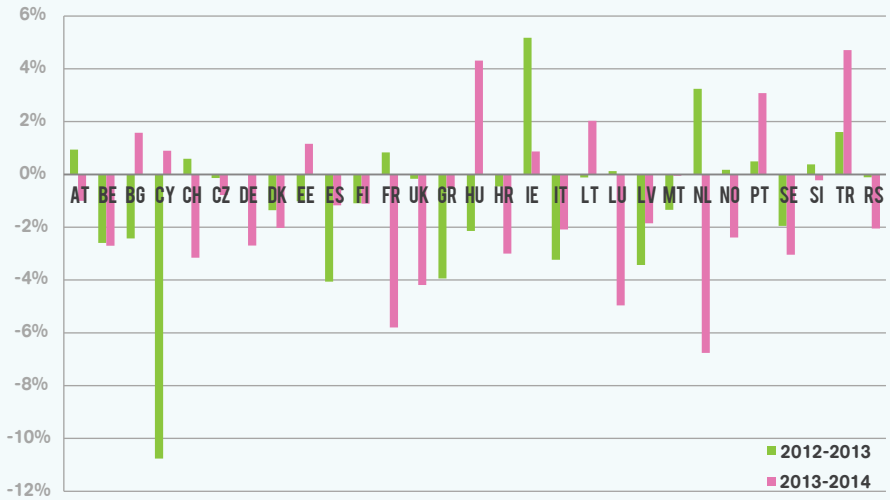
Energy Efficiency

Chapter 3 - Energy Efficiency

Improved energy efficiency, including the efficient production, distribution and use of electricity, is central for climate change mitigation and to improve security of supply. However, increased use of electricity can actually enable decarbonisation when it is replacing fossil fuels.

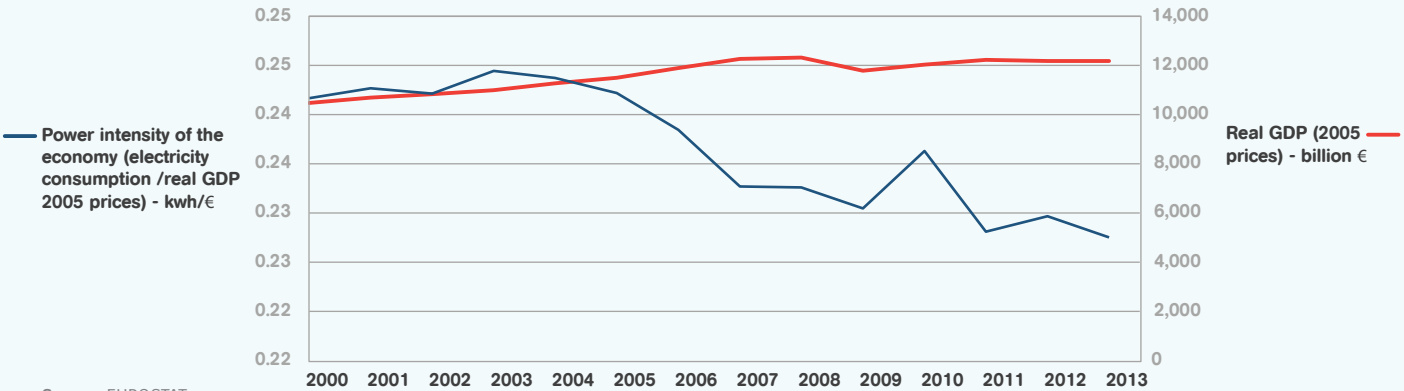
Electricity is on track to becoming a carbon neutral energy carrier and, if used more widely in heating, cooling and transport, it can contribute to improved energy efficiency, and reducing greenhouse gas emissions.

Figure 11: Annual increase/decrease in final electricity consumption in 29 European countries



Source: EURELECTRIC.

Figure 12: GDP and power intensity of the EU economy



Source: EUROSTAT.

Power demand continues to decrease

Final electricity consumption has decreased in the European Union in recent years. The annual power consumption reached its peak in 2008 when 2,866 TWh of electricity was consumed in the EU28. The average annual decrease was 0.9% between 2008 and 2013 power consumption in 2013 stood at 2,711TWh[5].

Most of EURELECTRIC reporting countries experienced a decrease in electricity consumption in 2014.

The Netherlands, France, Luxembourg, the United Kingdom and Switzerland had the highest consumption decrease in 2014 (between 3 and 7 percentage points). However, some Eastern European countries (Bulgaria, Estonia, Hungary, Lithuania), as well as Cyprus, Ireland, Portugal and Turkey saw their power consumption increase in 2014.

The power intensity of the European Union has been following a downward trend since 2003. Since 2008, electricity consumption in Europe has been decreasing while, since 2009, GDP has increased steadily.

[5] EUROSTAT.

4 Decarbonisation

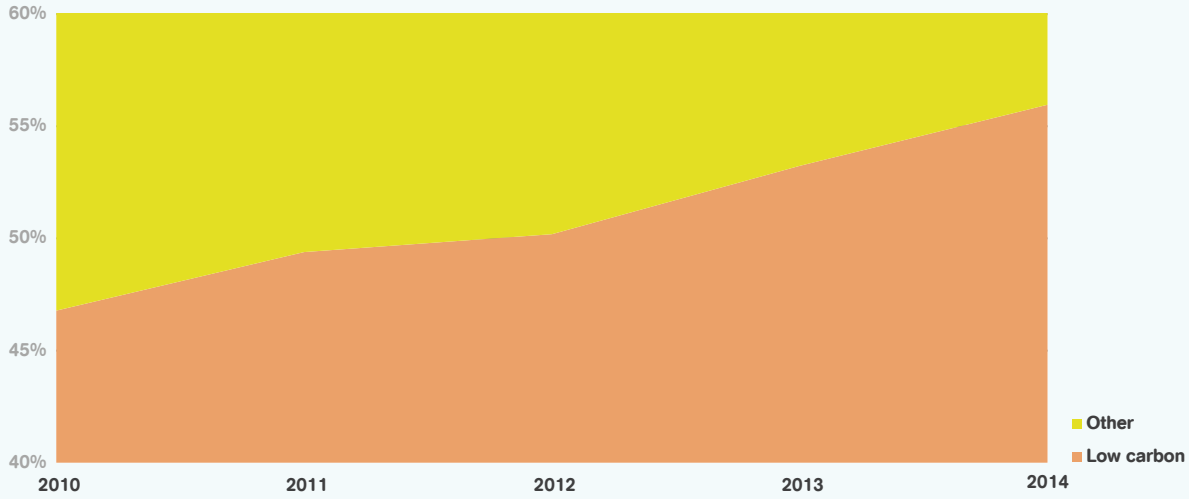
Chapter 4 - Decarbonisation

The EU is committed to achieving at least a 20% reduction in greenhouse gas emissions (compared to 1990 levels) by 2020 and at least a 40% reduction by 2030. The power sector is a global leader on the path way towards decarbonisation and has committed to deliver carbon neutral electricity supply by 2050. According to the European Environment Agency, the share of RES in Europe is growing fastest in the power sector[6].

Growing share of low carbon generation contributes to reductions in CO2 emissions

The total share of low-carbon generation in the EU power mix was 56% in 2014. Since 2012, the annual share of low carbon generation in the EU generation mix has been higher than the share of non-low carbon generation.

Figure 13: Share of low carbon technologies in the EU power generation mix

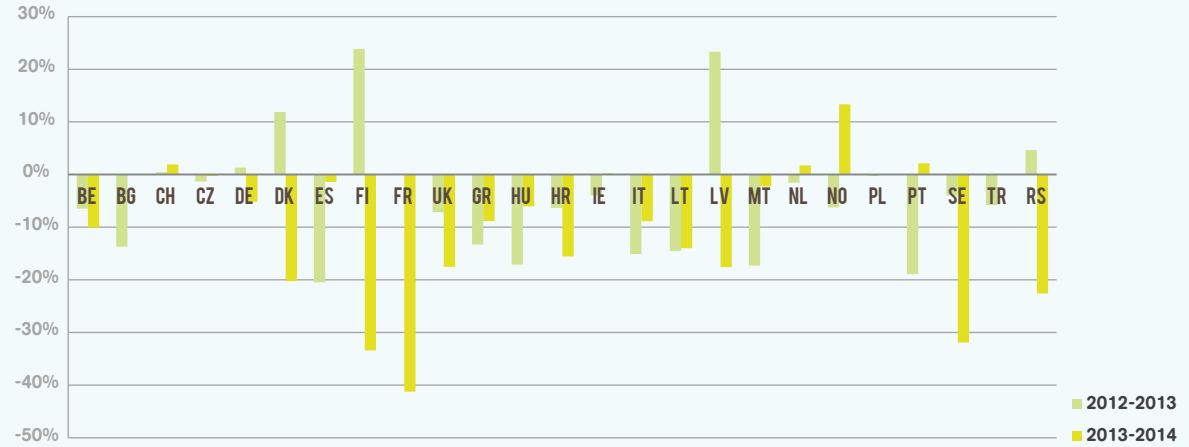


Source: EURELECTRIC.

The European power sector's CO2 emissions decreased significantly in most countries in 2014. Emissions dropped, especially in the Nordic market (Sweden, Finland and Denmark) mainly due to weather conditions that led to an increase in hydropower and a decrease in thermal generation compared to 2013. Emissions decreased sharply also in France (due to a mild winter) as well as in Serbia.

While the sharp decrease in emissions in certain countries is linked to the weather conditions, the decreasing share of fossil fuels in the power mix and a decrease in demand are also contributing to a decline in the CO2 emissions reductions in the power sector.

Figure 14: Increase/decrease of CO2 emissions by the power sector



Source: EURELECTRIC.

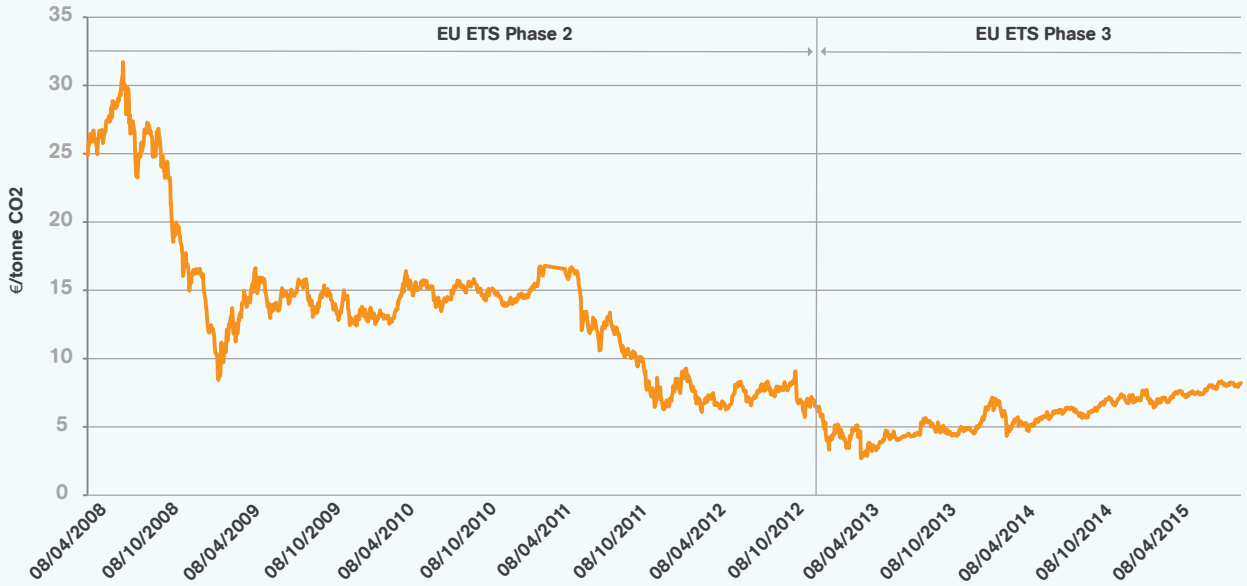
[6] EEA report, "Trends and projections in Europe 2015 — Tracking progress towards Europe's climate and energy targets", 2015.

The price of EU ETS carbon allowances has been increasing slowly and gradually since mid-2013, and has reached a level above €8, following the lowest price of €2.7 registered in April 2013. The market stability reserve (MSR) reform and the legislation on backloading contributed to this increase in the ETS prices (+200% in two years).

Electric vehicles increase strongly in key countries, but overall share is still low

Electric Vehicles (EVs) will have a strong role to play in achieving the objectives under the European decarbonisation agenda.

Figure 15: Evolution of the ETS emissions allowance prices

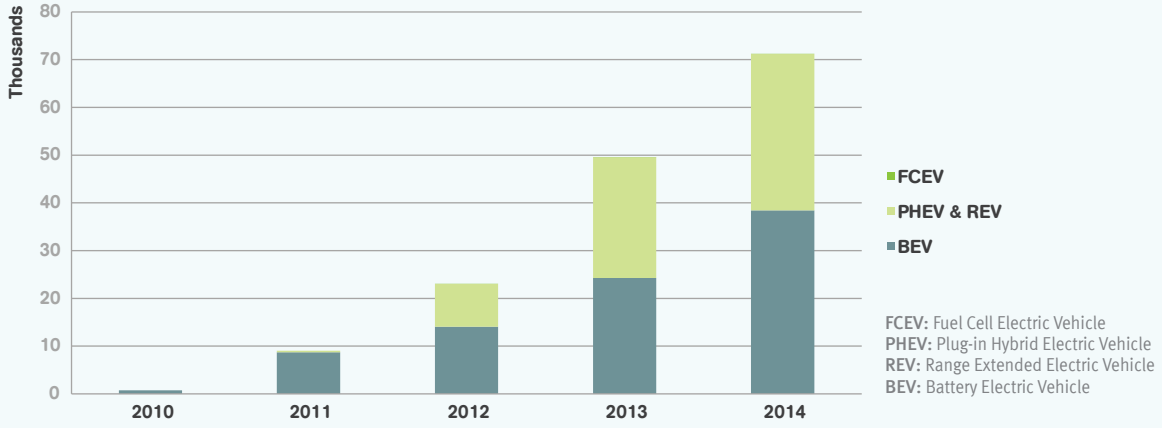


Source: : Quandle.

Since 2010, annual new electric car registrations have increased significantly in the EU, from less than 800 to more than 70,000 today. The number of models on offer has also increased in this period, from 3 to 27, thus providing more choice to customers (see figure 16).

However, the market share of new electric vehicles registration remains very low, at 0.7% of all vehicle registrations in Europe[7] in 2014. In the EU and EFTA countries, four markets (the Netherlands, France, Germany and the UK) accounted for more than 80% of all electric vehicle registrations in the EU in 2014[8]. The increase of EVs is progressing at a particularly fast pace in Norway: in the first quarter of 2015, 20.4% of new car sales in Norway were electric vehicles.

Figure 16: New registrations of electrical passenger cars in the EU



Source: JRC Science and Policy Report: "Electric Vehicles in the EU from 2010 to 2014 – is full scale commercialisation near?", 2015.

[7] EU 28 and EFTA countries. Source: JRC study.
[8] Source: JRC study.

5

Innovation

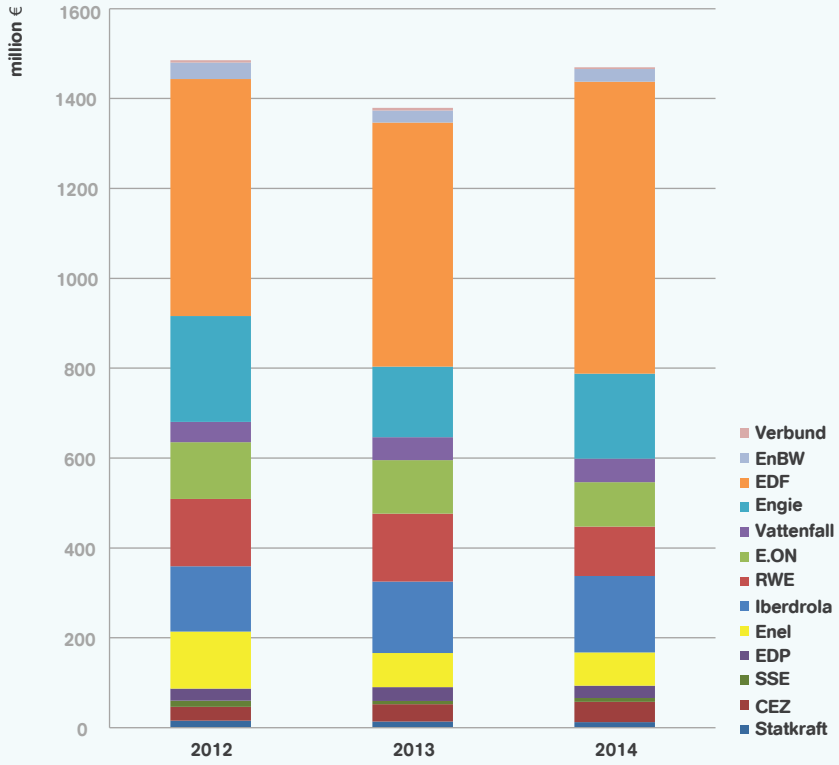
Chapter 5 - Innovation

The ongoing transition in the energy sector has propelled innovation in the power sector to the fore. It has been estimated that accelerated innovation in power supply technologies and business models for energy efficiency will be worth €70 billion[9] to the EU economy by 2030. Additional benefits are also expected in energy security, lower system costs, and consumer convenience.

Power companies invest in R&D despite the difficult economic situation

Innovation represents an important part European power companies' budgets, in spite of the current economic difficulties of the sector. The total R&D expenditure of 13 major European utilities reached €1.4 billion in 2014, an 7% increase compared to 2013.

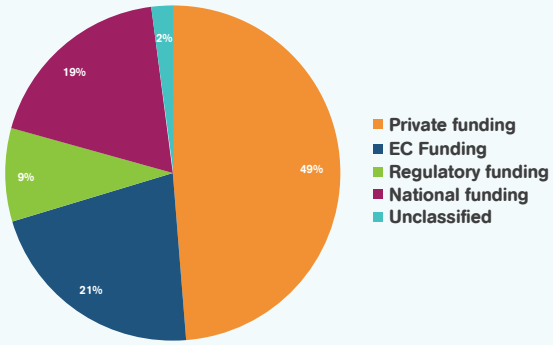
Figure 17: R&D expenditure by major European utilities



Source: Annual Reports.

Between 2002 and 2014, €3 billion has been invested in smart grid projects in the European Union[10].
49% of the funding for such projects came from private sources, while the European Commission and the Member States represented 21% and 19% of the budget respectively. Regulatory institutions also contributed through economic regulation schemes (9%).

Figure 18: Investment in Smart Grids: funding source of projects launched from 2002 to 2014 in the European Union



Source: JRC, based on JRC survey.

[9] EURELECTRIC Innovation Action Plan 2013.
[10] JRC Survey.

Policy Recommendations

Chapter 1 - Security of Supply

- New factors in many of today's markets may put security of supply at risk. Variable generation is having a significant impact on market outcomes. Consequently, many markets today face a paradox: they need back-up capacity to secure electricity supply for customers, but do not provide the right market incentives to ensure that such capacity remains online or that the necessary investments take place. More flexibility is also needed in the power system to respond to increasingly sharp, short-term variations in the market.
- Energy-only markets remain the reference for the completion of the internal energy market (IEM). However, since in many markets the introduction of a capacity element is becoming increasingly important, EURELECTRIC recognises that properly designed, centralised and decentralised capacity markets are an integral part of future market design. Conventional generation, renewables, demand response and storage should participate in energy and capacity markets on an equal footing and be remunerated in the same way for the energy, capacity and flexibility they provide.

Chapter 2 – Internal Energy Market

- The cornerstone to all market developments in Europe is the completion of the internal electricity market to optimise the use of assets across Europe. Significant progress has been achieved with the day-ahead market coupling, but further progress is needed regarding the development of robust cross-border intraday and balancing markets to ensure that the system remains balanced as the share of renewables continues to grow.
- A more efficient operation of existing interconnections and an increase in interconnection capacity is needed in order to integrate the power markets, to facilitate the integration of renewables, and to enhance security of supply. The need for new transmission lines should be decided on a case-by-case basis following a positive cost-benefit analysis. Special attention should be paid to the least connected regions.
- Wholesale prices continue to linger on a low level compared to the levelised costs of technologies, leading to investment dilemma as well as mothballing and decommissioning of existing capacity. The following actions should be prioritised to improve the business environment:
    - completion of the internal electricity market;
    - review of the market design;
    - ensuring the EU ETS is the main instrument in delivering decarbonisation.
- Further steps should be taken to provide more transparency and to communicate to national governments and regulators the need to free the power bill from unrelated taxes and levies.

Chapter 3 – Energy efficiency

- EU electricity consumption has decreased steadily from 2008 to 2013, which can be attributed to the economic recession, structural changes in the economy and improvements in energy efficiency.
- Electricity is on track to becoming a carbon neutral energy carrier and if used more widely to replace fossil fuels in transport and heating, more electricity can actually mean more energy efficiency, and above all, reductions in greenhouse gas emissions.

Chapter 4 – Decarbonisation

- Changes in the power mix and decrease in demand are contributing to a decline in CO_2 emissions reductions in the power sector.
- EU ETS reform measures such as the implementation of a Market Stability Reserve and the revision of the EU ETS Directive are expected to have a bullish effect on the price of ETS allowances and lead to further fuel-switching to low carbon sources in the future.
- The success of the reformed EU ETS will depend on ensuring consistency between the other elements and targets of the 2030 Energy and Climate Framework, as well as developing an adequate governance framework to support the progress towards the agreed 2030 targets. Investments in renewables should be driven by market signals and renewables should be fully integrated into the market.
- Progress in electrification would enable decarbonisation in Europe. While the penetration of electricity-powered vehicles (EV) is on the rise, the increase is focused on only four markets that account for more than 80% of all EV registrations in the EU in 2014. Stronger commitment to electrification by the European Commission and the Member States is needed in order to ensure that not only the electricity mix, but also important sectors such as heating, cooling and transport, will be decarbonised.

Chapter 5 – Innovation

- There is significant potential value in power sector innovation. Accelerated innovation in power supply technologies and business models for energy efficiency could be worth €70 billion to the EU economy in 2030. Additional benefits are also expected in energy security, lower system costs, and consumer convenience.
- The ongoing transition requires significant contribution from the utilities to R&D and innovation. An enabling policy framework and funding possibilities at the EU level are therefore crucial. Innovation being recognised as one of the key pillars of the Energy Union should accelerate the process.
- The current evolution of European smart grid projects shows that there is room for further investment. In this respect, R&D and innovation funding in the EU will play an important role to bring innovation to the market. In order for European utilities to fund innovative projects closer to the end user, innovation funding should be rationalised (both throughout the EU and within Member States), while national regulatory authorities must specify better innovation reward schemes in order for network companies to keep up the pace in terms of innovative solutions.

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ELECTRICITY FOR EUROPE

Union of the Electricity Industry - EURELECTRIC

Boulevard de l'Impératrice, 66 boîte 2
1000 Brussels
Belgium
EU Transparency Register number: 4271427696-87

T.: + 32 (0)2 515 10 00 - F.: + 32 (0)2 515 10 10
website: www.eurelectric.org
twitter.com/EURELECTRIC

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