



# Energy and Climate Policies beyond 2020 in Europe

- Overall and selected countries

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# 1. Executive Summary

The decarbonisation of EU economies is at the core of the EU's agenda for climate change and energy. As an overall long-term policy, the EU wants to contribute to limiting the global warming to 2 degree celsius. The EU has formulated legally binding targets for 2020 and supplementary goal for 2030 and 2050. We will briefly review their status and the mechanisms to achieve the targets with emphasis on the renewable energy targets.

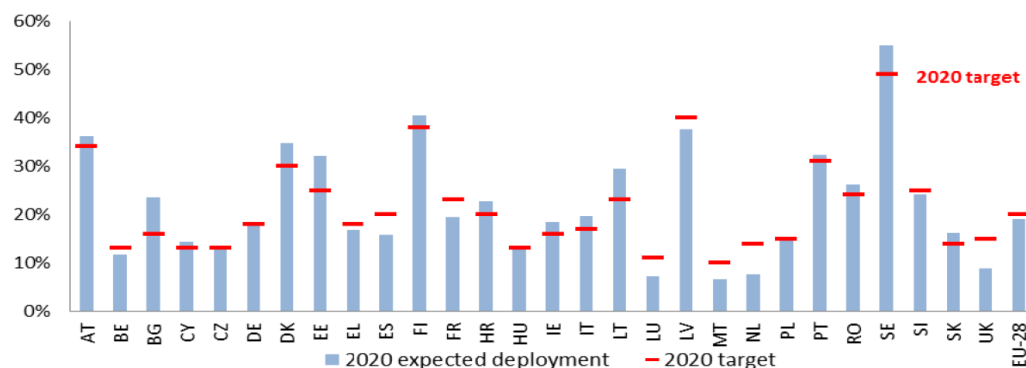
## The 2020 climate and energy package

The core of the 2020 climate and energy package is a set of binding legislative targets aiming to ensure the European Union meets its ambitious climate and energy targets by 2020. It requires the member states to cut their greenhouse gas emissions by 20%, to produce 20% of their gross energy consumption from renewable energy sources and to reduce their gross primary energy consumption by 20% compared to a reference scenario. It represents an integrated approach to increase the EU's energy security and strengthen its competitiveness.

The GHG emissions from the member states are divided into two groups: Those that are covered by the Emission Trading System (ETS) – an emission cap and trading system covering all 28 member states – and the non-ETS. ETS covers power production and large industries and represents app. 40% of the emissions. The remaining 60% are non-ETS and covers important sectors like transportation and agriculture. The emission reduction targets for the non-ETS are allocated on member states by an allocation formulation based on economic wealth, and the span for country targets range from -20 % to +20%.

The renewable energy targets by country represent the different starting points and potential for increasing renewable energy production and range from 10% in Malta to 49% in Sweden. The roadmap to reach the target is formulated in so-called National Renewable Energy Plans (NREAP) being monitored by the European Commission semi-annually. The table below shows the target for 2020 and the expected fulfilment of the target for each country, and the variety in the countrywide target and the expected level of fulfilment.

Expected RE-deployment in Member States and 2020 RE-targets



The member states performance in relation to the target for 2020 is monitored by the European Commission. Regarding the targets for green-house gasses, all projection shows that EU will overfulfill the 20% target and probably achieve a 24% reduction.

For renewable energy the current estimation for 2020 is indicating 21% for the EU as a whole vs. the current level (2014) of 15 %. However, there is great variation in the level of fulfilment among the member states. Countries like France, the Netherlands and UK will probably not reach their renewable energy target, while countries like Sweden, Denmark, Finland and Belgium will overfulfill their target.

It is encouraging that the overall targets are close to being fulfilled for the EU. One important lesson is however that the targets were formulated before the economic crisis of 2008 and the associated reduced economic activity is one of the major reasons for the achievement of the GHG targets. The discouraging part is however that the mechanism intended ensure the achievement has not been effective. The carbon prices on the European market are far below the anticipated level of 50 – 70 EUR/tonne, because of oversupply due to the economic crises. The spot price of the EUA declined sharply in the beginning of 2009. The EU has not been able politically to cope with collapse of the carbon price, and the price has been in the low end since. As a consequence the cost of fossil fuels still does not include the costs of their negative environmental impacts.

### **The 2030 – targets**

In late 2014 EU formulated its targets for 2030, which are 40 % reduction of GHG and 27% renewable energy and 27 % improvement of the energy efficiency. The targets are also approved for the EU's Intended Nationally Determined Contributions (INDC) for the COP21. The national targets to fulfil the 2030 will be for discussion and will be formally decided later in 2015 or next year. Current projections of the GHG emissions indicate that it will be impossible for EU to fulfil the 2030 targets without a change in the current policies.

At the center of ensuring the achievement of the 2030 targets is the so-called Repowering of the ETS market addressing the surplus of emission allowances built up during the recent years. The major initiative is to establish a market stability reserve fund from 2021, and secondly will the cap of emissions be reduced with a higher pace than previously anticipated also from 2021.

The introduction of the EU Energy Union, where power and natural gas will become a part of the internal market, will further enhance the integration of the European power systems with the aim of ensuring transition to a low-carbon society that is built to last.

### **The 2050 – targets**

The Roadmap for moving to a competitive low-carbon economy in 2050 has also been formulated by the EU Commission. The Roadmap suggests reducing emissions to 80 - 95 % below the 1990 levels, and covers all the emitting sector power, industry, transport, buildings, construction and agriculture. The plan includes a large investment program of an average of 270 bn annually in improved infrastructure, and will actually take the EU back to the level of investment before the crisis of 2008 and contribute substantially to economic growth. A number of new transmission lines and other project has been

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identified as Projects of Common Interest (PCI) in the long term strategy, and will be granted special priority by the EU Commission.

Renewable energy and Energy Efficiency will play a crucial role achieving the 2050 goal. The relationship between carbon prices inside EU and outside EU may become a decisive element for the deployment of renewable energy. The risk of carbon leak to the neighbouring countries is one the concerns in case EU are opting for a very ambitious goals and higher carbon prices than the surrounding countries.

### **Conclusions**

The EU has ambitious short, medium and long term goals and a political framework for combatting climate change. Deployment of renewable energy is one of the main pillars of the strategy.

The EU member states are generally on the pathway to fulfil the 2020 targets for renewable energy with important exceptions, like France and the Netherlands. Achieving the 2030 targets will require adjustments of the current policies with focus on an efficient Emission Trading System.

The legally binding country specific GHG, Renewable and Energy Efficiency targets and policies for the EU member states creates a stable framework for the development of renewable energy.

The introduction of carbon market is a delicate process, where instruments for timely adjustments to compensate for economic cycles are required.

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## 2. Introduction

The decarbonisation of EU economies is at the core of the EU's agenda for climate change and energy. The 2020 climate and energy package adopted in late 2008 requires the EU's member states to cut their greenhouse gas emissions by 20 %, to produce 20 % of their gross energy consumption from renewable energy sources, and to reduce their gross primary energy consumption by 20 %. In 2009, this agenda was complemented by the long-term goal of reducing greenhouse gas emissions by 80-95 % by 2050. All of this to support the climate target set in Copenhagen in connection with the COP 15 conference in 2009 to reduce global warming to 2 degree Celsius.

These ambitions were reaffirmed in October 2014, when EU member states agreed to set targets for 2030 of 40 % for domestic greenhouse gas emissions reduction, at least 27 % for the share of renewable energy and at least 27 % improvement of energy efficiency as the European contribution to a possible COP 21 agreement in Paris later this year.

As means to reach both the 2020, 2030 and ultimately the 2050 targets for the climate and energy policy an array of specific policies has been and will be implemented both on an EU level (directives) and on national levels (national laws and regulation). We will in this report put focus on the most important part of the implementation of the overall EU climate and energy targets including principles, market implementations and obvious challenges facing both the European Union and the member states. The later has of course to some degree been addressed in national policies and regulatory implementations. For that part we have both been focusing on specific European countries (Germany, UK, France and Denmark) and issues related to certain types of countries (poor and developing European countries, countries blessed with certain natural resources, etc.).

Finally we have tried to project some of the European learnings and experiences into a Chinese context including useful learnings and political and regulatory tools useful in a Chinese context in order to promote a sustainable and prosperous patch for the Chinese economy and society both regionally, nationally and in a global context addressing the overall challenges of climate change and global warming mitigation.

### 3. Offset in the 2020 climate and energy package

The foundation of the current common climate and energy plan in the European Union was formed in the early part of the last decade in the preparation of an international climate agreement as the next step of the Kyoto Protocol to cope with the challenges of climate change and global warming. The core of the 2020 climate and energy package was a set of binding legislative targets which aims to ensure that the European Union meets its ambitious climate and energy targets by 2020. These targets, known as the “20-20-20” targets, set three key objectives:

- A 20% reduction in EU’s greenhouse gas emissions (GHG) from the 1990 level
- Raising the share of EU energy consumption produced from renewable energy sources like solar, wind and hydro to 20%
- A 20% improvement in the EU’s energy efficiency

The targets were set by EU leaders in March 2007, when they committed Europe to become a highly energy efficient, low carbon economy, and were enacted through the climate and energy package in 2009. Apart from the climate issue the 20-20-20 targets represent an integrated approach to increase the EU’s energy security and strengthen its competitiveness.

#### 3.1 Adjusting the European emission trading system

In market based economies like the Europeans it is a general problem to get the cost of externalities like GHG and climate change imbedded into the market so that these cost will influence decisions about production, consumption and investment. As highlighted in the Stern report and other climate change assessment studies the future society costs of climate change and global warming are quite high although not evenly geographical and sector distributed. To better reflect these costs for producers, consumers and investors and make up for part of the market imperfection a European Union Emission Trading System (EU ETS) was designed back in 2003. By putting a price on carbon and thereby giving a financial value to each tonne of emissions saved, the EU ETS has placed climate change on the agenda of company boards across Europe. A sufficiently high carbon price also promotes investment in clean, low-carbon and energy efficient technologies.

The EU ETS scheme covers the most GHG intensive sector in Europe including the power sector and a number of industrial sectors like cement and steel production, etc. These sectors accounts for more than 40% of the total GHG emission in Europe. The EU ETS works on the ‘cap and trade’ principle. The overall volume of GHG that can be emitted each year by the power plants, factories and other companies covered by the system is subject to a cap set at EU level. Within this Europe-wide cap, companies receive or buy emission allowances which they can trade if they wish.

The first phase of the EU ETS scheme (2005-2007) was a three-year pilot period of ‘learning by doing’ to prepare for phase two, when the EU ETS would need to function

effectively to help ensure the EU and Member States met their Kyoto Protocol emission targets.

In phase one the EU ETS covered only CO<sub>2</sub> emissions from power generators and energy-intensive industrial sectors. Almost all allowances were given to businesses free of charge. The penalty for non-compliance was EUR 40 per tonne CO<sub>2</sub>. Phase one succeeded in establishing a price for carbon, free trade in emission allowances across the EU and the necessary infrastructure for monitoring, reporting and verifying actual emissions from the businesses covered.

The 2020 climate and energy package includes a comprehensive revision and strengthening of the legislation which underpins the EU ETS, the [Emissions Trading Directive](#). The revision applies from 2013, the start of the third trading period of the EU ETS. Major changes include the introduction of a single EU-wide cap on emission allowances in place of the existing system of national caps. The cap will be cut each year so that by 2020 emissions will be 21% below the 2005 level.

The free allocation of allowances was progressively replaced by auctioning, starting with the power sector. The sectors and gases covered by the system were slightly widened. As an example the aviation sector was brought into the EU ETS on 1 January 2012 through legislation adopted in 2008. For 2012 the cap on aviation allowances was set at a level equivalent to 97% of aviation emissions in the 2004-2006 reference period. 85% of allowances were given to aircraft operators for free.

### 3.2 Legal binding country specific targets

For the **GHG emissions** from non-EU ETS sectors and the renewable energy target the 2020 climate and energy package is based upon a set of country specific legal binding targets. Under the so-called [Effort Sharing Decision](#), EU member states have taken on binding annual targets for reducing their GHG emissions from the sectors not covered by the EU ETS, such as housing, agriculture, waste and transport (excluding aviation). Around 60% of the EU's total emissions come from sectors outside the EU ETS scheme.

The foundation for this approach has been statistical standards for measuring GHG emission in the different EU Member States to ensure equal terms and trust in the system. Verifiable statistics is at the core of the European GHG political system.

The national targets, covering the period 2013-2020, are differentiated according to EU member states' relative wealth. They range from a 20% emissions reduction (compared to 2005) by the richest EU member states to a 20% increase by the least wealthy (though this will still require a limitation effort by all countries).



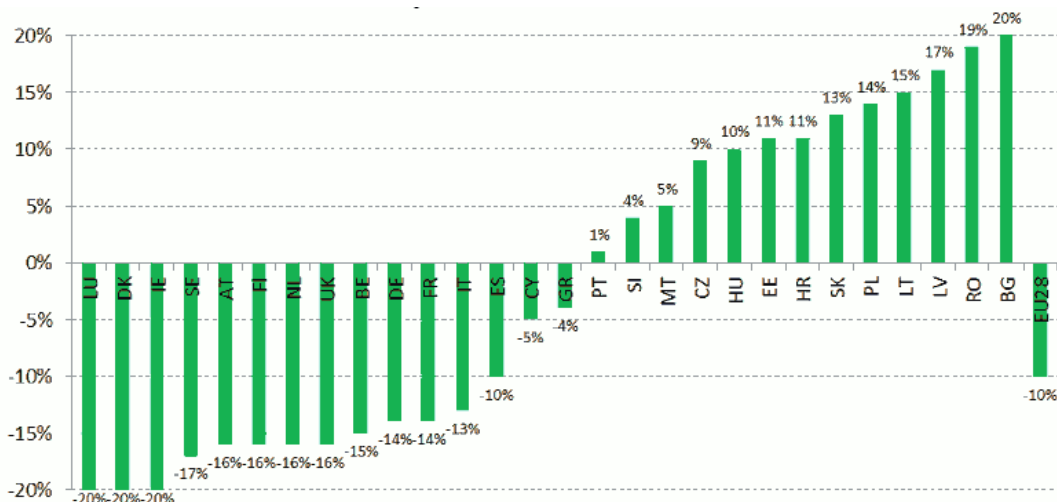
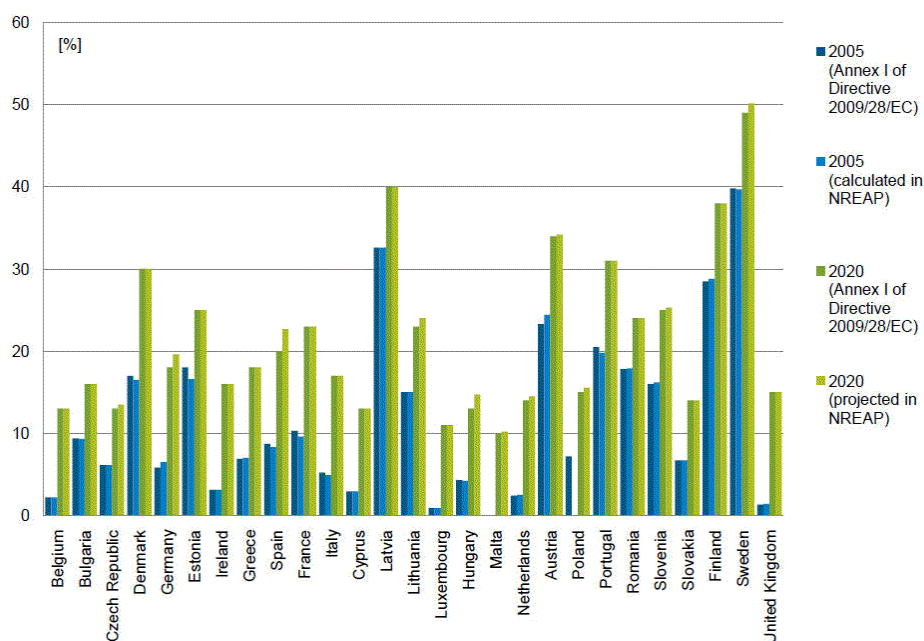


Table 1 EU member state GHG emission limits for non-EU ETS sectors in 2020 compared to 2005  
Source: European Commission

As for the **renewable energy** target the [Renewable Energy Directive](#), EU member states have taken on binding national targets for raising the share of renewable energy in their energy consumption by 2020. These targets, which reflect EU member states' different starting points and potential for increasing renewables production including natural resources (hydro, wind and solar), range from 10% in Malta to 49% in Sweden.



National Renewable Energy Action Plans – Share of gross final energy consumption  
Source: The European Environment Agency

The national targets will enable the EU as a whole to reach its 20% renewable energy target for 2020 - more than double the 2010 level of 9.8% - as well as a 10% share of renewable energy in the transport sector (the only sector specific target in the directive). As mention the individual EU countries have different available resources and their own

unique energy markets. This means that they will have to follow distinctive paths when it comes to meeting their obligations under the Renewable Energy Directive, including their legally binding 2020 targets. In their [National Renewable Energy Action Plans](#) (NREAPs), they explain how they intend to do this. The plans cover:

- Individual renewable energy targets for the electricity, heating and cooling, and transport sectors
- Planned mix of different renewables technologies
- Policy measures to achieve national targets including cooperation between local, regional, and national authorities
- Planned statistical transfers and/or joint projects with other EU countries
- National policies to develop biomass resources
- Measures to ensure that biofuels used to meet renewable energy targets are in compliance with the EU's sustainability criteria

### 3.3 Boosting energy efficiency

The 2020 climate and energy package does not itself address the energy efficiency target directly. This is being done through the 2011 Energy Efficiency Plan and the [Energy Efficiency Directive](#). As previously mentioned the EU has set itself a 20% energy savings target by 2020 when compared to the projected use of energy in 2007 – roughly equivalent to turning off 400 power stations. The EU has adopted a number of measures to improve energy efficiency in Europe. They include:

- An annual reduction of 1.5% in national energy sales
- EU member states making energy efficient renovations to at least 3% of buildings owned and occupied by central governments per year
- Mandatory energy efficiency certificates accompanying the sale and rental of buildings
- Minimum energy efficiency standards and labelling for a variety of products such as boilers, household appliances, lighting and televisions ([EcoDesign](#))
- Preparation of National Energy Efficiency Action Plans every three years by EU countries
- Planned rollout of close to 200 million smart meters for electricity and 45 million for gas by 2020
- Large companies conducting energy audits at least every four years
- Protecting the rights of consumers to receive easy and free access to data on real-time and historical energy consumption

The 2012 Energy Efficiency Directive establishes a set of binding measures to help the EU reach its 20% energy efficiency target by 2020. Under the Directive, all EU countries are required to use energy more efficiently at all stages of the energy chain from its production to its final consumption.

EU countries were required to transpose the Directive's provisions into their national laws by June 2014. New national measures have to ensure major energy savings for consumers and industry alike. For example:

Energy distributors or retail energy sales companies have to achieve 1.5% energy savings per year through the implementation of energy efficiency measures

- EU member states can opt to achieve the same level of savings through other means such as improving the efficiency of heating systems, installing double glazed windows or insulating roofs
- Public sector in EU member states should purchase energy efficient buildings, products and services
- Every year, EU governments will carry out energy efficient renovations on at least 3% of the buildings they own and occupy by floor area
- Empowering energy consumers to better manage consumption. This includes easy and free access to data on consumption through individual metering
- National incentives for SMEs to undergo energy audits
- Large companies will make audits of their energy consumption to help them identify ways to reduce it
- Monitoring efficiency levels in new energy generation capacities

To help officials in EU member states implement the Energy Efficiency Directive, the EU Commission publishes a number of [guidance notes](#).

To reach the EU's 20% energy efficiency target by 2020, individual EU member states have set their own indicative national energy efficiency targets. Depending on country preferences, these targets can be based on primary or final energy consumption, primary or final energy savings, or energy intensity. These plans are formulated in the so called [National Energy Efficiency Action Plans](#) (NEEAPs) set out estimated energy consumption, planned energy efficiency measures and the improvements individual EU countries expect to achieve.

Apart from the specific energy efficiency measures both individual EU Member Countries and EU has been pushing for more focus on energy efficiency through energy taxation. Denmark is an excellent example of an EU country that has stimulated energy efficiency through long-term taxation of various form of energy (fuel, electricity, etc.). Raising the price of energy for consumers and business improves the business case of energy efficiency measures. Subsidizing energy on the other hand erode the business case of energy efficiency measures.

Energy taxes already exist in all EU Member States, and are harmonized to a certain degree at EU level. The current [Energy Taxation Directive](#), adopted in 2003, was designed primarily to avoid competitive distortions in the energy sector within the Internal Market. It sets out common rules on what should be taxed, when and what exemptions are allowed. **Minimum rates**, based mainly on the volume of energy consumed, are laid down for products used in heating, electricity and motor fuels. Above these minimum rates, Member States are free to set their own national rates as they see fit. Although the directive was not design specifically for the aim of combating GHG emission and climate change it had ensure more focus on energy saving initiatives and consequently contributed to a reduction of GHG emission compared to a BAU.

By 2011 the EU Commission proposed a revision of the Energy Taxation Directive in order to make it more focused upon GHG emission and contribute to a de-carbonization of EU energy system. According to the EU Commission, the current minimum rates for energy products are mainly based on volume (EUR/1000l) and are set according to historical rates in the EU Member States. This creates unfair competition between fuel sources and unjustifiable tax benefits for certain types of fuel compared to others. For example, under the current minima, coal is the least taxed and ethanol is the most taxed. Renewables face particular discrimination under the Energy Taxation Directive, because they are taxed at the same rate as the energy source they are intended to replace (e.g. biodiesel is taxed the same as diesel etc.). As this rate is based on volume, rather than energy content, products with lower energy content such as renewables carry a heavier tax burden compared to the fuels they are competing with. The EU Commission proposed to revise Directive to link energy taxes to energy content. The EU Commission proposed a new system based upon two components:

- One would be based upon CO<sub>2</sub> emissions of the energy product and would be a fixed tax per tonnes of CO<sub>2</sub>
- Another one would be based on energy content i.e. on the actual energy that a product generates measured in Gigajoules (Gj)

The proposal from the EU Commission included social clauses that enable the EU Member Countries to exempt energy consumed by households for heating. After a lengthy debate with the member countries and EU Council the EU Commission withdrew their proposal early 2015.

### 3.4 Review process

Both the national legal binding GHG emission targets and renewable energy targets are subject to an ongoing review process by the EU Commission through the relevant EU authorities (DG Energy, etc.). For GHG emissions the EU Commission publishes annually the Kyoto and EU 2020 Progress Report, which provides information about the progress made by EU and its Member States towards their GHG emission targets.

As for the renewable energy targets the EU countries report on their progress towards the EU's 2020 renewable energy goals every two years. Based on the national reports, the EU Commission produces an EU-wide report which gives an overview of renewable energy policy developments in EU countries.

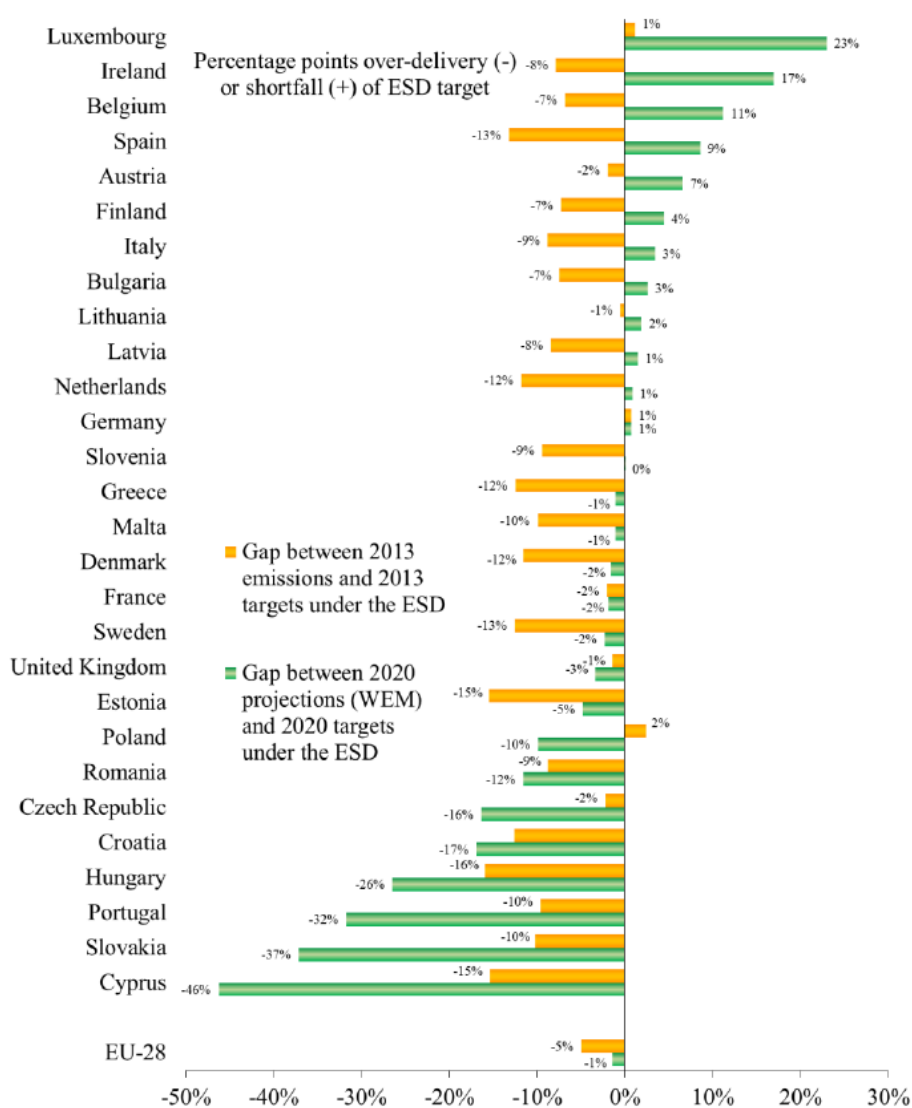
Finally under the Energy Efficiency Directive, they must draw up these plans every three years. The EU member states must also provide annual reports focusing on the progress of energy efficiency.

### 3.5 Targets vs. actual performance

The EU has set itself three targets to be attained by 2020 for GHG emissions reductions (20%), the share of renewable energy (20%) and improvements in energy efficiency (20%). The EU Commission reports in the [Progress towards achieving the Kyoto and EU](#)

[2020 objectives report](#) in October 2014 that overall the current energy and climate policies are delivering substantial progress towards these 20-20-20 targets:

- GHG emissions in 2012 decreased by 18% relative to emissions in 1990 and are expected to reduce further to levels 24% and 32% lower than in 1990 by 2020 and 2030 respectively on the basis of current policies
- The share of renewable energy has increased to 13% in 2012 as a proportion of final energy consumed and is expected to rise further to 21% in 2020 and 24% in 2030
- The EU had installed about 44% of the world's renewable electricity generation capacity (excluding hydro) at the end of 2012
- The energy intensity of the EU economy has reduced by 24% between 1995 and 2011 whilst the improvement by industry was about 30%
- The carbon intensity of the EU economy fell by 28% between 1995 and 2010



Gap between projected 2013 and 2020 emissions and targets in the non-ETS sectors. (percentage of 2005 base year emissions)

Source: Progress towards achieving the Kyoto and EU 2020 objectives, EU Commission, October 2014

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Regarding specific development for the **renewable energy** target the latest [Progress Report](#) from the EU Commission from 2015 concludes that:

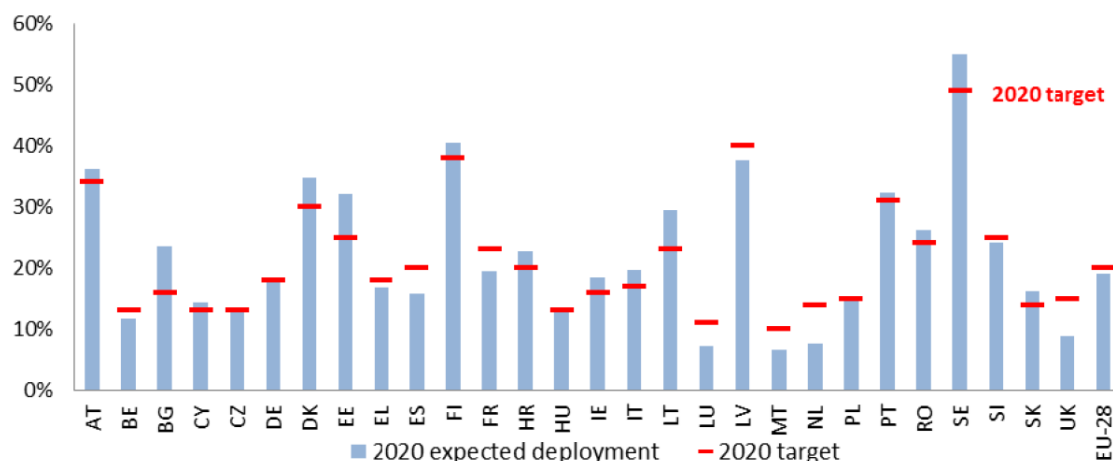
25 out of the original 27 EU countries are expected to meet their 2013/2014 interim renewable energy targets specified in their NREAPs

- In 2014, the projected share of renewable energy in the gross final energy consumption is 15.3%
- The EU's 2020 renewables target has resulted in around 326 Mt of avoided CO<sub>2</sub> emissions in 2012, rising to 388 Mt in 2013
- It has also led to a reduction in the EU's demand for fossil fuels to the level of 116 Mtoe (2013 figure)
- The 2014 projected share of renewable energy in transport is 5.7% meaning that achieving the target will be challenging but feasible, with some EU countries making good progress

Nineteen EU member states, including for example Austria, Estonia, Denmark, Germany, Italy, Lithuania, Romania or Sweden, may according to the EU Commissions assessment exceed, some even considerably, their 2020 renewable energy targets with implemented and planned renewable energy policies.

However, some EU member states, including France, Luxembourg, Malta, the Netherlands and the United Kingdom, and to a lesser extent Belgium and Spain need to assess whether their policies and tools are sufficient and effective in meeting their renewable energy objectives according to the EU Commission. Achievement of the 2020 renewable energy targets is also not certain in the case of Hungary and Poland: it is only under optimistic assumptions related to the future development of energy demand and country-specific financing conditions that the 2020 renewable energy targets appear achievable.

It must be noted that this assessment is based on EU Commission modelling and only includes policy measures implemented until the end of 2013. Some EU member states have meanwhile taken important decisions on public support or policy reforms, that could, if implemented in a timely manner, deliver the necessary growth in renewable energy deployment by 2020. EU member states have also been engaged in discussions on the possible signing of cooperation agreements. The EU Commission expects new information from EU member states by the end of 2015, the due date for next round of national renewable energy reports. There are good prospects for cooperation and re-distribution of renewable energy target achievement between the EU member states. Therefore, 2015 and 2016 will be crucial years for signing cooperation agreements between EU member states.



Expected RES deployment in Member States and 2050 RES targets

Source: EU Commission, based on TU Wien (Green-X) projections (2014)

As for the progress of **energy efficiency** the latest [Energy Efficiency Communication](#) (July 2014), the EU Commission is expected the EU member states to combined achieve energy savings of 18%-19% by 2020 – missing the 20% target by 1%-2%. However, if EU countries implement all of the existing legislation on energy efficiency, the 20% target can be reached without additional measures.

The EU's drive towards a more energy efficient future has already produced substantial benefits for Europeans. For instance:

- New buildings consume half the energy they did in the 1980s
- Energy intensity in EU industry decreased by almost 19% between 2001 and 2011
- More efficient appliances are expected to save consumers EUR 100bn annually – about EUR 465 per household – on their energy bills by 2020
- EU countries have committed themselves to rolling out close to 200 million smart meters for electricity and 45 million for gas by 2020, leading to greater savings for consumers
- The share of refrigerators meeting the highest energy efficiency labelling classes (A and above) increased from less than 5% in 1995 to more than 90% in 2010

Further benefits are expected in the future. They include:

- For every 1% improvement in energy efficiency, EU gas imports fall by 2.6%
- Lower energy costs for people who live and work in energy efficient buildings, as well as additional benefits such as improved air quality and protection from external noise provided by energy efficient windows
- Business opportunities for European companies such as construction firms and manufacturers of energy-using equipment
- New jobs in construction, manufacturing, research, and other industries investing in energy efficiency

### 3.6 Key learnings from the 20-20-20 framework

As mentioned in the previous chapter the overall progression toward the 20-20-20 targets set more than five years ago for 2020 is definitely reassuring. Although different plans and targets for specific EU Member Countries is lagging behind the overall target including reducing EU's GHG emissions toward a more sustainable level also in a global context. However it is far from all the energy and climate initiatives from the EU that has produced the result that was envisioned. On the contrary some of the main political instruments like carbon pricing and sector specific results have not produced the market impact forecasted. The overall reduction in GHG emissions and performance in renewable energy and energy efficiency seems more to be a result of other factors such as overall weak economy, improvement in energy economy and high and fluctuating fuel prices. We would like to highlight some of the key learning that Europe has had from various political and regulatory instruments and measures vs. actual results.

#### *GHG contribution from the economic crisis section*

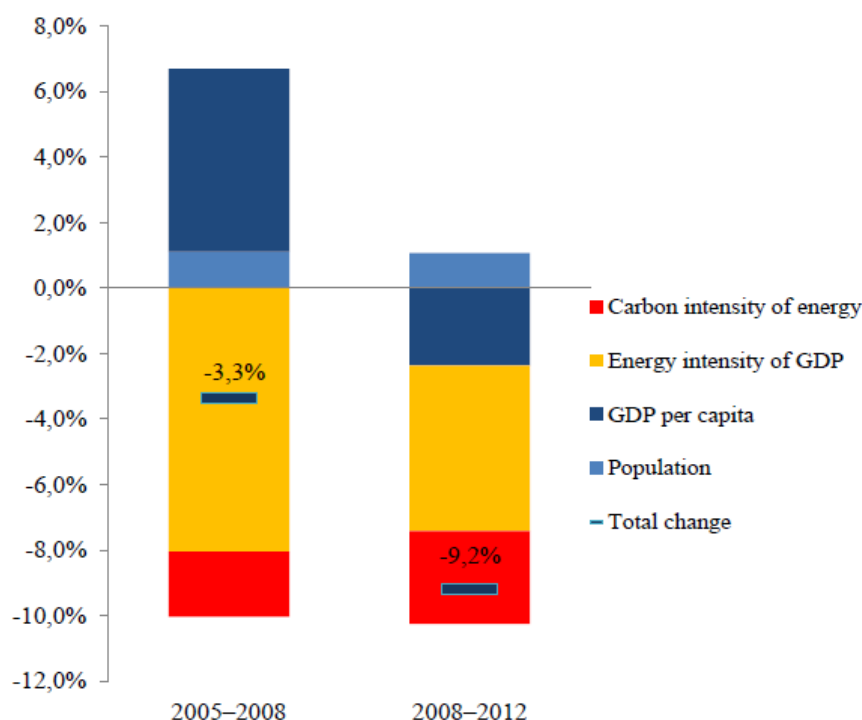
The 20-20-20 plan was launched just in the beginning of the worst financial crisis since the 1930<sup>th</sup> and the huge economic impact on especially Southern European economies was not included in targets for GHG emissions, energy consumption and overall economic activity (production and consumption). The impact of the economic crisis on emissions trends can be assessed by developing a counterfactual growth scenario. Total GHG emissions can be considered in light of their relationship to GDP and the ratio of emissions to GDP, known as GHG emissions intensity of the economy.

During the 2008-2012 period, the EU GDP decreased by 1.2 % as the result of the economic downturn. The GHG emission intensity of the economy improved by 8 % during this period, mainly due to improvements in the energy intensity of the economy and the decrease of fossil fuel in primary energy consumption.

In the counterfactual growth scenario, an annual 1 % GDP growth is assumed between 2008 and 2012 (i.e. a 4.1 % growth over the period instead of a contraction of the economy by 1.2 %). The GHG emissions intensity is assumed to have decreased by the same quantity regardless of the economic crisis. On this basis, the total GHG emissions would have decreased by 4.2 % instead of 9.2 % over the period. Accordingly, under such a counterfactual scenario, the total GHG emissions would have been 15 % lower in 2012 as compared to 1990, instead of 19 %.

The analysis carried by the European Environment Agency and the above-described counterfactual analysis show that the economic crisis contributed to less than half of the reduction observed during this period (2008-2012).





Aggregate decomposition of the change in total CO<sub>2</sub> emissions from fossil fuel combustion in the EU for the 2005-2008 and 2008-2012 periods

Source: European Environment Agency

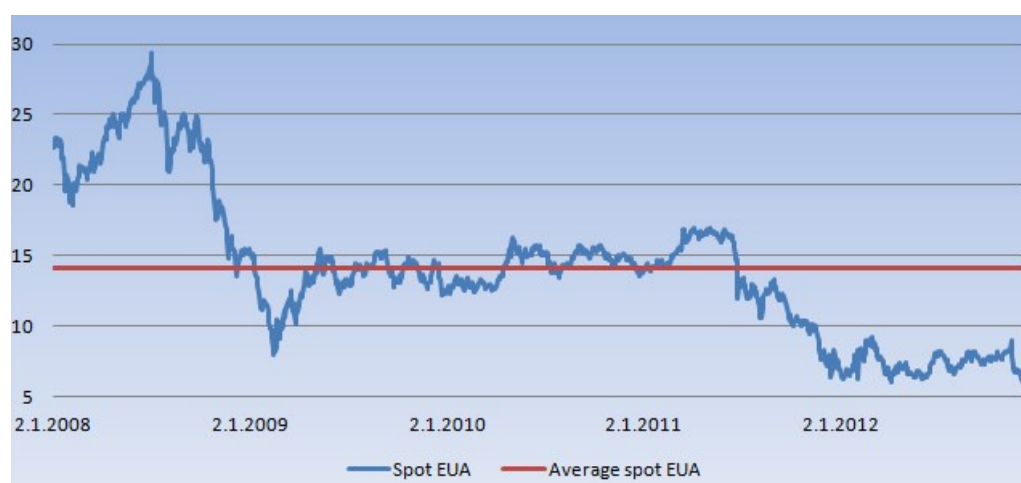
### Low EU carbon prices (EUA)

A more profound effect of the financial and economic crisis 2008 and onward has been on the balance in the carbon market in Europe (ETS). A combination of lower demand for emission rights from the relevant sectors including the power industry and plenty of emission rights (EUA) has led to a collapse of the carbon price in Europe since mid-2008 reducing the price by 50% from a level above EUR 30 per tonnes to a level around EUR 15 per tonnes toward 2012.

A major revision of the ETS system was approved in 2009 in order to strengthen the system. That meant that the phase 3 is significantly different from phases 1 and 2 and is based on rules which are far more harmonised than before. The main changes were:

- A [single, EU-wide cap](#) on emissions applies in place of the previous system of national caps;
- [Auctioning](#), not free allocation, is now the default method for allocating allowances. In 2013 more than 40% of allowances will be auctioned, and this share will rise progressively each year;
- For those allowances still given away for free, [harmonized allocation rules](#) apply which are based on ambitious EU-wide benchmarks of emissions performance;
- Some more sectors and gases are included;
- 300 million allowances set aside in the New Entrants Reserve to fund the deployment of innovative renewable energy technologies as well as carbon capture and storage through the [NER 300 programme](#).

Never the less the market price on carbon further plummets after 2012 to a level below EUR 10 per tonnes due to the weak recovery in the northern part of the EU Union and continuing crisis in many Southern European countries.



Carbon prices in Europe (Spot EUA prices – Phase 2)

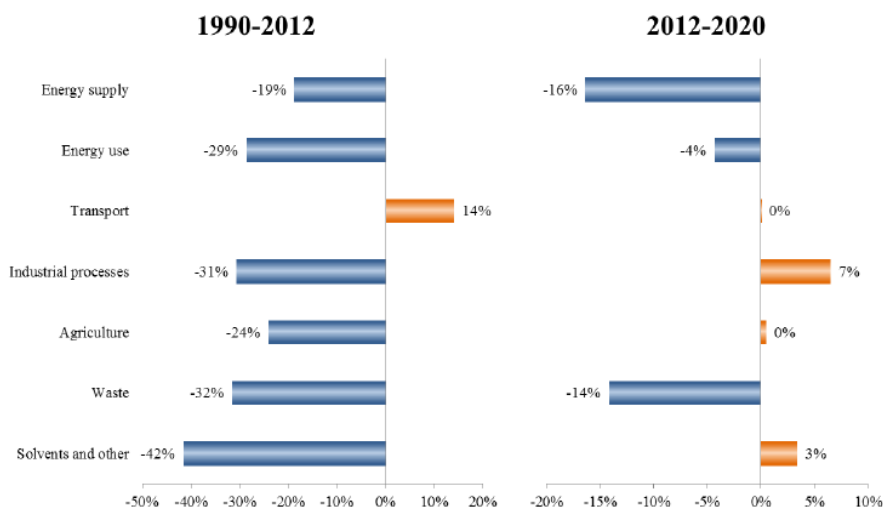
Source: EEX

The bottom line is that the carbon pricing system in Europe has failed to produce a more realistic long-term price on CO<sub>2</sub> emission (EUR 50-70 per tonnes) and has failed to give the right price signals on carbon to ensure a more market driven low carbon transition in Europe. Both growth in renewable energy and energy efficiency will be stimulated by high GHG prices through a higher price on energy from fossil fuelled energy sources. As a consequence to positive development in both renewable energy and energy efficiency has been based upon other instruments as support schemes, standards and regulation.

#### *GHG sector contribution section*

Since 1990, emissions in energy, agriculture, industrial processes and waste have been decreasing while emissions in the transport sector significantly increased. However, total transport emissions have also been decreasing since 2007.

According to the EU Commission's projections based on existing measures, emissions from energy supply will further decrease between 2013 and 2020, mainly due to the renewable energy policy and the EU ETS. Emissions from energy use and, to a lesser extent, from transport are also projected to decrease. For transport, the EU Commission is expecting that the increasing demand will be compensated by the improvement of the efficiency of the means of transport and also to a limited extent by the promotion of rail. Emissions from agriculture are projected to remain almost stable until 2020. According to national projections, emissions in the industrial sector will start increasing again. Emissions from waste will continue to decrease while those from solvents and other sectors will increase.



Change in EU-28 GHG emissions by sector and share of sectors in total GHG emissions

Source: European Environment Agency

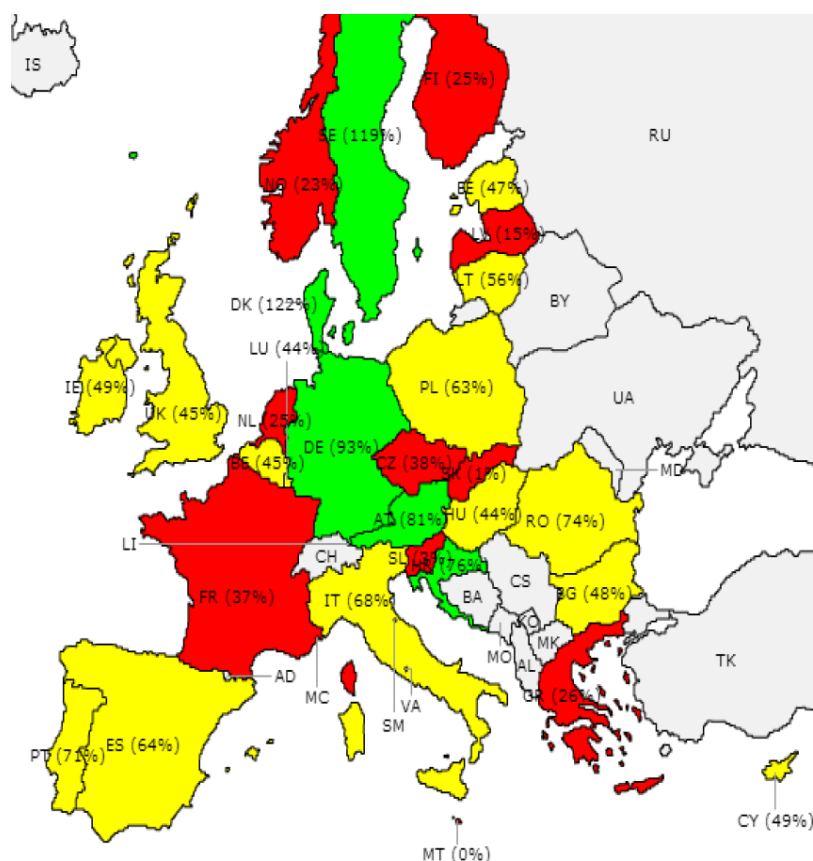
### *NREAP trend section*

Although the overall progression of deploying more renewable energy capacity in the EU is close to the original plans when adding up the National Renewable Energy Action Plans (NREAP) there is substantial deviations to individual national plans for different technologies. As for the GHG reduction targets the fulfilment of the renewable energy targets has become easier due to the financial and economic crisis as the targets are based upon projection for the future energy consumption in 2020 and the associated capacity and energy generation from new RE based energy capacity. The actual energy consumption is in most cases well above the current actual energy consumption.

Technology progress in terms of utilization rate (certain energy generation per installed capacity unit) is also having the effect that the necessary capacity is going down in order to reach both the overall 20% RE contribution target as well as individual country specific targets. A good example is wind energy where we have witness that the capacity factor for new wind capacity has been going up given the local wind condition due to larger rotors and higher towers.

As an example the targets for onshore wind capacity vs. the actual installed capacity since 2009 shows a quite uneven picture with a number of countries add or above the trajectory included in their NREAP's like Germany, Sweden and Denmark. On the other hand a number of countries are significant below the projected installation rates like France, Netherlands and Greece.

For the later a number of issues regarding insufficient or uncertainty regarding support schemes, problems with planning procedures and funding issues has slow down the installation of new onshore wind capacity. It is unlikely that these countries can catch up with their NREAP's for onshore wind without new political and regulatory initiatives to attract developers, investors and banks to drive the expansion.



Wind energy – Fulfilment of the 2020 NREAP capacity targets

Source: 2014 JRC Wind Status Report

For solar PV on the other hand the deployment of new capacity is general well above the NREAP's for this technology. By the end of 2013 more than 81 GW of PV capacity was installed in the EU 27 countries. By the end of 2020 these countries has set a target of 84 GW. For a number of countries like Italy and Denmark the current PV fleet is even well above the 2020 target. In Denmark's NREAP was included 6 MW of installed PV capacity but the combination of a generous feed-in tariff and sharply declining PV panel prices has meant that the current fleet is above 600 MW.

A better cost trajectory and slow adjustment of financial incentives like investment support or/and feed-in tariffs has meant much more interest by various investors including households in many EU countries. Difficulties in projecting both economic, technology and planning aspects of various renewable energy technologies has shown that it is difficult to make even medium term plans for the build-out of renewable energy source. On the other hand does system requirements like grid capacity and system flexibility it necessary to prepare for renewable energy expansion. The development in and constrains for large scale offshore wind in countries like Germany is a god example of that.

## 4. Frameworks for EU 2030 energy and climate change targets

As a next step for the 20-20-20 framework the EU leaders agreed in October 2014 the common domestic 2030 GHG reduction target of at least 40% compared to 1990 together with the other main building blocks of the 2030 policy framework for climate and energy, as proposed by the EU Commission in January 2014. This 2030 policy framework aims to make the EU's economy and energy system more competitive, secure and sustainable and also sets a target of at least 27% for renewable energy and energy savings by 2030.

### 4.1 Initial proposal from the EU Commission

The 2030 framework as proposed by the EU Commission in January 2014 builds on the experience of, and lessons learnt from, the 2020 climate and energy framework. It also takes into account the longer term perspective set out by the EU Commission in 2011 in the [Roadmap for moving to a competitive low carbon economy in 2050](#), the Energy Roadmap 2050 and the [Transport White Paper](#). These documents reflect the EU's goal of reducing GHG emissions by 80-95% below 1990 levels by 2050 as part of the effort needed from developed countries as a group.

To prepare for the 2030 framework, a [Green Paper](#) adopted by the EU Commission in March 2013 launched a public consultation on what the framework should contain.

### 4.2 Current 2030 framework from European Council

A center piece of the framework is the binding target to reduce EU domestic GHG emissions by at least 40% below the 1990 level by 2030. This target will ensure that the EU is on the cost-effective track towards meeting its objective of cutting emissions by at least 80% by 2050. By setting its level of climate ambition for 2030, the EU will also be able to engage actively in the negotiations on a new international climate agreement that should take effect in 2020.

To achieve the overall 40% target, the sectors covered by the EU ETS would have to reduce their emissions by 43% compared to 2005. Emissions from sectors outside the EU ETS would need to be cut by 30% below the 2005 level. This will need to be translated into EU member state targets. The European Council has outlined the main principles to achieve this.

#### *Repowering of the ETS market*

The EU ETS will be reformed and strengthened. A 43% greenhouse gas reduction target in 2030 in the ETS translates into a cap declining by 2.2% annually from 2021 onwards, instead of the rate of 1.74% up to 2020.

In January 2014 the EU Commission proposed to establish a market stability reserve from 2021 onwards. This is to address the surplus of emission allowances in the EU ETS that has built up in recent years and to improve the system's resilience to major shocks.

This will ensure that in the future the EU ETS is more robust and effective in promoting low-carbon investment at least cost to society.

The European Council underlined that a reformed, well-functioning ETS with an instrument to stabilize the market in line with the [EU Commission's proposal](#) will be the main instrument to achieve GHG emission reductions.

#### *New non-ETS target of reducing GHG by 30 %*

According to the 2030 plan non-ETS sectors would need to cut emissions by 30% (compared to 2005) – this needs to be translated into individual binding targets for EU Member States. As previously mentioned, currently, the country specific attribution is made on the basis of relative wealth using GDP per capita which results in a wide spread of obligations ranging from a 20% reduction to a 20% increase in emissions.

The analysis underpinning the EU Commission's Impact Assessment provides the cost-effective allocation of effort between EU Member States. It confirms that costs and investments would be relatively higher in lower income EU Member States whilst minimizing costs for the EU as a whole. This reflects their relatively higher carbon intensity, lower energy efficiency as well as smaller capacity to invest. For example, the analysis made by the EU Commission indicates that EU countries with a GDP below 90% of the EU average would need to make investments in the period 2021-2030, at levels estimated to be some EUR 3 billion per annum higher than the EU average increase in the period 2021-2030.

The EU Commission considers in their proposal, therefore, that in implementing a 2030 framework, each EU Member State's GHG reduction target should continue to take into account these distributional factors while ensuring the integrity of the internal market, for example, in relation to energy efficiency and energy using products. Given the importance of future investments, solutions that contribute to improved finance will also be required. The EU Commission sees no merit in proposing a higher "conditional target" ahead of the international negotiations. Should the outcome of the negotiations warrant a more ambitious target for the EU, this additional effort could be balanced by allowing access to international credits.

#### *New RE and EE targets for 2030*

Renewable energy will play a key role in the transition towards a competitive, secure and sustainable energy system. The EU Commission proposed an objective of increasing the share of renewable energy to at least 27% of the EU's energy consumption by 2030. The European Council endorsed this target which is binding at EU level but not so far on a national level as was the case for 2020 targets.

Public interventions such as support schemes remain necessary to make certain renewable energy technologies competitive. To avoid distorting energy prices and the market however, these schemes should be time-limited and carefully designed. The EU has issued [guidance on support schemes](#) to help governments when they design or revise support schemes.

The EU Commission proposed a 30% energy savings target for 2030, following a review of the Energy Efficiency Directive. The proposed target builds on the achievements already reached: new buildings use half the energy they did in the 1980s and industry is about 19% less energy intensive than in 2001. The European Council, however, endorsed an indicative target of 27% to be reviewed in 2020 having in mind a 30% target.

### *Empowering of energy consumers in Europe*

Recognizing that citizens must be at the core of the Energy Union, the Commission presents a Communication on delivering a new deal for energy consumers, based on a three-pillar strategy:

- Helping consumers save money and energy through better information
- Giving consumers a wider choice of action when choosing their participation at energy markets
- Maintaining the highest level of consumer protection

Consumers need to become just as well-informed and empowered as buyers and sellers on wholesale markets through clearer billing and advertising rules, trustworthy price comparison tools and by leveraging their great bargaining power through collective schemes (such as collective switching and energy cooperatives).

Finally, consumers need to be free to generate and consume their own energy under fair conditions in order to save money, help the environment, and ensure security of supply.

### *Working for the creation of an Energy Union in Europe*

In February 2015 the EU Commission launched a plan for the creation of an [Energy Union](#) for the EU. The Energy Union strategy is designed to help deliver our 2030 climate and energy targets and make sure that the European Union becomes the world leader in renewable energy. Achieving these goals will require a fundamental transformation of Europe's electricity system including the redesign of the European electricity market.

The EU Communication has launched a Public Consultation on what the new electricity market design should look like in order to meet consumers' expectations, deliver real benefits from new technology, facilitate investments, notably in renewables and low carbon generation; and recognize the interdependence of EU member states when it comes to energy security.

This should reap maximum benefits from cross-border competition and allow decentralized electricity generation, including for self-consumption and support the emergence of innovative energy service companies.

The Energy Union means in particular:

- **Solidarity clause:** reducing the dependence on single suppliers and fully relying on their neighbors, especially when confronted with energy supply disruptions. With more transparency when EU member states make deals to buy energy or gas from countries outside the EU
- **Energy flows, as if it were a Fifth freedom:** that of free flow of energy across borders - strictly enforcing the current rules in areas such as energy unbundling and the independence

of regulators – taking legal action if needed. Redesigning the electricity market, to be more interconnected, more renewable, and more responsive. Seriously overhauling state interventions in the internal market, and phasing out environmentally harmful subsidies

- **Energy efficiency first:** fundamentally rethinking energy efficiency and treating it as an energy source in its own right so that it can compete on equal terms with generation capacity
- **Transition to a low-carbon society that is built to last:** ensuring that locally produced energy – including from renewables – can be absorbed easily and efficiently into the grid; promoting EU technological leadership, through developing the next generation of renewables technology and becoming a leader in electromobility (electrical vehicles, electrical trains, etc.), while European companies expand exports and compete globally

In an Energy Union, citizens are at the core. The prices they pay should be affordable and competitive. Energy should be secure and sustainable, with more competition and choice for every consumer.

### 4.3 The EU INDC

In March 2015 the Environment Council approved the EU's Intended Nationally Determined Contribution (INDC) based upon an at least 40% domestic reduction in GHG emissions compared to 1990 levels by 2030. This translates the agreement by EU Heads of State and Government in October 2014 on the EU 2030 climate and energy framework, in accordance with the requirements for upfront information agreed at the COP 20 Lima climate conference in December 2014.

The EU Presidency and the EU Commission will communicate this INDC to the United Nations Framework Convention on Climate Change (UNFCCC). A new global climate agreement is expected to be concluded at the COP 21 in Paris in December 2015. Countries have agreed to submit their intended nationally determined contributions, containing emissions reductions targets, well in advance of the Paris conference.

The EU's intended contribution puts the EU on a cost-effective pathway towards long term domestic emission reductions of 80%. This is consistent with the Intergovernmental Panel on Climate Change (IPCC)'s assessment of the reductions required from developed countries as a group, to reduce emissions by 80-95% compared to 1990 levels by 2050. It is also in line with the objective of reducing global emissions by 60% compared to 2010 levels by 2050, at the upper end of the IPCC's range of 40-70% reductions necessary to achieve the below 2 degree Celsius target.

### 4.4 Process going forward

In order to transform to EU Commission climate and energy proposal into actual EU legislation that can be adopted by the EU Parliament and later the member states a series of consultations are going to be held in 2015 (see links [here](#)).



## 5. 2050 energy roadmap for Europe

With its Roadmap for moving to a competitive low-carbon economy in 2050, the EU Commission has looked beyond these short-term objectives and set out a cost-effective pathway for achieving much deeper GHG emission cuts by the middle of the century. All major economies will need to make deep emission reductions if global warming is to be held below 2 degree Celsius compared to the temperature in pre-industrial times.

### 5.1 *Planning for a low carbon future for Europe*

The Roadmap is one of the long-term policy plans put forward under the Resource Efficient Europe flagship initiative intended to put the EU on course to using resources in a sustainable way.

The Roadmap suggests that, by 2050, the EU should cut its emissions to 80% below 1990 levels through domestic reductions alone. It sets out milestones which form a cost-effective pathway to this goal - reductions of the order of 40% by 2030 and 60% by 2040. It also shows how the main sectors responsible for Europe's emissions - power generation, industry, transport, buildings and construction, as well as agriculture - can make the transition to a low-carbon economy most cost-effectively.

The transition to a low-carbon society would boost Europe's economy thanks to increased innovation and investment in clean technologies and low- or zero-carbon energy.

A low-carbon economy would have a much greater need for renewable sources of energy, energy efficient building materials, hybrid and electric cars, 'smart grid' equipment, low-carbon power generation and carbon capture and storage technologies.

To make the transition the EU would need to invest an additional EUR 270bn or 1.5% of its GDP annually, on average, over the next four decades. The extra investment would take Europe back to the investment levels seen before the economic crisis, and would spur growth within a wide range of manufacturing sectors and environmental services.

Up to 1.5 million additional jobs could be created by 2020 if governments used revenues from CO<sub>2</sub> taxes and from auctioning of emission allowances to reduce labor costs.

Energy efficiency will be a key driver of the transition. By moving to a low-carbon society, the EU could be using around 30% less energy in 2050 than in 2005. Households and businesses would enjoy more secure and efficient energy services.

More locally produced energy would be used, mostly from renewable sources. As a result, the EU would be less dependent on expensive imports of oil and gas and less vulnerable to increases in oil prices. On average, the EU could save EUR 175-320bn annually in fuel costs over the next 40 years.

Greater use of clean technologies and electric cars will drastically reduce air pollution in European cities. Fewer people would suffer from asthma and other respiratory diseases; considerably less money would need to be spent on health care and on equipment to control air pollution. By 2050, the EU could save up to EUR 88bn a year in these areas.

## **5.2 Early days for legal implementation of 2050 targets**

Apart from being a part of most of the EU member states long-term energy and climate planning the huge reduction in GHG emission is currently not part of the specific sector legislation and regulation. This is partly due to the awaited impact of overall EU policies including the economic impact of the EU ETS market that should make the business case for both renewable energy and energy efficiency more obvious in a market based economy.

Another reason for less specific 2050 regulation is the anticipated technology and system evolution. New energy related technology and the price reduction of current know technical solution can for sure change the patch toward a low carbon future for Europe.

Additionally the need for much more cooperation between the EU member states is also going to be a much more determining factor for actual policies. Internal battles of more open energy market both within EU member states and between neighboring countries needs to be settle to support a more cost effective way to reduce GHG emission to substantial lower levels by 2050. Also this process makes European politician less likely to be very specific on means and policies for the 2050 targets.

Finally European politician await more long-term initiatives from the other major GHG emitters for specifying more firm long-term policies. Especially the pricing of CO<sub>2</sub> outside will be important in terms of adding more ambitious EU ETS adjustment. The risk of “carbon leakage” is still very much in focus among European politician. Losing jobs due to climate initiatives is a non-starter for most European governments in a situation with high unemployment rates in many EU countries.

A growing numbers of intermediate targets like 2030 standards supported by specific actions and regulation should make the 2050 patch clearer. Especially which sectors are expected to be the main contributors to the de-carbonization of the European economies is increasingly being addressed by new initiatives within energy and climate legislation.

## **5.3 Long-term energy planning**

In order for the European energy system and infrastructure to adapt to a future with much more renewable energy plans for fundamental changes is already being taken on different levels both nationally and on international level. The European Council of October 2014 called for all EU member states to achieve interconnection of at least 10% of their installed electricity production capacity by 2020. This means that each EU member state should have in place electricity cables that allow at least 10% of the electricity that is produced by their power plants to be transported across its borders to its neighboring countries.

When power plant fails or during extreme weather conditions, EU member states need to be able to rely on their neighbors for the importation of the electricity they need. Without infrastructure it is impossible to buy and sell electricity across borders. Therefore, connecting isolated electricity systems is essential for security of supply and helps achieve a truly integrated EU-wide energy market which is a key enabler for the EU.

Put simply with good connections between neighbors:

- Electricity systems will be more reliable and there is a lower risk of black-outs
- EU member states can save money by reducing the need to build new power stations
- EU consumers will have more choice putting downward pressure on household bills
- Electricity grids can better manage increasing levels of renewables, particularly variable renewables like wind and solar

The long-term energy infrastructure policy was first outlined in the [Communication on Energy infrastructure priorities for 2020 and beyond – a blueprint for an integrated European energy network](#) and successively enshrined in the recently adopted [Regulation on Guidelines for trans-European energy infrastructures](#) (TEN-E Guidelines) which identify nine strategic geographic infrastructure priority corridors in the domains of electricity, gas and oil, and three EU-wide infrastructure priority areas for electricity highways, smart grids and carbon dioxide transportation networks, the implementation of which is the EU's common short and long-term priority.

The first set of Projects of Common Interest (PCIs) is an important step towards the better integration of EU member states' networks and making sure no EU member state remains isolated, in facilitating integration of renewable energy sources across the EU, in diversifying sources of gas supply by opening new gas corridors, and in offering alternatives to EU member states dependent on a single source of oil or gas supply.

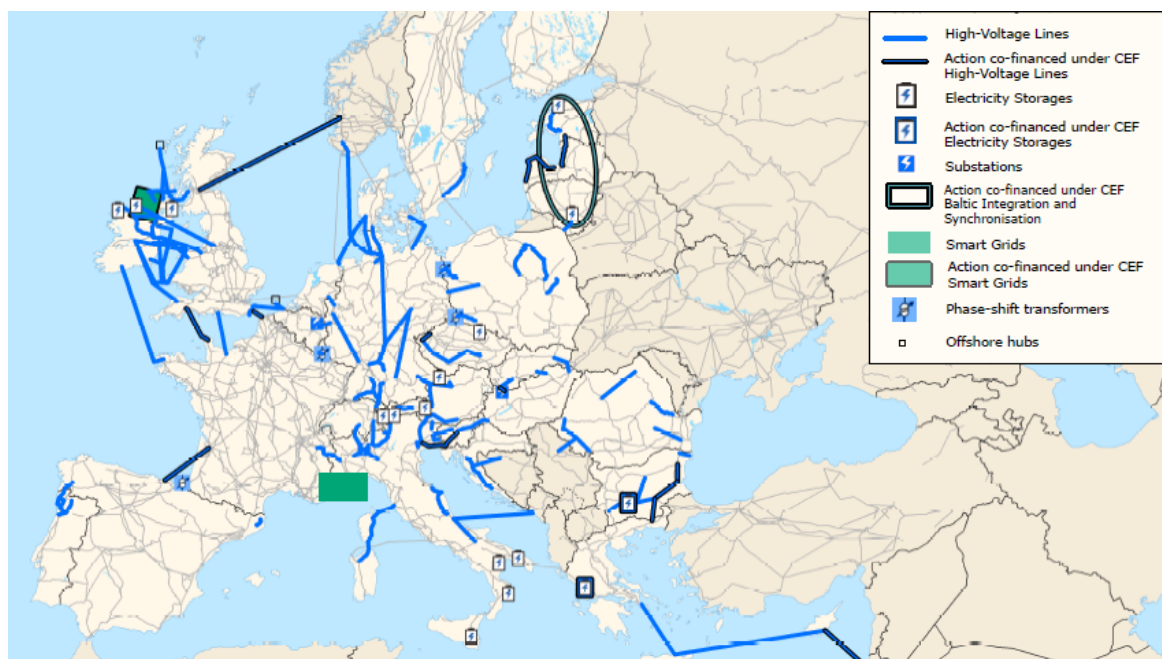
But much more still needs to be done. The first EU list of PCIs is just the first step towards the implementation of the longer term infrastructure vision. The PCI list will be reviewed every two years with a view to integrating new projects, so as to fully implement the twelve priority corridors and areas in the direction of the long-term vision of a pan-European market integration and low-carbon transition. In particular, the Union must make sure that the remaining energy islands are integrated as soon as possible, but also that the emerging Northern Seas off-shore grid is expanded and further developed through the electricity highways into a truly pan-European electricity system. At the same time, the Union must make sure that the neighboring countries are effectively integrated with the Union through adequate infrastructure networks and regulatory frameworks in line with the strategy outlined in the Communication on security of energy supply and international cooperation.

The timely implementation of the PCI is a common priority. That is why the TEN-E Guidelines introduce strict requirements on the permit granting process for PCIs, including binding time limits for the permit process (in general 3.5 years), the establishment of a national 'one-stop-shop' for permit granting, early and effective public consultations and a requirement for the EU member states to streamline environmental assessment procedures. These requirements are aimed at accelerating the permitting process, whilst respecting the strict standards of the EU environmental standards. The EU Commission services dealing with energy and environment have jointly prepared a [guidance document](#) in order to support EU member states in defining adequate legislative and non-legislative measures to streamline environmental assessment procedures and to ensure coherent application of these procedures required under EU law with regards to PCIs.

The projects of common interest identified in this first round mainly focus on completing a borderless internal energy market, with only few projects of common interest affecting neighboring countries or beyond. Once the internal bottlenecks are being removed, the Union can effectively engage with and provide a larger market place for energy produced and consumed in the Union and in the neighboring countries. Every two years, the process of project identification will be launched to cater for new emerging projects geared to fulfil future needs. This planning is made not only for electricity but also for the oil and natural gas supply and infrastructure throughout the EU.

In electricity, the areas which will require further projects and technological development are:

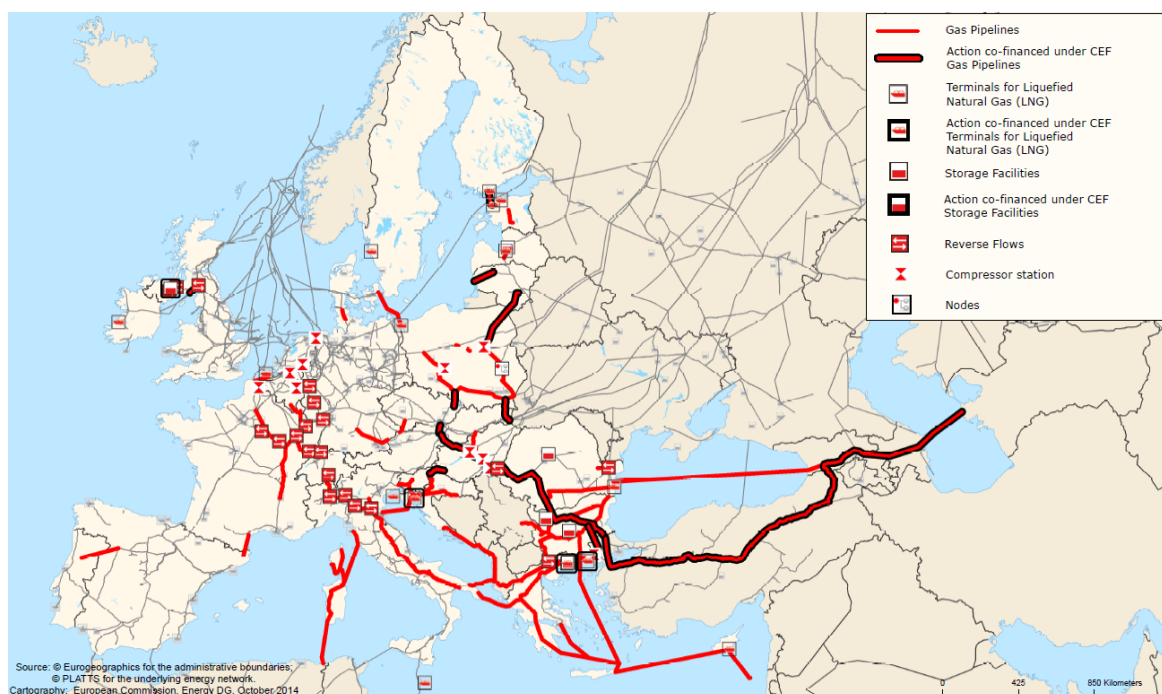
- Further increase the interconnection level between the Iberian Peninsula and the rest of the continent to fully benefit from an optimal allocation of electricity generation from renewable sources. In the longer term, further connections with Northern African countries should be explored
- Implementation of the Baltic energy market interconnection plan, with the future synchronization of the Baltic electricity system with the ENTSO-E system
- Further expanding a truly meshed off-shore grid in the Northern Seas. While the current list of projects of common interest does include about 20 interconnectors and relevant internal reinforcements, there is only one grid-ready off-shore hub involving anticipatory investments as a forerunner for the future integrated off-shore grid. The technology challenges are being pursued by major manufacturers in this area. The design and coordinated development and management of the future meshed grid and storage solutions, as well as appropriate regulatory and financing solutions remain to be developed. The abundant geothermal storage resources in Iceland should also be looked at in the longer term.
- More and more electricity will have to be transported over increasingly longer distances within and from outside Europe. Removing or preventing bottlenecks through the construction of high-capacity electricity highways remains a focus for the future. Such electricity highways would include links beyond the Union borders, connecting the Energy Community, Turkey, Russia as well as the North African and Eastern Mediterranean countries with the Union, as well as links to import electricity from the sub-Saharan area in the longer term, while also taking into account the possible evolution of distributed generation and demand-response. While some of the PCIs, such as the German North-South connections, may be considered as forerunners for this priority area, the design and coordinated development of EU-wide electricity highways as well as the technological challenges remain to be solved
- The first PCI process has identified only two projects in the field of smart electricity grids which intelligently enlarge the area of consumption to better align with the provided generation and thus demonstrate that it is possible to ease tension in the electrical system by the cooperation of DSOs and TSOs while bridging across national borders. It is a new challenge for – so far – locally oriented and distribution centered smart grid developers to establish vertical (distribution and transmission level) co-operation whilst crossing national borders at the same time. More determination will be needed in the deployment of smart grid technologies as smart grids provide promising results in the managing of distributed and variable generation from renewable sources, offering new customer side services, thus complementing traditional infrastructures



Projects of common interest (PCIs) – Electricity and smart grid

Source: EU Commission

Similar plans are made for the natural gas system in Europe both including energy supply and security of supply including dependency of specific natural gas rich countries like Russia.



Projects of common interest (PCIs) – Natural gas

Source: EU Commission

## 6. Specific climate and energy plans for selected European countries

### 6.1 Germany

Climate protection policies have been a prominent part of German politics for more than two decades. This is based on a comprehensive strategy that was initiated early on and has been constantly developed by the federal government. Germany has for a long period of time been focusing on addressing the energy and climate issues through a planned transformation of the energy sector and supply both on a national level and on provincial level (Länder). Despite a relative low impact of the economic crisis and the decision of phase-out the nuclear power plants Germany is well on the road to meet the legal binding EU targets on both GHG reduction and renewable energy supply.

Important strategies, policies and measures in the areas of energy and climate protection were adopted with the Integrated Energy and Climate Protection Programme of 2007 and the Energy Concept of 2010 and in the decisions on accelerating the Energiewende in summer 2011, known collectively as the “energy package”. Long-term energy and climate targets for Germany were also approved for the first time in the Energy Concept.

The federal government approved the [Energy Concept](#) in September 2010. It describes the orientation of Germany’s energy policy up to 2050, particularly measures to expand the use of renewable energy sources and the grids and increase energy efficiency.

#### *GHG reduction targets*

In the Energy Concept, the German federal government set itself the target of reducing GHG emissions in Germany by 40% by 2020, 55% by 2030, 70% by 2040 and 80% to 95% by 2050 (all in relation to base year 1990). The first and last target is in line with the legal binding target in the EU 20-20-20 framework and the long-term EU 2050 roadmap respectively.

#### *Renewable energy policies targets*

The transformation of the German energy sector (Energiewende) has been an ongoing process dating back to the 1980s and well rooted in the German society and public. Because of the importance of the Energiewende for society as a whole and for the economy, the federal government has created integrative structures and working processes for steering and coordination purposes. Solutions for various issues are discussed with major players in the Energiewende in forums that have been established for participation. The most important bodies are:

- **Undersecretaries’ Steering Group:** federal government steering group at the undersecretary level, which reports on important projects related to the Energiewende, sets areas of emphasis, and coordinates new projects

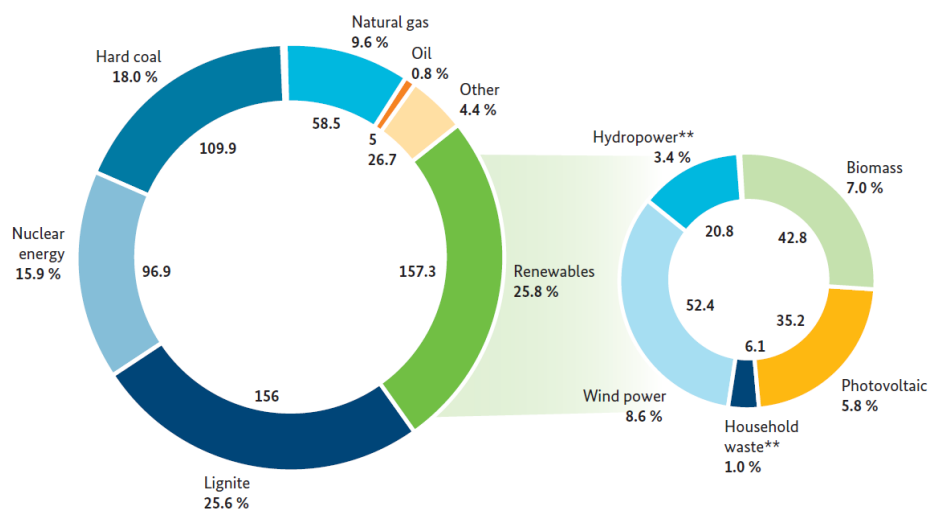
- **Energy talks:** Semi-annual energy talks by the Chancellor and the responsible Federal Ministers with the heads of the Länder governments, along with regular technical and policy consultations with the Länder
- **“Sustainable energy grids” platform, power plant forum, and renewable energies platform:** dialogue with the relevant groups on key issues of the Energiewende

The expansion of renewable energy is one of the main pillars in Germany's energy transition. Germany's energy supply is becoming "greener" from year to year because it is becoming more climate-friendly - and making us less dependent on the world's diminishing reserves of fossil fuels. With the amended [Renewable Energy Sources Act \(EEG\)](#), solar, wind and bioenergy and other renewable energies will be integrated even better into the market and systematically expanded whilst the cost dynamics are noticeably slowed.

Mainly based upon a consumer financed Fixed Feed-In Tariff system for renewable generated electricity the EEG has made Germany the single biggest market for both wind and solar based electricity. The design of EEG is well fitted as the base for the business model of high initial investment of wind and solar projects and to secure high investor confidence reducing weighted average cost of capital (WACC) for German wind and solar projects. Over the years a number of forward looking adjustments have been made.

Up until the amendment of the EEG that went into force on 1 August 2014, operators of plants that generate electricity from renewable energy sources could receive a fixed remuneration for each fed-in kilowatt-hour from the transmission system operators (TSO) for a period of usually 20 years. In the future, the operators of new wind and solar power, biomass and other facilities will need to sell their electricity themselves on the market. For this they will obtain a market premium as funding from the grid operators. The market premium compensates for the difference between the fixed feed-in tariff and the average trading price for electricity. The market premium is optional for older power facilities and small new facilities. They can continue to claim a fixed remuneration instead. The difference between grid operators' expenditures and revenues for the funding payments (the so-called EEG differential costs) will continue to be distributed over power consumption (final consumption liable to the EEG), as far as this is not privileged by special regulations, that is partially exempt from the surcharge. The resulting quantity is the so-called EEG surcharge. It is paid with the price of electricity and is currently EUR 6.24 cents/kWh. After 1 January 2015, the EEG surcharge drops to EUR 6.17 cents/kWh for the first time since the enactment of the EEG. Thus, it was possible to break the cost dynamics of recent years.

Objectives with the 2014 amendment of the EEG are to significantly slow the rise in the level of the EEG surcharge, make the development of renewable energies more plan able and advance their integration into the market.

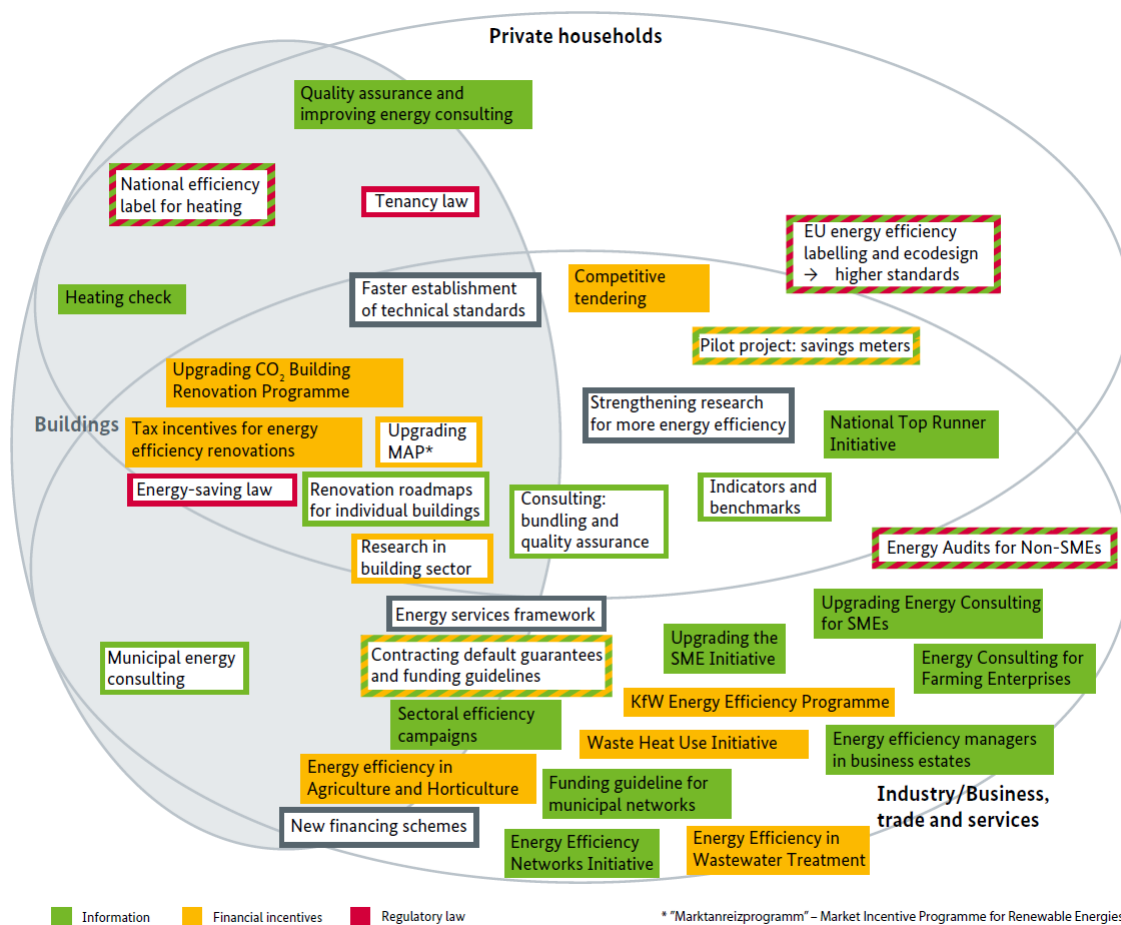


\* Preliminary figures  
 \*\* Regenerative part

Gross power production in Germany in 2014 (610 TWh\*)  
 Source: AG Energiebilanzen

As mentioned before, the role of nuclear energy as presented in the Energy Concept was re-evaluated following the core meltdown of the Fukushima Daiichi nuclear power plant in Japan in March 2011. Germany's seven oldest nuclear power plants were permanently shut down, and one additional nuclear power plant was scheduled for shutdown. It was also decided that operation of the remaining nine nuclear power plants would be phased out by 2022. The "Energy Package" of June 2011 was added to the measures contained in the Energy Concept, and implementation was accelerated. The Energy Concept and the decisions on the Energiewende, Germany's transition to a new energy system, provide for 166 specific measures, amendments to laws, and legislative proposals, most of which have already been implemented or are in progress. They have also been supplemented by additional measures.





Short-term measures and long-term work processes of NAPE

Source: Federal Ministry for Economy Affairs and Energy Regulatory

The central short-term measures of NAPE include:

- Introducing new competitive tendering for energy efficiency
- Raising funding for building renovation (CO<sub>2</sub> Building Renovation Programme) and introducing tax incentives for efficiency measures in the building sector supported by the Federal Government and state governments (Länder)
- Setting up energy efficiency networks together with business and industry

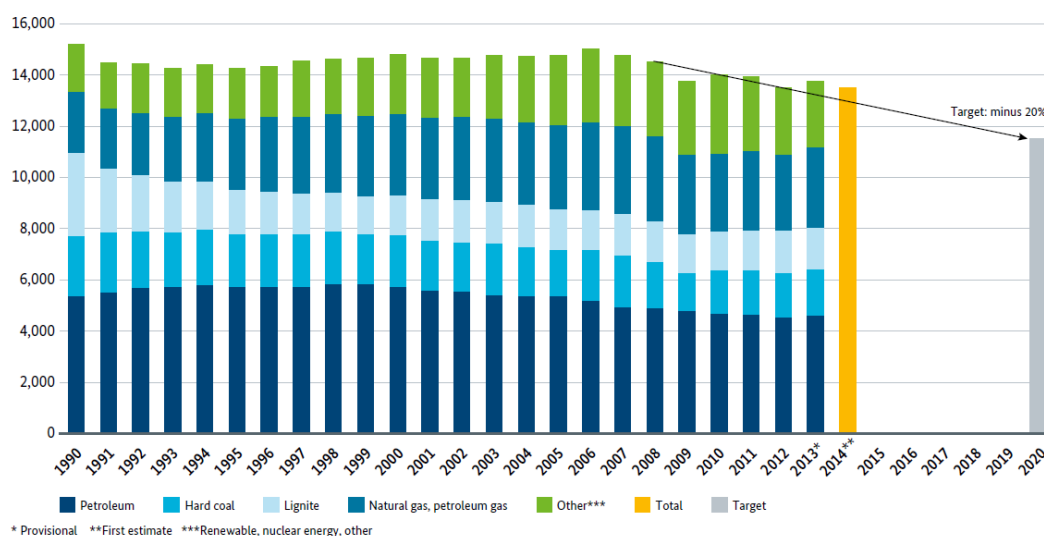
The targets set by the German Federal Government in its Energy Concept of September 2010 for reducing energy consumption compared with the baseline year 2008 – particularly the 20% reduction of primary energy consumption (PEC) by 2020 and 50% by 2050 – still form the basis and frame of reference for its policy. Adjusted for temperature, primary energy consumption (PEC) in Germany from 2008 to 2013 declined by 5.1% or more than 700 PJ (Source: AG Energiebilanzen 2014).

The German authorities expect that the absolute primary energy consumption will decline further by 2020. Various scenario calculations – especially the measures scenario from 2012 (from climate mitigation scenarios in 2012) and the Forecast Report of 2013 – and the extrapolated trend based on statistical data predict (without additional measures) a reduction of 7.2% to 10.1% by 2020 in comparison with the baseline year 2008. Progress

made so far and the energy-saving measures conducted in the last few years will therefore still not be sufficient to meet the national energy efficiency targets.

This means that a substantial additional PEC reduction of at least 1,400 PJ will be necessary to meet the PEC target in the Energy Concept by 2020. It must, however, be borne in mind that the scenarios cited do not account for energy efficiency measures adopted since October 2012. These include in particular the stricter provisions in the Energy Saving Ordinance ([EnEV 2013](#)), the already completed replenishment of the CO<sub>2</sub> Building Renovation Programme by EUR 300m to a current EUR 1.8bn in annual programme funding and the introduction of programmes for the promotion of energy efficiency in industry. These measures are expected to make for an additional reduction in energy consumption of about 43 PJ (about 2.5 million tonnes of CO<sub>2</sub>-equivalent) by 2020 and have to be included accordingly in the overall assessment.

Primary energy consumption in 2020 is, however, not the only evaluation yardstick for the Federal Government. Also of crucial importance in all energy efficiency measures is to keep a balanced view of long-term target achievement by 2050, for which the 2020 target will be a decisive milestone.



*Development of primary energy consumption by energy source (Adjusted figures in petajoules (PJ))*

Source: AG Energiebilanzen

## 6.2 UK

The UK has been stating that it takes its responsibilities to tackle climate change seriously and takes a strong role in taking action to significantly reduce GHG emissions.

Provisional data show that the UK is 27% below 1990 emission levels and on track to meet the 34% 2020 GHG emission reduction target. Market-based solutions to price carbon are at the heart of delivering the UK's climate change objectives at the lowest possible cost, by providing incentives for behavior that protects or improves the environment, as well as deterring actions that are damaging to the environment. By internalizing environmental costs into prices, they help to signal the structural economic changes needed to move to a more sustainable economy. They can provide the right incentives for investment,

encouraging innovation and the development of new technology. However the low carbon price under EU ETS has also reduced the effectiveness of this policy tool in the UK.

Department of Energy and Climate Change (DECC) coordinates UK policy on climate change at official level through inter-departmental committees chaired by DECC. A Cabinet Committee chaired by the Chancellor of the Exchequer makes decisions at ministerial level. The UK government's programme is supported by action taken by the Devolved Administrations in Scotland, Wales and Northern Ireland. While the UK government has overall responsibility for ensuring that a programme is put in place to deliver the UK's Kyoto target and its domestic carbon budgets, all the four administrations (England, Scotland, Wales and Northern Ireland) will play a part in meeting these targets. The approach taken by each administration will differ, drawing on the range of policies at their disposal. The main focus on renewable energy and energy efficiency policies relates to the overall UK and England policy framework.

### *GHG reduction targets*

The [Climate Change Act 2008](#) established the world's first long-term legally-binding framework to reduce GHG emissions, committing the UK to reducing its emissions by at least 80% below the 1990 baselines levels by 2050, with an interim target to reduce GHG emissions by at least 34% compared to the 1990 baseline by 2020.

To help set the trajectory, the Climate Change Act also introduced carbon budgets, which set legally-binding limits on the total amount of GHG that the UK can emit for a given five-year period (reduction of 35% by 2018-22 and 50% by 2023-2027).

### *Renewable energy policies and targets*

The UK government is reforming the electricity market to attract investment in low carbon electricity generation while maintaining security of supply and minimizing consumer bills. [Electricity Market Reform](#) (EMR) provides support for low carbon technologies in the short to medium term, working towards a long term vision of a competitive market where all technologies participate on a level playing field without direct financial support.

The government published its White Paper on EMR, [Planning our electric future: a White Paper for secure, affordable and low-carbon electricity](#) on July 2011. This set out the government's commitment to transform the UK's electricity system to ensure that our future electricity supply is secure, low carbon and affordable. The White Paper was informed by previous recommendations made by the Committee on Climate Change (CCC). The key elements of EMR are:

- Contracts for difference (CfDs) to stimulate investment in low carbon technologies by providing predictable revenue streams that encourage investment and make it easier and cheaper to secure finance
- Capacity market to ensure security of supply
- Carbon price floor to provide a clear economic signal to drive the move towards a low carbon economy by increasing the cost of emitting CO<sub>2</sub>
- Emissions performance standard (EPS) to provide a regulatory backstop to prevent the construction of the most carbon intensive forms of electricity generation, such as unabated coal fired power stations.

The government is currently consulting on detailed proposals to implement EMR. Updated CfD contract terms and strike prices for renewable technologies, and the EMR Delivery Plan were published in December 2013. The government is on track to deliver EMR in 2014: The first CfDs under the enduring regime are expected to be signed in the latter half of 2014; and the first capacity auction is expected to be run in 2014, for delivery of capacity in winter 2018-2019 (subject to state aid approval).

The renewables obligation (RO) is currently the main mechanism for supporting large-scale renewable electricity projects in the UK. It is a market-based support mechanism and works by placing an obligation on licensed electricity suppliers (the biggest contributors of carbon into the atmosphere) to source a specified and annually increasing proportion of their electricity sales from renewable sources, or pay a penalty.

The RO is administered by Ofgem which issues tradable Renewables Obligation Certificates (ROCs) to renewable electricity generators relating to the amount of eligible renewable electricity they generate. Suppliers can meet their obligation either by acquiring ROCs or by paying a buy-out price, set at GBP 42.02 per ROC for 2013/14 (linked to RPI), or by a combination of both. Money paid into the buy-out fund is recycled to ROC holders at the end of the 12-month Obligation period on a pro rata basis. The level of the obligation for 2013/14 in England, Wales and Scotland is 0.206 ROCs/MWh and 0.097 ROCs/MWh in Northern Ireland.

The most significant reform of the RO since its establishment was the introduction of banding in April 2009, that moved the RO from a mechanism which offered a single level of support for all renewable technologies to one where support levels vary by technology according to a number of factors, including their costs and level of potential deployment. As part of the operation of the banding mechanism, the support levels are subject to periodic reviews every four years, to allow adjustments of the support level and to reflect the evolution of costs and revenues.

A review took place between 2010 and 2012, and set the support levels for 2013–17, for new developments and capacity added to existing generating stations accredited under the RO during this period. This support package balances growth and affordability, providing reassurance to investors and value for money for consumers. The RO has helped to support the GBP 31bn of investment in renewable generation announced since 2010 and will help to drive growth and support jobs across the renewables sector in the future.

These support levels will ensure continuity of support as we transition towards the new Contracts for difference (CfDs). The RO will operate in parallel to CfDs during the transition towards RO closure to new generation in April 2017. Thereafter it will provide grandfathered support (for 20 years from the date of accreditation) for the generating capacity that is accredited under the RO before this date. The RO scheme will end in 2037.

Since its introduction in 2002, the RO has helped in tripling the level of renewable electricity (from 2.9% of total UK generation to 11.3% in 2012). In March 2012 total capacity under the RO was almost 12,500 MW, with over 30 TWh of renewable generation, and a saving of 15.1 MtCO<sub>2</sub>e. It is estimated that the RO was worth around GBP 2bn in support to the renewable electricity industry in 2012/13.

### *Energy efficiency measures and targets*

The UK government is committed to realizing the energy efficiency opportunity in the UK. The UK government sees energy efficiency improvements offer one of the most cost-effective ways to reduce the amount of energy they use, and UK carbon emissions across the business, residential, public and industrial sectors. Energy efficiency improvements can also save households and businesses money on their energy bills, promote economic growth and enhance business productivity, and revitalize their energy infrastructure.

The UK is committed to building on progress already made on energy efficiency; in 2012 the UK's energy intensity was 39% lower than the G8 average. However, there remains significant untapped cost-effective energy efficiency potential in the UK economy.

The UK government's current Energy Efficiency Strategy: the [Energy Efficiency Opportunity in the UK](#), published in November 2012, estimated that through socially cost-effective investment in energy efficiency the UK could be saving 196 TWh in 2020. UK's existing policy package should according to government estimates save the UK 154 TWh in 2020.

The Energy Efficiency Strategy identified four key barriers to the deployment of cost-effective energy efficiency investments in the UK economy:

- **Embryonic markets:** The UK already has an energy efficiency market but it is small relative to the size of the opportunity. There are significant economic benefits to be realized from growing this market and making energy efficiency a mainstream activity.
- **Information:** There is currently a lack of access to trusted and appropriate energy efficiency information. Where information is available it may be generic and not tailored to specific circumstances, which means that enterprises are not able to fully assess the benefits of an energy efficiency investment.
- **Misaligned financial incentives:** Those investing in energy efficiency measures are not always the ones receiving the direct benefit. For example, the wider benefits of energy efficiency investment, such as improved security of supply and reduced carbon emissions, are not always realized by those making the investment.
- **Undervaluing energy efficiency:** Partly as a result of the lack of trusted information, the long-term benefits of improved energy efficiency are often regarded as less certain.

Consequently, energy efficiency is undervalued relative to other investment options and not prioritized as it might otherwise be.

- The introduction of new policies and the simplification of existing ones has resulted in: expanded choice and support for households; simplified and extended support for UK businesses and the public sector; improved access to financing for energy efficiency measures; and improved awareness of the benefits of energy efficiency.

The transposition of the EU Energy Efficiency Directive is a key priority for the UK government. The Directive aims to put the EU on track to meet its target to reduce primary energy consumption by 20% by 2020. By April 2013, the UK submitted to the EU Commission its non-binding target to achieve an 18% reduction in final energy consumption relative to 2007 Business As Usual projections (equivalent to a 20% reduction in primary energy consumption).

### 6.3 France

France produced its first National Programme for Tackling Climate Change back in 2000 and its measures were later either inscribed in laws or regulations on energy, finance, agriculture, urban planning, or abandoned. The same process occurred with the Climate Plans 2004, 2006, 2009, 2011 and 2013. The Climate Plan must be refreshed every two years according to the 2005 Energy Policy Framework Law and local authorities are encouraged to adopt the same process and to draw up territorial climate plans to develop a genuinely local climate and energy policy in their own jurisdictions.

A new law regarding the green transition of the French economy was passed in July 2015 ([Law for energy transition and green growth](#)) setting new targets for the interim period between 2020 and 2050. The main points of the new law are five main objectives:

- Reduce GHG emissions by 40% by 2030 (base year 1990) and by 75% for 2050;
- Reduce consumption of fossil fuels by 30% by 2030;
- Reduce the share of nuclear energy in the energy mix from 75% to 50% by 2025;
- Reach a minimum share of 32% of renewable energy in energy consumption (around 40% of electricity produced, 38% of heat consumed and 15% of transport fuels);
- Reduce final energy consumption by 50% by 2050 with an intermediate target of 20% reduction by 2030

The new energy transition law still lacks a lot of detailed laws and regulation. Especially the reduction of nuclear energy is political controversial among the rightwing opposition. The next general election in France is in 2017 which could alter that part of the French energy and climate policy. The phase out of nuclear energy will force France to increase its cooperation with neighboring countries to both secure energy supply and security and reaching medium and long-term climate targets.

#### *GHG reduction targets*

Being well on track to reach its overall GHG reduction targets for 2020 (-14% in 2011 vs. 1990 level) an intermediate target of 40% is well in line with the long-term target of 75% reduction target by 2050. To further support the GHG reduction the newly adopted energy transition plan included a trajectory for the carbon tax on fossil fuel for non-EU

ETS sectors of EUR 56 per tonnes CO<sub>2</sub> by 2020 and EUR 100 per tonnes CO<sub>2</sub> by 2030. This kind of taxation will also support the energy efficiency targets especially in the transportation sector as we have witness in other EU countries like Denmark.

From a GHG emission point of view the new cap on the nuclear power plant fleet of 63.2 GW equivalent to the current fleet and a reduction of the share of power generation from the current 77% to 50% by 2025 does pose a challenge to the conversion to other low or non-GHG emitting power generation technologies.

### *Renewable energy policies and targets*

The Energy Policy Framework Law 2005 has a 10% renewable energy target for 2010, involving thermal energy sources as well as the use of biofuels in the transportation sector. The [Grenelle I](#) law (2009) increased the renewable energy target to 23% by 2020, beyond the official EU target of 20%. In support of the objectives in the National Action Plan to Support Renewable Energies (2009-2020), France uses fiscal tools such as tax incentives for renewable energies or feed-in tariffs as part of the country's finance laws.

The [Grenelle 2](#) law (2010) promotes electricity produced by renewable sources through the enhancement of various supporting tools. France's largest utility company, EdF, is already required to purchase electricity produced by certain renewable energy generators. Under Grenelle 2, local governments can also benefit from this purchase guarantee if they produce electricity from renewable sources. Moreover, any individual can now install PV panels at home and benefit from a "feed-in tariff" that guarantees producers of renewable energy a specified price for every MWh of power fed into the grid. To improve conditions for renewables, the electricity grid will be strengthened and enhanced in the coming years.

The France currently uses a wide range of instruments to support the development of renewable energies:

- Budgetary expenses, especially in support for thermal renewable energies. A billion euro "Fonds chaleur renouvelable" (Renewable Energy Heating Fund) for the period 2009 to 2013 has enabled considerable development of heat production in the tertiary and manufacturing sectors from renewable sources such as wood, geothermal energy and solar power while improving and diversifying heating sources in multiple dwelling units. It will enable 2.7 Mt of CO<sub>2</sub> emissions to be cut per year from 2015 according to official estimates
- Tax expenses. The "sustainable development" tax credit in particular, which helps individuals to buy renewable energy equipment: solar powered water heaters, heat pumps, solar panels, etc., has been extended until 2015
- Consumer financing measures: implementation of electricity buy-back tariffs to make investment in the various renewable energies profitable. A considerable increase in the number of wind turbines in mainland France is due to these measures. In this sector alone annual emission reductions in 2020 will be 5.37 Mt CO<sub>2</sub> eq. according the official estimates
- Regulatory measures such as the use of solar heating to cover at least 50% of the hot water requirements of new homes built in French Overseas Departments from 1st May 2010

Despite more ambitious renewable energy target France is one of the EU countries lacking behind its NREAP. For instance by the end of 2014 France had only installed 37% of the project wind energy target set for 2020. The main reason has been problems with

the French support scheme for wind energy that for some time has been paralyzed by a legal dispute internally in France and with the EU Commission.

As mentioned before the new energy transition law includes 2030 target of 32% renewable energy target of gross energy consumption by 2030 or additional 10% point on the 2020 target. In order to make investment in renewable energy assets more attractive and at the same time solve some of the issues of the current support schemes vs. the EU regulation for state aid a new support scheme including a feed-in premium combined with an auction based system for larger project will be introduced. The detail will be presented later this year. Along with some clarification regarding planning for onshore wind should accelerate deployment of wind and solar energy in France.

### *Energy efficiency measures and targets*

The integrated approach of the Grenelle I and 2 has contributed to bringing principles and policies on energy demand, energy supply, and sustainable transportation into the mainstream. The Grenelle I and 2 has either strengthened those policies and goals that already were part of national legislation, or has incorporated them into a dedicated law on the environment. Although some of the initial measures have proven challenging given the economic slowdown and budgetary constraints, the Grenelle 2 law still contains many positive provisions, including a focus on emission reductions and energy efficiency improvements in buildings and transportation (which account for the bulk of GHG emissions).

As stated before the new energy transition law set new energy efficiency targets for 2030 and 2050 with a reduction in final energy consumption of 20% by 2030 and 50% by 2050 with the baseline of 2012. Given the current target of 2020 of 17% the new intermediate target does not seem very ambitious. The main focus of the new law is still very much on building sector. Among others the new energy transition law which sets a target for 100% renovation of all real estate to the “low consumption building” standard by 2050 focusing on low income households. Also the new law aims at fivefold increase in the contribution of district heating and cooling by 2030.

The Energy Policy Framework Law 2005 includes a target to decrease energy intensity by 2.5% in 2030. The Thermal Regulation 2012, complemented by creation of two new labels, strengthens building efficiency requirements, aiming at reducing the primary energy consumption in buildings by 150bn kWh between 2013 and 2020, and reducing the CO<sub>2</sub> emissions by 13m-35m tonnes of CO<sub>2</sub> (depending on the method) between 2013 and 2020.

The new energy transition law sets a target of reducing the average energy consumption of buildings nearly 40% by 2020, and puts a focus on advanced energy performance for both old and new buildings. New buildings built after 2012 are to consume less than 50 kilowatts per square meter, and those built after 2020 must be "energy positive," producing more energy than they consume. As of 2013, old buildings must be renovated at a rate of 400,000 buildings per year, with the renovation of public buildings starting before the end of 2012. Through this means, the government aims to reduce the energy



consumption of public buildings by at least 40 percent and to cut their greenhouse gas emissions 50 percent by 2020.

## 6.4 Denmark

The so called [Danish Energy Model](#) has shown that through persistent and active energy policy with ambitious renewable energy goals, enhanced energy efficiency and support for technical innovation and industrial development, it is possible to sustain significant economic growth and a high standard of living, while reducing fossil fuel dependency and mitigating climate change. Danish climate policy is based on two pillars – the European and the national. As a small country with an open economy, it is clear that the more Denmark can implement climate policy with common European solutions, the better the total effect of climate policy and the easier it will be to maintain Danish competitiveness in relation to trading partners in the EU.

The future foundation for Danish energy policy is based on two broadly supported political agreements, namely the [Energy Agreement](#) of 2012 and the [Climate Change Act](#) of 2014.

The Danish Government has established the long-term goal of a fossil-free economy, meaning that the entire energy supply – electricity, heating, industry and transportation – is to be covered by renewable energy by 2050.

The Energy Agreement is the roadmap for development of energy supply and demand for the period 2012–2020. This agreement contains a wide range of ambitious initiatives, bringing Denmark a good step closer to the target of 100% renewable energy supply. Through expanded offshore wind production and use of biomass, renewables are expected to cover more than 70% of Danish electricity production by 2020. The Energy Agreement and current results and projections shows that Denmark will more than fulfill its obligations toward the EU 20-20-20 targets within energy efficiency, renewable energy and reduction of carbon emissions.

The Climate Change Act will establish an overarching strategic framework for Denmark's longer-term climate policy with a view to achieving the transition to a low-emission society by 2050, i.e. a resource-effective economy with an energy supply based on renewable energy and significantly lower emissions of greenhouse gases from other sectors, while taking economic growth and development into consideration. The new strategic framework will ensure transparency and public access to the status, direction and progress of Denmark's climate policy.

The overall results of the Danish energy and climate policy and regulation has been that Denmark has reduced the adjusted GHG emissions by more than 30% since 1990 – and is set to achieve 40% reduction by 2020. Denmark has the highest contribution of non-hydro renewables in any electricity system worldwide: 46% in 2013. In 2014, almost 40% of the Danish electricity consumption was based on wind power; by 2020 this figure is target to be 50%.

### *GHG reduction targets*

The Energy Agreement has brought Denmark a long way towards realizing the domestic target of a 40% reduction by 2020 compared with 1990. However, significant additional efforts will be needed to reach the domestic target. Sensitivity analyses show that a higher allowance price will reduce Danish emissions significantly, while a lower allowance price will only increase emissions slightly. But still, both the energy scenario and projections of non-energy related emissions are subject to uncertainty.

### *Renewable energy policies and targets*

Despite almost no hydropower resources, Denmark has managed to become a global leader in renewable energy generation. Renewable energy's share of final energy consumption in Denmark has been steadily increasing since 1980. Today, more than 25% of Denmark's final energy consumption is covered by renewable energy. Measuring electricity supply alone, renewable energy today accounts for close to 50% of domestic generation, which is mainly due to the incorporation of wind energy in electricity production. Denmark today has 4,893 MW of installed wind energy capacity, of which 1,271 MW are offshore wind turbines (ultimo 2014). On windy days, wind turbines in Denmark produce more than the domestic demand.

Promoting renewable energy requires a favorable investment climate, a developed power grid and long-term planning. Stimulating demand through financial and market support has been a central element in promoting the expansion of renewable energy in Denmark. A positive investment climate has been created with priority grid access and resource based feed-in tariffs. Feed-in tariffs for offshore wind are settled by tender and feed-in premiums with a cap regulate the support for onshore wind power.

Central and long-term planning has ensured timely and relevant investments in the power grid and system. Thus the grid and system have been developed incrementally in order to handle the steady increase in fluctuating renewable energy production. Strategic planning of future grid investments follows the current political energy agreement with adopted measures and policies toward the Danish government's long-term goal of full cover the Danish energy demand with renewable energy generation by 2050.

Reaping the full benefits of new renewable energy technologies has caused radical changes to the Danish energy system and networks. Danish experience shows that flexibility in conventional production in combination with strong transmission and distribution networks, and larger exchange of power with neighboring countries in order to increase balancing areas, are important components in overcoming challenges.

### *Energy efficiency measures and targets*

The Danish economy's energy consumption is among the lowest in the world relative to gross output. Denmark has become one of the world's most energy efficient economies. Since 1990, Danish GDP has increased by nearly 40%. During this period, the domestic energy consumption has declined by 7% and the adjusted carbon emissions by more than

30%. This development has not only benefitted the competitiveness of Danish enterprises through lower energy costs and less exposure to highly volatile fossil fuel prices, but also fostered new products and industries.

Energy efficiency is a vital element in the green transition of the energy sector. Without extensive energy efficiency improvements, it would have been disproportionately expensive to meet energy demands with new and initially more expensive energy sources like renewable energy. Successful energy efficiency deployment enables meeting society's demand for various energy services more efficiently and effectively, so that energy consumption is reduced. Results are achieved in part by transitioning to more energy efficient technologies and solutions, but also highly dependent on increasing energy consciousness and altering consumer behavior.

Potential remains for cost effective energy efficiency improvements. These exist in all sectors and areas of use. Significant improvements on national energy efficiency performance can be achieved with products and technologies that are already developed and available as consumer solutions. Often, it will be cost effective for consumers to use existing solutions; however, energy efficiency improvements do not come about automatically. Active efforts are needed to promote additional efficiency improvements and savings. Danish energy policy therefore contains a number of initiatives to increase energy efficiency improvements in order to minimize energy use and energy waste in all sectors.

In addition to more efficient energy production, a number of initiatives have been carried out to increase the efficiency of end-user consumption, that is, consumption by consumers and enterprises. Danish environmental- and energy taxes contribute to a better reflection of the environmental costs of production, use and disposal in consumer prices on energy.

By formulating schemes in close dialogue with industry, knowledge about challenges and possibilities are integrated in the measures.

Initiatives include:

- Energy labelling of buildings
- Building codes focusing on energy consumption
- Electricity saving trusts
- Energy labelling of appliances
- Energy savings in the public sector
- Energy efficiency obligation schemes

## 7. Documentation

Summary of implemented and planned common EU climate and energy policies and measures

### “Cross-cutting” climate measures

Policies and measures ‘Cross-cutting’	Stage of implementation /timetable /comments
EU Emission Trading Scheme	In force
Monitoring Mechanism Regulation	Adopted and in force since 8 July 2013
Back loading	Auctioning of 900 million allowances from the early years of phase 3 of the EU ETS postponed to the end of the trading period. Auctioning Regulation amended accordingly on 25 February 2014.
Creation of a market stability reserve for the ETS phase 4 (2021 onwards)	Proposal adopted on 22 January 2014; submitted to the Council and Parliament. The current draft proposes under pre-defined circumstances automatic adjustments of the volume of allowances to be auctioned in relation to the number of allowances in circulation.
2030 Climate and Energy package	Communication adopted by the Commission on 22 January 2014, subject to discussions within the EU institutions.
European Energy Security Strategy	Communication adopted by the Commission on 28 May 2014, subject to discussions within the EU institutions.
Roadmap for moving to a competitive low-carbon economy in 2050 (2011)	Communication adopted by the Commission “
7 <sup>th</sup> Environment Action Programme (2013)	In force
Clean Air Policy Package	Package proposed by the Commission, subject to discussions within the EU institutions.

### Energy Supply

Policies and measures ‘Energy supply’	Stage of implementation /timetable /comments
Promotion of electricity from RES-E (2001)	In force
Renewable energy Directive (Directive 2009/28/EC)	In force
CCS Directive	In force
NER 300 laying down criteria and measures for the financing of commercial demonstration projects for CCS and innovative renewable energy	Under the first call for proposals, the Commission made funding awards in December 2012 for a total value of € 1.2 billion to 23 renewable energy projects. Second call for proposals was awarded in

Policies and measures 'Energy supply'	Stage of implementation /timetable /comments
technologies under the revised EU ETS	July 2014 and amounts to € 1 billion, supporting 18 renewable and 1 CCS projects.
Directive on promotion of cogeneration	In force until mid-2014. Repealed by the new Energy Efficiency Directive.
Further measures on renewable heat (including biomass action plan)	Biomass Action Plan, Dec 2005, over 20 further actions planned. Renewable heat included in proposed new Directive on renewable energy
Intelligent Energy for Europe: programme for renewable energy	Programme for policy support in renewable energy
Developing the internal energy market	Amendments to a number of directives to continue to help complete the internal energy market.
Strategic Energy Technology (SET) Plan	6 European Industrial Initiatives and 10 Integrated Research Programmes that address the development and market roll-out of new generation of renewable energy, carbon capture and storage, nuclear and smart grids technologies are in force since 2010/11. At EU level these initiatives are supported by FP7.

## Energy demand

Policies and measures 'Energy demand'	Stage of implementation / timetable /comments
Energy Efficiency Directive	The Directive entered into force on 4 December 2012. Most of its provisions had to be implemented by the Member States by 5 June 2014.
Directive on the energy performance of buildings	Replaced by the recast Directive below.
Directive on the energy performance of buildings (recast)	Adopted in May 2010 with implementation deadline for most of its provisions by July 2012.
Directive on ecodesign requirements for energy-related products Directive on labelling of the consumption of energy and other resources by energy-related products	Product policy under implementation. 25 implementing measures adopted on ecodesign, including voluntary industry agreements and 12 on energy labelling. Numerous implementing measures are under the preparation.
Regulation on the labelling of tyres with respect to fuel efficiency and other essential parameters	Product policy under implementation
Regulation on energy efficiency labelling programme for office equipment (Energy Star)	Product policy under implementation

Policies and measures 'Energy demand'	Stage of implementation / timetable / comments
Directive on energy end use efficiency and energy services	In force until 5 June 2014, except for Article 4 which will be repealed from 1 January 2017. Afterwards to be (almost fully) replaced by the new Energy Efficiency Directive; National Energy Efficiency Action Plans adopted in all EU-27.
Action Plan on Energy efficiency as a follow-up to the Green Paper	Launched Oct 2006. Identifies 10 priority actions to help achieving the 20% energy efficiency target of 368 Mtoe primary energy savings in 2020 (or 740 MtCO <sub>2</sub> -eq). Reinforced in March 2011 (see below).
Energy Efficiency Plan 2011	Launched March 2011. Aims at closing the gap to the 20% energy efficiency target in 2020. It was followed by the adoption of the new Energy Efficiency Directive.
Action under the Industrial emission directive	Reference document on Best Available Techniques regarding Energy Efficiency finalised.
Intelligent Energy for Europe programme (incl. Covenant of Mayors, ELENA), followed by the Horizon 2020 programme	Programme for policy support in energy efficiency
European Energy Efficiency Fund	Launched in July 2011. Estimated investment potential of EUR 265 million for energy efficiency, renewables and sustainable urban transport projects.
Public procurement	EU Handbook developed for guidance for increased energy efficient public procurement
Strategic Energy Technology (SET) Plan	Launch in 2012 of the Smart Cities and Communities European Innovation Partnership addressing the demand side of low carbon technologies in energy, transport and ICT sectors.

## Transportation

Policies and measures 'Transport'	Stage of implementation / timetable / comments
Strategy on CO <sub>2</sub> from light duty vehicles; Regulation on CO <sub>2</sub> emissions from passenger cars, Regulation on CO <sub>2</sub> emissions from light commercial vehicles, car labelling directive	The two amending Regulations implementing 2021/2020 targets for cars/vans entered into force. Regulations request a review setting targets beyond 2020 by the end of 2015.
Fuel quality Directive –setting a 6/% reduction target of the carbon intensity of fuels and also regulates the sustainability of biofuels	First implemented in 1998. Revised in 2009 and amended in 2011 - implementing act laying down calculation methods under preparation
Directive on the promotion of transport bio-fuels	Repealed, Replaced by the Renewable Energy Directive (Directive 2009/28/EC).
Initiative on fair and efficient road pricing, revising Directive 1999/62/EC and Directive 2004/52/EC	Proposal under preparation by the Commission
Infrastructure charging for heavy goods (revised Eurovignette)	Adopted (Directive 2011/76/EU)
Proposal for a Directive revising Directive 96/53/EC on maximum weights and dimensions	Proposal adopted by the Commission.
Shifting the balance of transport modes	Package of measures in implementation
Fuel taxation (Energy taxation directive 2003/96/EC)	In force Review of the Energy Tax Directive under special legislative procedure with unanimity.
Directive on mobile air conditioning systems: HFCs	In force
Inclusion of Aviation in EU ETS for flights within the EEA	Adopted. Includes all intra-European flights since 1/01/2012. Since March 2014, the coverage of the EU ETS is limited to flights within the European Economic Area for the period from 2013 to 2016, pending the adoption of international rules under the aegis of the International Civil Aviation Organization.
Strategy on Integrating maritime transport emissions in the EU's greenhouse gas reduction policies	Adopted. In June 2013 the Commission proposed a Regulation which would establish an EU-wide system for the monitoring, reporting and verification of CO <sub>2</sub> emissions from large ships starting in 2018
Public procurement of vehicles (Directive on the Promotion of Clean and Energy Efficient Road Transport Vehicles 2009/33/EC)	In force The Directive requires that energy and environmental impacts linked to the operation of vehicles over their whole lifetime, including CO <sub>2</sub>

Policies and measures 'Transport'	Stage of implementation / timetable / comments
	emissions, are taken into account in public procurement decisions.
Strategic Energy Technology (SET) Plan	One Joint technology Initiative on Fuel cells and Hydrogen in force since 2009 and one European Industrial Initiative and Integrated Research Programme on bioenergy in force since 2010/11. At EU level these initiatives are supported by FP7.
White Paper: Roadmap to a Single European Transport Area	Strategy to create a competitive and efficient internal EU transport system, cut transport emissions by 60% by 2050, adopted in 2011
Regulation EURO 5 and 6 (692/2008/EC)	In force
Euro VI standard for heavy duty vehicles (2013)	In force
Clean Power for Transport package including the deployment of alternative fuel infrastructure	Proposal adopted by the Commission

## Industry & non-CO<sub>2</sub> gases

Policies and measures 'Industrial Processes'	Stage of implementation / timetable / comments
Fluorinated gases: <ul style="list-style-type: none"> <li>- F-gas Regulation</li> <li>- MAC Directive (mobile air conditioning systems)</li> </ul>	In force.  The newly adopted F-gas Regulation 517/2014 replaces the previous Fgas Regulation 842/2006 and will apply from 1 January 2015.
Industrial Emissions Directive 2010/75/EU	In force  In 2008 the IPPC Directive was codified and in 2010 amended by the Industrial Emissions Directive

## Agriculture



Policies and measures 'Agriculture'	Stage of implementation /timetable /comments
Reduction of CH <sub>4</sub> and N <sub>2</sub> O from animal manure	Possibility for support through Rural development programmes, through anaerobic digestion and improved manure storage and management.
N <sub>2</sub> O from soils	Possibility for support through Rural development programmes and from an improved implementation of the nitrates Directive (1991/676/EEC). Through promotion of more efficient usage of nitrogen fertiliser.
CAP reform post 2013	<p>The reformed CAP was agreed in late 2013. This consists of two pillars</p> <p>Pillar I: Direct payments (new changes will be ready for 2015)</p> <ul style="list-style-type: none"> <li>• Contains a new greening component to help protect soil carbon</li> </ul> <p>Pillar II: Rural development program (changes will impact on country RDPs submitted this year)</p> <p>Includes a new 20% climate mainstreaming requirement</p>

## Forrest and soils

Policies and measures 'Forests'	Stage of implementation /timetable /comments
Decision on accounting rules and action plans on greenhouse gas emissions and removals resulting from activities related to land use, land use change and forestry (LULUCF)	<p>Adopted and in force since 8 July 2013.</p> <p>In the Decision, Member States agreed to improve monitoring, reporting and verification of agricultural soil and other carbon pools in a non-binding way as from 2015. Provisional estimates will be made for each year from 2013 (delivered in 2015, etc.) for both forest and agricultural land activities. The accounting rules applied will be those applicable under KP. Information on national actions for enhancing mitigation in the sector are to be communicated by mid-2014 (or alternatively, early 2015 for some MS).</p>
EU Forest Strategy and EU Forest Action Plan	The Forest Action Plan was presented in June 2006. Its timeframe was 2006-2011. It builds on the EU's Forestry Strategy adopted in 1998. The EU Forestry Strategy, moving forward from the Forest Action Plan of 2006 and replacing the 1998 Strategy, has been revised, and Council conclusions adopted (May 2014). Work is underway to develop sustainable forest management criteria to be applied to solid biomass from forests.
<p>Afforestation and reforestation:</p> <ul style="list-style-type: none"> <li>- Afforestation programmes</li> <li>- Natural forest expansion</li> </ul>	The 2020 Common Agricultural Policy still provides for support of forestry schemes through rural development. However, scope for significant afforestation is limited to a few MSs, and natural forest expansion, while continuing, does counter the decline of forest carbon sink, due to age class legacy issues.
Restoration of forests damaged by natural disasters, fires, pests damage and forest fire prevention action	Possibility for support through Rural development programmes, specific measure for restoring forestry potential and introduction of prevention actions
Forest management (various measures)	Possibility for support through forestry scheme of rural development, dependent on national implementation.

## Waste

Policies and measures 'Waste'	Stage of implementation / timetable / comments
Landfill Directive	In force. Commission proposal to reinforce landfill reduction targets adopted on 2 July 2014.
Waste Framework Directive	In force. Commission proposal to reinforce re-use/recycling targets for municipal waste adopted on 2 July 2014.
Packaging and Packaging Waste Directive	In force. Commission proposal to reinforce recovery/recycling targets for packaging waste adopted on 2 July 2014.
Directive 2012/19/EU on waste electrical and electronic equipment (WEEE)	In force. Directive recast in 2012.

### Integration Research & Development

Policies and measures	Stage of implementation / timetable / comments
Research and Innovation Framework Programme	In force. Under the 7 <sup>th</sup> Framework program (FP7), which ran from 2007 to 2013, a budget of 50.5 billion euros was allocated over the entire period. Over 2.3 billion to energy related R&D activities.  First calls of the Horizon 2020 programme (2014-2020) have been launched. Around 35% of the Horizon 2020 budget of around 70 billion euro is expected to be invested in climate-related research and innovation actions.
Competitiveness and Innovation Framework Programme (CIP)	CIP ran from 2007 to 2013 with a total budget of 3.6 billion euros. The CIP is divided in three operational programmes two of which are related to energy and climate change.
Strategic Energy Technology (SET) Plan	In force since 2007 and implemented at EU level through FP7 and Horizon 2020.

### Integration Cohesion Policy

Policies and measures	Stage of implementation /timetable /comments
Integration climate change in structural funds & cohesion funds	<p>The legislative basis is in place for the structural and cohesion funds as part of the European Structural and Investment Funds (ESIF) 2014-2020; it includes a range of important references to climate action.</p> <p>The programming of ESIF is ongoing, including the mainstreaming of climate action into Partnership Agreements and fund-specific programmes (ERDF, ESF, CF, EAFRD, EMFF), and will largely be completed by end 2014. Overall the programming documents are expected to set out a comprehensive range of climate actions and contribute fully to the political objective of dedicating at least 20% of the budget of the Union to climate change objectives in the period 2014-2020. The climate mainstreaming covers both the mitigation of climate change (reducing emissions of greenhouse gases) and adaptation to climate change (enhancing the resilience to the adverse impacts). On the latter, the climate mainstreaming supports the implementation of the EU</p>
	<p>Strategy on adaptation to climate change. The mainstreaming of climate action represents a comprehensive process focusing on local climate action across the EU, Member States and regions, contributing to the transition to a low-carbon and climate resilient economy.</p>