EWEA
THE EUROPEAN WIND ENERGY ASSOCIATION

EU Energy Policy to 2050

Achieving 80-95% emissions reductions

March 2011

A report by the European Wind Energy Association

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Achieving 80-95% emissions reductions

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1 EXECUTIVE SUMMARY

Since 1997, the European Union has had a successful renewable energy policy which has enabled significant progress to be made towards the EU's objectives of reducing greenhouse gas emissions, ensuring security of supply and improving EU competitiveness. Ambitious targets are at the core of the EU's policies to promote energy from renewable sources. Due to the early adoption of ambitious national and EU targets, European companies are world leaders in wind power technology, and have a leading share of the world market. As a result, Europe today gets approximately 20% of its electricity from renewable energy sources, including 5.3% from wind energy.

In order to continue the development and deployment of renewable energy technologies, the EU adopted the 2009 Renewable Energy Directive[1], which included a 20% renewable energy target by 2020 for the EU. In 2020, according to the Renewable Energy Directive's 27 National Renewable Energy Action Plans, 34% of the EU's total electricity consumption will come from renewable energy sources, including 495 TWh from wind energy meeting 14% of consumption.

Importantly, expectations for wind energy and other renewables in 2020 are converging – as can be seen by comparing scenarios by EWEA, the European Commission's 'Trends to 2030', the European Commission's Joint Research Centre, ENTSO-E, and the National Renewable Energy Action Plans – with renewables meeting between 32.6% and 36% of electricity consumption.

The EU has provided the power sector with a very clear trajectory over the next ten years. What is yet to be done is for the EU to provide the power sector with an equally clear trajectory to 2050.

Currently, the agreed framework for post-2020 consists of two elements: the Heads of States' commitment to reduce greenhouse gas emissions by 80-95% by 2050, and the directive on the EU Emissions Trading System, which will continue to reduce the emissions cap for the ETS sectors by 1.74% each year beyond 2020.

Given the difficulty in the 2050 timeframe to eliminate emissions in sectors such as transport and agriculture, achieving the Heads of States' commitment is only certain if the power sector emits zero carbon well before 2050.

2050 may seem a long time from now but in the power sector, 2050 is only one investment cycle away, which means decision makers must act today and provide the markets with clear signals on technology choice. Due to the long lifetime of fossil fuel power plants, (35-45 years for coal and 30-35 years for gas[2]) the commitment by Heads of State means that no new carbon-emitting power plant should be built after 2015.

Necessary to achieving a zero-carbon power sector by 2050 is an EU regulatory framework for the post-2020 period. In order to provide the power sector with the necessary investment stability and predictability, the EU will ideally need to decide during the course of the present Commission and Parliament – that is, by the end of 2014 – on a new regulatory framework for the power sector.

1 Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

2 SRU German Advisory Council on the Environment. "Climate-friendly, reliable, affordable: 100% renewable electricity supply by 2050". Statement May 2010.

EWEA proposes such a framework, which would have three key elements:

Core post-2020 pillar: an ambitious, binding 2030 target for renewable energy

Given the proven success of the EU regulatory framework for renewables since 1997, EWEA considers the most effective post-2020 regulatory framework to be a binding 2030 renewable energy target. This would give the power sector a vital stepping stone, taking it from an expected 34% renewable electricity in 2020 to 100% renewables by 2050.

The EU's renewable energy policy - the 2001 Renewable Electricity Directive and the 2009 Renewable Energy Directive - is successfully transforming our power sector. Therefore, the most effective post-2020 framework would be to replicate the successful approach and set an ambitious, binding 2030 target for renewable energy that is compatible with the necessary carbon reductions in the power sector.

Enhancing the post-2020 framework: an Emissions Performance Standard

The most effective way of ensuring a carbon-free power sector by 2050 would be to ban carbon emissions from new power plants installed after 2015. The simple way to do this would be to introduce a technology neutral Emissions Performance Standard (EPS) of zero grams of CO_2/kWh for new power plants, thereby letting the market decide the most cost efficient way of delivering carbon-free primary energy.

Given the challenge of developing a sufficiently flexible electricity system, the EPS could alternatively be set at around 350g CO_2/kWh in 2015, equivalent to the emissions of a new gas plant. The Standard should be gradually reduced for new plants over time in order to encourage progress in gas plant technology.

Enhancing the post-2020 framework: tightening the Emissions Trading System

Any post-2020 legislative framework should include a tighter emission reduction target for the ETS to reach 95% domestic greenhouse gas reductions by 2050, preceded by a target of 30% domestic GHG reductions by 2020, and further domestic targets for 2030, 2040 and 2050 (95% reduction).

It is clear that the most effective way of ensuring that the EU is able to continue reducing its greenhouse gas emissions beyond 2020 is to continue with the existing, stable, predictable and successful EU policy framework, by establishing a binding and ambitious renewable energy target for 2030. This policy should be complemented with other technology neutral policies — an ambitious EPS and ETS.

Photo: Thinkstock

2 INTRODUCTION

We need what European Commission President, José Manuel Barroso, called The Third Industrial Revolution:

"Oil and other hydrocarbons are a limited resource, and our own internal reserves are dwindling. Today we import around 50% of our energy. By 2030 that will be nearer 70%, if we continue with current policies. At the same time, with the rise of new economic giants like China and India, global demand for these hydrocarbons is increasing (...)

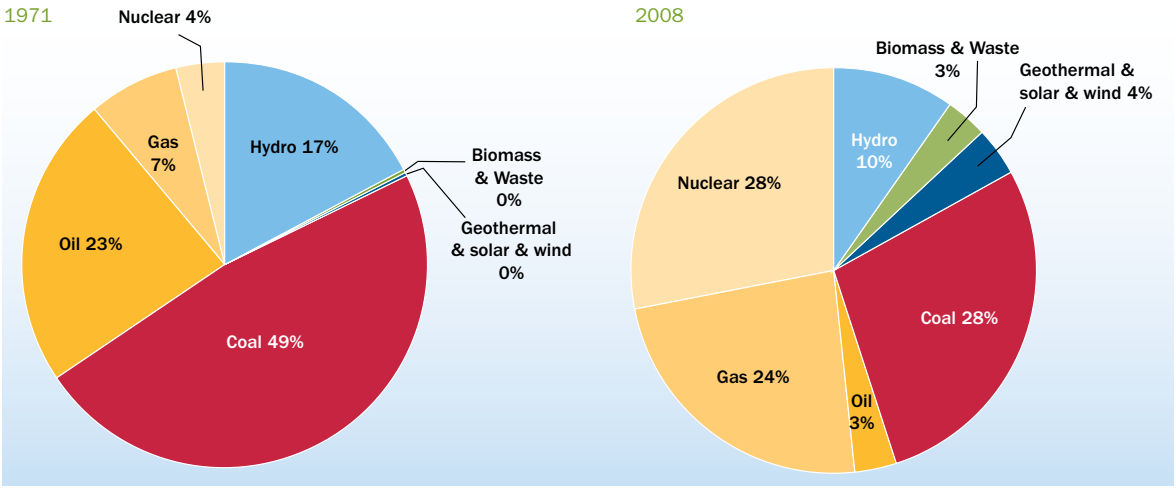
With its emphasis on renewable energy and a transformation to a low carbon economy, this revolution will help us to strike a major blow in the fight against climate change. At the same time, it will improve Europe's energy security, and decrease geopolitical tensions."[3]

Since then, the EU Heads of State have agreed to reduce greenhouse gas emissions across the whole economy by 80-95% by 2050[4] compared to 1990 levels. This will require an EU power sector with zero greenhouse gas emissions, well before 2050 because residual emissions, e.g. in agriculture and transport will be difficult or prohibitively expensive to eliminate in that timeframe.

Reaching a power system that does not emit carbon in 40 years is a tremendous task. However, history reveals that it is possible to make dramatic changes to our energy supply structure in that timeframe, but it requires strong political signals and the right frameworks to develop, integrate and deploy new technology.

Europe's power mix changed dramatically over the past 40 years (see fig 1). Four decades ago, almost half of Europe's power came from coal, and a quarter from fuel oil. Back then natural gas was at the level that wind energy is today, less than 3% of our power came from nuclear energy. Today we generate about one quarter of our electricity from gas, just 3% from fuel oil and, in 2009 about 20% from renewable sources.

FIG 1: **EU27'S EVOLVING ENERGY MIX (% OF ELECTRICITY CONSUMPTION)**



1971 Calculations provided by 3E using the following sources: IEA Electricity Information (2010 Edition); IEA Energy statistics of non-OECD countries (2010 Edition); IEA CO_2 emissions from fuel combustion - Annual historical series (1971-2008); US Energy Information administration (EIA, www.eia.doe.gov, installed capacity non OECD) 1971 (TWh 1,376).
2008 Ibid 2008 (TWh 3,341)

3 "Europe's energy policy and the third industrial revolution"; Madrid 1 October 2007.2050". Statement May 2010.

4 European Council Conclusions 29/30 October 2009. Paragraph 7: "The European Council calls upon all Parties to embrace the 2°C objective and to agree to global emission reductions of at least 50%, and aggregate developed country emission reductions of at least 80-95%, as part of such global emission reductions, by 2050 compared to 1990 levels; such objectives should provide both the aspiration and the yardstick to establish mid-term goals, subject to regular scientific review. It supports an EU objective, in the context of necessary reductions according to the IPCC by developed countries as a group, to reduce emissions by 80-95% by 2050 compared to 1990 levels."

We can make significant changes to our power system over the coming 40 years if we are determined. The decommissioning of ageing coal power plants over the next 40 years, and their replacement with renewable energy power plants, will need to mirror what happened to fuel oil power plants over the last 40 years - but with greater ambition and clear regulatory certainty. One advantage available to policy makers today is that there are many more renewable energy technologies available today than technologies available 40 years ago.

Europe is debating how our energy system should look in 2050. For the power sector, the EU commitment to reduce greenhouse gas emissions 80-95% means that it cannot emit any carbon by then. Due to the long lifetime of power plants, the commitment means that, ideally, no new carbon emitting power plant can be constructed after 2015, because it would continue to emit CO_2 after 2050.

While it is widely acknowledged that the power sector must move to zero carbon emissions by 2050, the direction for the period after 2020 is still unclear. Will we move to a carbon-free power system based exclusively on a mix of renewable energy sources, or do we combine these with construction of new nuclear power plants and fossil fuel plants with carbon capture and storage (CCS), were the technology to become available? A power system based on 100% renewables is both technologically and economically feasible to reach by 2050, as several studies have shown[5]. Whether it will happen is, in the end, a matter of political decisions made over the next five years.

5 The Future of the European Electricity Supply: Moving from Energy-Mix Projections to Renewables-Based Scenarios. Julia Hertin, Christian Hey and Franz Ecker (German Advisory Council on the Environment). 2010

Photo: Energypicturesonline

3 DEVELOPING EUROPE'S RENEWABLE ENERGY SECTOR 1997 - 2010

Since 1997, the European Union has had a successful renewable energy policy which has enabled significant progress to be made towards the EU's objectives of reducing greenhouse gas emissions, ensuring security of supply and improving EU competitiveness. Ambitious targets are at the core of the EU's policies to promote energy from renewable sources.

Due to the early adoption of ambitious national and EU targets, European companies are world leaders in wind power technology, and have a leading share of the world market. At the end of 2010 an installed capacity of 84 GW in the EU would, in a normal wind year, produce 181 TWh, thereby supplying 5.3% of the EU's electricity demand, and will avoid the emission of 126 million tonnes of CO_2 each year.

The 1997 White Paper

The European Commission White Paper of 1997 on Renewable Sources of Energy[6] set the goal of doubling the share of renewable energy in the EU's energy mix from 6% to 12% by 2010. It included a target of 40,000 MW installed wind power capacity in the EU by 2010, producing 80 TWh and saving 72 million tonnes of CO_2. The 40,000 MW were installed by 2005, five years ahead of the Commission's target year. Another target of the White Paper was to increase the share of electricity from renewable energy sources (RES-E) from 337 TWh in 1995 to 675 TWh in 2010. In 2009, the latest year for which data was available, 608 TWh of electricity was produced by renewable sources[7].

The 2001 Renewable Electricity Directive

The European Commission's White Paper was followed by Directive 2001/77/EC on the Promotion of Electricity from Renewable Energy Sources. At the time, it was the most important piece of legislation ever introduced for wind power and other renewables, and led the 27 Member States to develop frameworks for investment in renewables, and ways of overcoming administrative and grid access barriers.

The Directive set national indicative targets for the share of electricity from renewables as a percentage of gross electricity consumption. The overall goal set out in the directive was to increase the share of electricity coming from renewables from 14% in 1997 to 22% in 2010. With enlargement, the overall EU target was adjusted to 21% of electricity consumption.

Provisional Eurostat data for 2009 shows that already in 2009 about 19.9% (608 TWh) of Europe's total electricity consumption (3,042 TWh) came from renewable energy sources[8]. Hydro power contributed with the largest share (11.6%), followed by wind (4.2%), biomass (3.5%), and solar (0.4%). This was an increase on 2008, when electricity generation from renewable energy covered 16.6% (558 TWh) of gross electricity consumption[9], at 3,357 TWh.

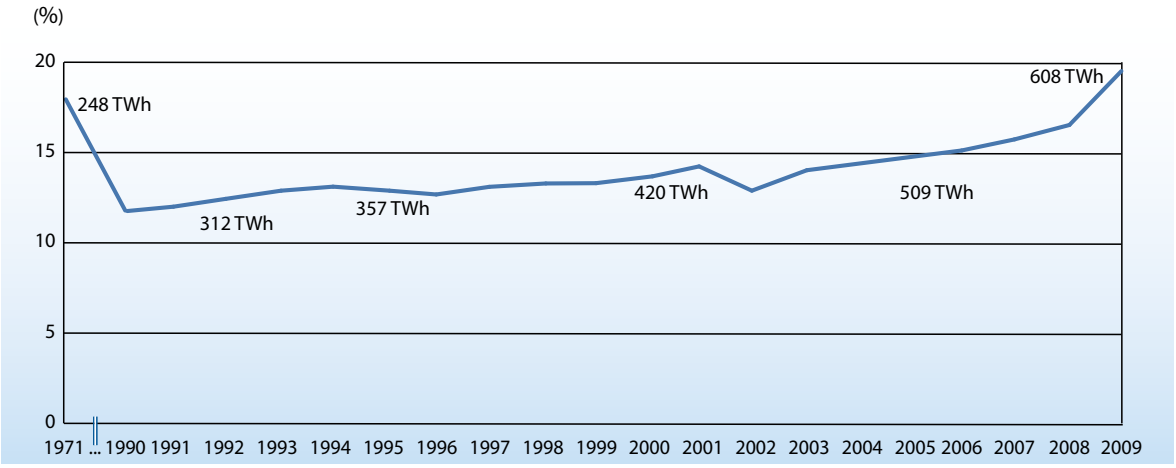
6 European Commission (COM(1997) 599 final): Communication for the Commission. "Energy for the future: Renewable sources of energy. White Paper for a Community Strategy and Action Plan. 1997".

7 "Renewable Energy Snapshots 2010". Hans Bloem, Fabio Monforti-Ferrario, Marta Szabo and Arnulf Jäger-Waldau http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/14436/1/reqno_jrc59050_re_snapshots_eur_2010.pdf%5b1%5d.pdf

8 "Renewable Energy Snapshots 2010". Hans Bloem, Fabio Monforti-Ferrario, Marta Szabo and Arnulf Jäger-Waldau http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/14436/1/reqno_jrc59050_re_snapshots_eur_2010.pdf%5b1%5d.pdf

9 Eurostat 56/2010 http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-SF-10-056/EN/KS-SF-10-056-EN.PDF

FIG 2: RENEWABLE ELECTRICITY'S SHARE OF TOTAL EU27 ELECTRICITY CONSUMPTION 1971 - 2010 (%)

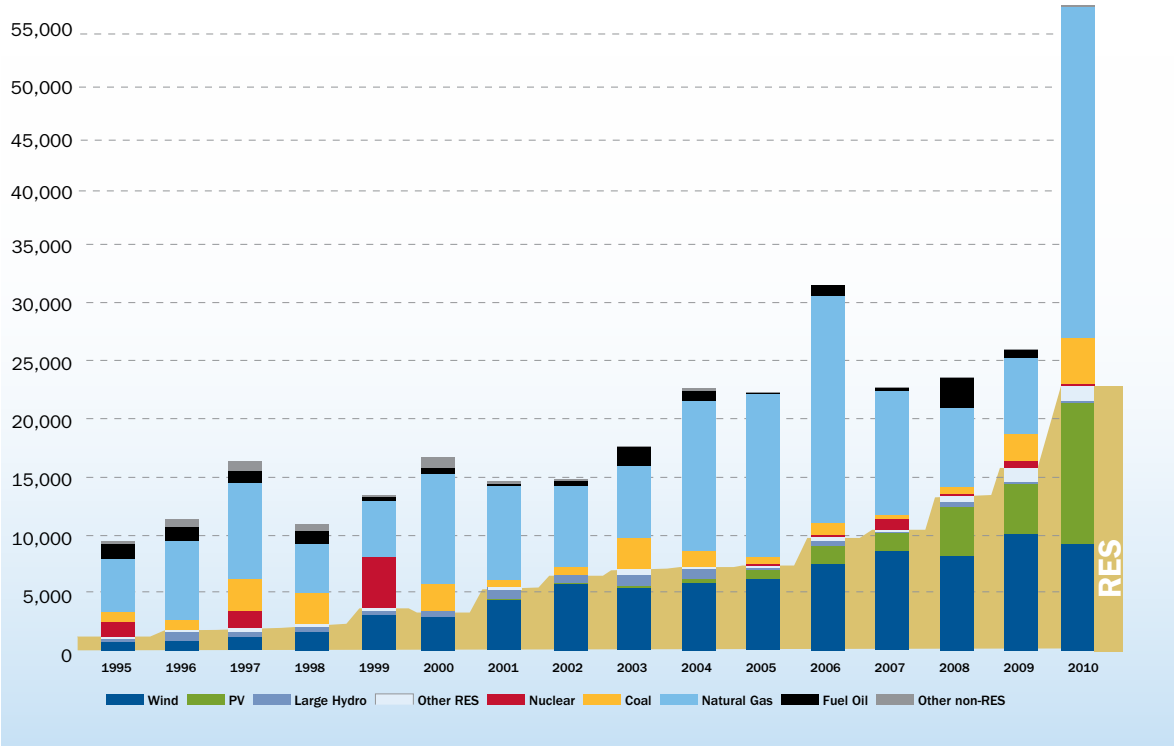


Source %: 1971 3E; 1990 - 2008 Eurostat; 2009 EWEA assumption; 2010 NREAPs
Source TWh figures: EWEA estimation based on above sources

Renewable power installations continue to increase

The increase in electricity generated from renewable sources is a result of the fact that a majority of newly installed generating capacity is renewable. In 1995, new renewable power installations totalled just 1.3 GW (representing 14% of total EU power installations that year). Since 1995 they have gradually increased to 13.3 GW in 2008 (57% of total EU power installations that year), and 17.3 GW in 2009 (63% of total EU power installations that year). During 2010, a record 22.7 GW was installed. However, due to an exceptional year in new gas installations, the renewable share of new capacity was 41%.

FIG 3: NEW INSTALLED CAPACITY PER YEAR 1995 - 2010 (MW)



The decarbonisation of Europe's energy supply

The net growth in the last 11 years of natural gas power (118.2 GW), wind power (75.2 GW) and solar PV (26.4 GW) was at the expense of fuel oil (down 13.2 GW), coal (down 9.5 GW) and nuclear (down 7.6 GW). The EU power sector, therefore, continues to replace ageing fuel oil, coal and nuclear power plants with modern technology, whilst at the same time increasing its total installed capacity to meet increasing demand.

FIG 4: NET ELECTRICITY GENERATING INSTALLATIONS IN EU 2000 – 2010 (MW)

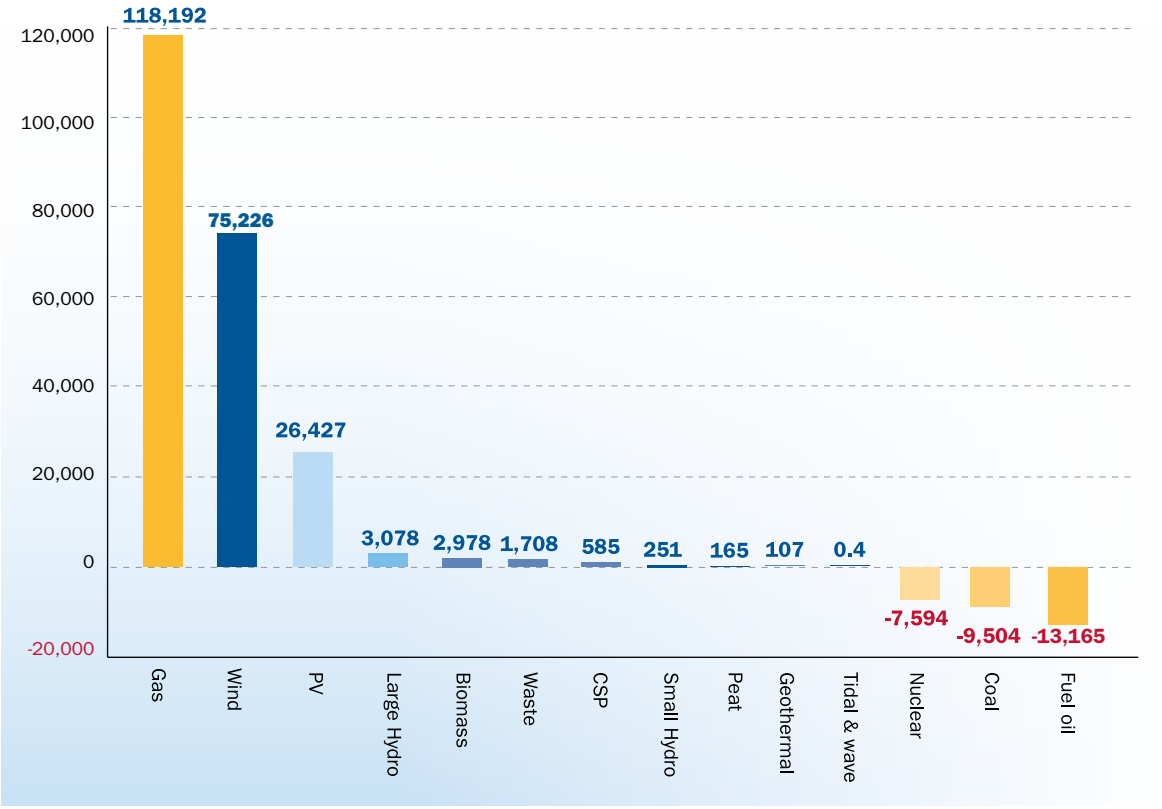


Photo: Siemens

4 THE IMMEDIATE FUTURE FOR RENEWABLE ENERGY IN EUROPE TO 2020

The 2009 Renewable Energy Directive

In order to continue the development and deployment of renewable energy technologies, the EU adopted the 2009 Renewable Energy Directive[10], which included a 20% renewable energy target by 2020 for the EU. The directive provides each Member State with a differentiated legally binding national target to reach the overall 20%, together with a requirement to put in place national policies in order to achieve that national target.

According to the National Renewable Energy Action Plans (NREAPs) that EU Member States submitted to the European Commission in 2010, it is clear the vast majority of Member States are taking their responsibilities seriously. According to the NREAPs, the EU-27 will exceed its target of meeting 20% of its gross final energy consumption from renewable sources by 2020. Taken together the NREAPs show that the EU-27 will meet 20.7% of its 2020 energy consumption from renewables.

Fifteen Member States plan to exceed their national target, led by Bulgaria at +2.8% above its target, Spain (+2.7%), Greece (+2.2%), Hungary (+1.7) and Germany (+1.6%). Ten Member States will meet their national target, and just two Member States, Luxembourg (-2.1%) and Italy (-0.9%), have informed the European Commission that they envisage using the co-operation mechanisms to meet their national targets.

It is encouraging that 25 of the 27 EU countries intend to either exceed or meet their target. This shows the vast majority of EU countries clearly understand the benefits of deploying renewable energy technologies, particularly wind power.

Converging expectations for 2020

It is increasingly clear that expectations for wind energy and other renewables in 2020 are converging – as highlighted below by EWEA, the European Commission's 'Trends to 2030' scenarios, the European Commission's Joint Research Centre, ENTSO, and the National Renewable Energy Action Plans.

EWEA[11]

EWEA's 2020 "baseline" scenario assumes 581 TWh of wind energy being produced, meeting 15.7% of EU electricity demand, from a total installed capacity of 230 GW of wind power. EWEA's 2020 "high" scenario assumes 680 TWh of electricity being produced from a total installed wind power capacity of 265 GW, meeting 18.4% of EU electricity demand.

10 Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

11 EWEA 2010. Consumption figure for 2020 taken from EC PRIMES 2010 (3,690 TWh).

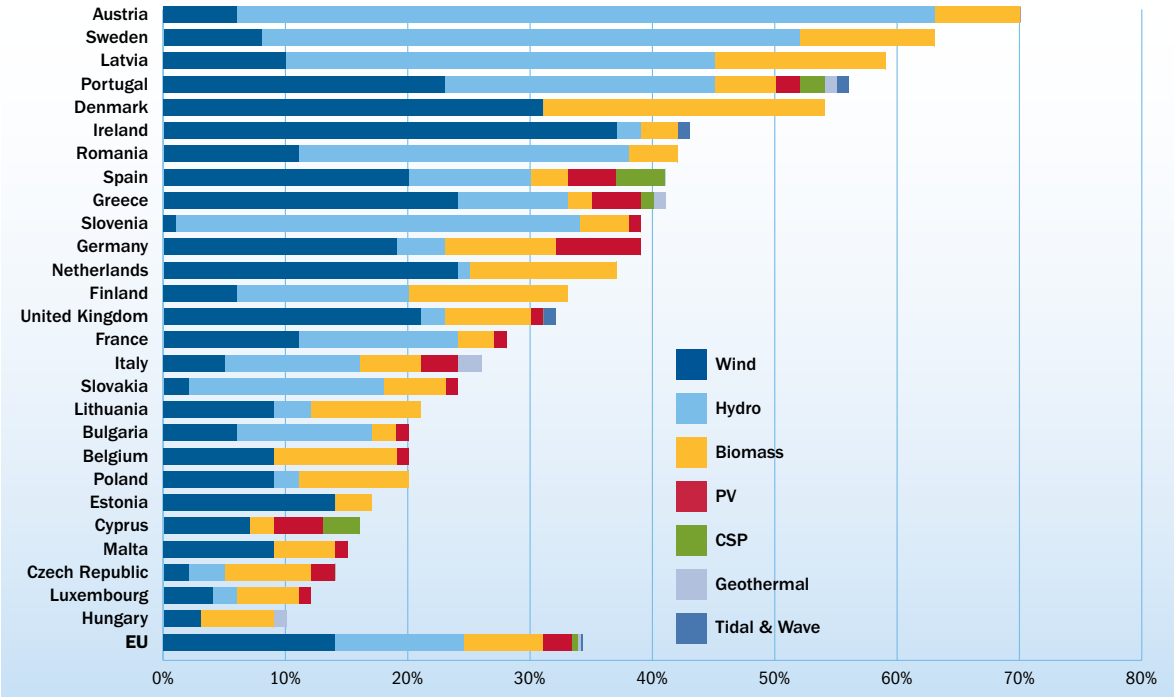
National Renewable Energy Action Plans[12]

In 2020, according to the Renewable Energy Directive's 27 National Renewable Energy Action Plans, 34% (1,199 TWh[13]) of the EU's total electricity consumption (3,529 TWh) will come from renewable energy sources. The 34% in 2020 consists of:

- Wind energy - 14% (494.7 TWh from 213 GW installed capacity);
- Hydro - 10.5% (370.3 TWh from 136 GW of installed capacity);
- Biomass - 6.7% (232 TWh from 43 GW of installed capacity);
- Solar PV - 2.4% (83.3 TWh from 84 GW of installed capacity);
- Concentrated solar power - 0.5% (20 TWh from 7 GW of installed capacity);
- Geothermal - 0.3% (10.7 TWh from 1.6 GW);
- Tidal, wave and ocean - 0.2% (5.8 TWh from 2 GW of installed capacity).

A detailed quantitative and qualitative analysis of the 27 NREAPs is set out in subsequent sections 6 and 7 of this report.

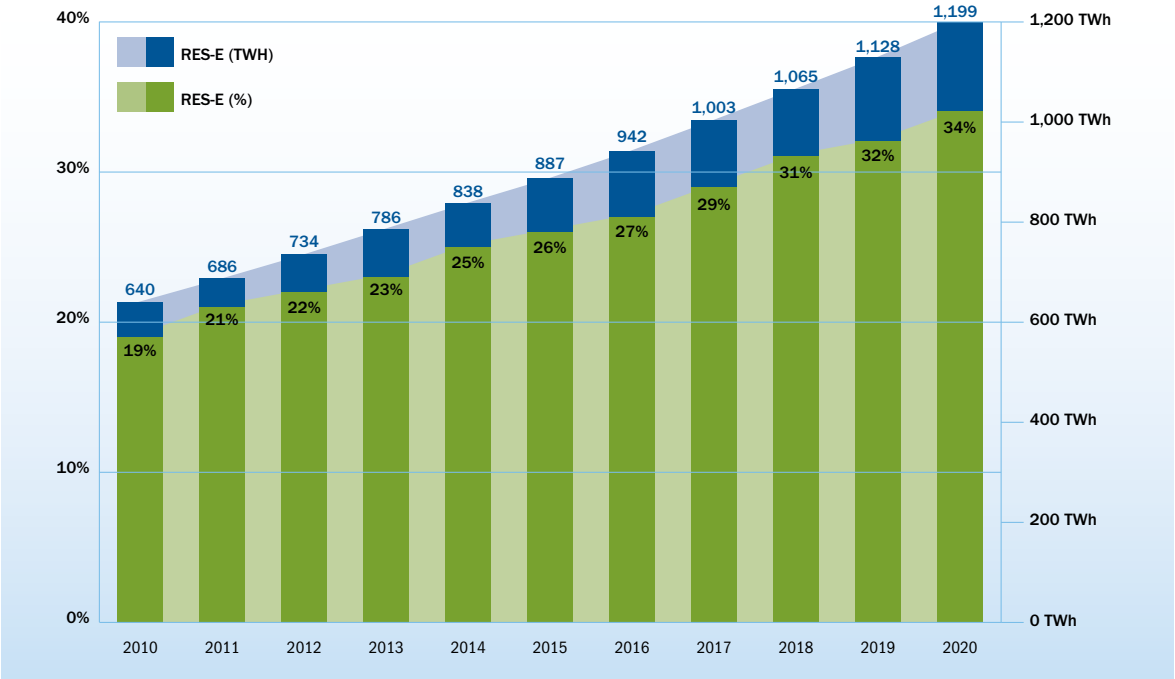
FIG 5: RENEWABLES' SHARE OF ELECTRICITY CONSUMPTION PER MEMBER STATE (%) IN 2020 ACCORDING TO THE NREAPS



12 http://ec.europa.eu/energy/renewables/transparency_platform/action_plan_en.htm

13 EWEA is aware of a discrepancy across the 27 NREAPs between renewable electricity production (1,217 TWh for EU-27) and Member States' reporting of "renewable energy contribution to final energy consumption" (the equivalent of 1,199 TWh expressed in Ktoe). This discrepancy can be due to, inter alia, rounding errors, miscalculations or Member States' taking grid losses into account. Therefore readers of this document and other analysis documents will come across the two different figures.

FIG 6: ELECTRICITY PRODUCTION FROM RENEWABLE ENERGY SOURCES ACCORDING TO THE NREAPS (EU-27)



European Commission – "EU Energy Trends to 2030"[14]

In September 2010, the European Commission published its new EU energy scenarios 'EU energy trends to 2030'. The scenario sees renewables generating 33% of electricity demand in 2020, with wind energy producing 14% (525 TWh from 222 GW installed capacity). The scenario expects 333 GW of new electricity generating capacity to be installed in the EU in the decade from 2011 to 2020. Wind power would account for 136 GW, or 41% of all new installations - by far the largest of any power technology. The Commission expects 64% of this total new capacity to be renewable energy, 17% gas, 12% coal, 4% nuclear and 3% oil.

Compared to its previous scenario from 2008, the European Commission has increased its expectations for EU wind energy capacity in 2020 by 85% from 120 GW to 222 GW.

European Commission - Joint Research Centre[15]

The European Commission's Joint Research Centre (JRC) estimates that "35 to 40% of the total electricity (3,200 – 3,500 TWh) has to come from Renewable Energy Sources in 2020 to meet the [EU renewable energy] target" and that, therefore, the "target corridor which has to be reached for electricity generation from Renewable Energy Resources is 1,120 – 1,400 TWh", up from 608 TWh in 2009.

The JRC concludes that "if the current growth rates […] can be maintained, up to 1,600 TWh (45 – 50%) of renewable electricity could be generated in 2020."

ENTSO-E

ENTSO-E in its Scenario Outlook and System Adequacy Forecast 2011 – 2025 sees renewables meeting a 36% share of consumption from 1,159 TWh in 2020.[16]

14 http://ec.europa.eu/energy/observatory/trends_2030/index_en.htm

15 "Renewable Energy Snapshots 2010". Hans Bloem, Fabio Monforti-Ferrario, Marta Szabo and Arnulf Jäger-Waldau http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/14436/1/reqno_jrc59050_re_snapshots_eur_2010.pdf%5b1%5d.pdf

16 Using its Top-down Scenario for the EU-27 for 2020 (excluding Malta) with a consumption of 3,221 TWh

Comparing the scenarios - 2020[17]

Using the ranges provided above by the European Commission's PRIMES model, ENTSO, the JRC and the NREAPs, between 33% and 50% of Europe's electricity will come from renewable energy in 2020. The range for wind energy, including EWEA's baseline scenario, the European Commission's PRIMES model, and the NREAPs, is producing between 495 TWh and 581 TWh (from an installed capacity of between 213 GW and 230 GW) meeting between 14% and 15.7% of the EU's electricity consumption. Renewables as a whole will be producing between 1,159 and 1,209 TWh, meeting between 32.6 and 36% of the EU's electricity consumption.

FIG 7A: EXPECTED GROWTH IN INSTALLED WIND POWER CAPACITY 2010 - 2020 (GW)

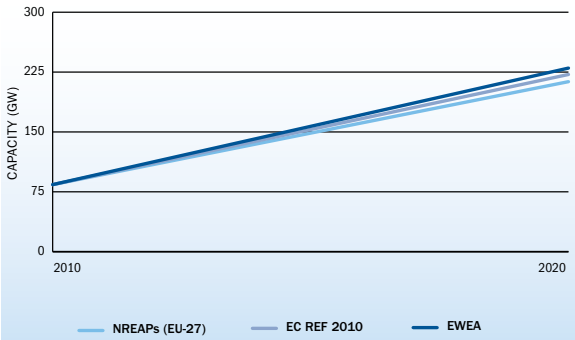


FIG 7B: EXPECTED GROWTH IN WIND ENERGY PRODUCTION 2010 - 2020 (TWH)

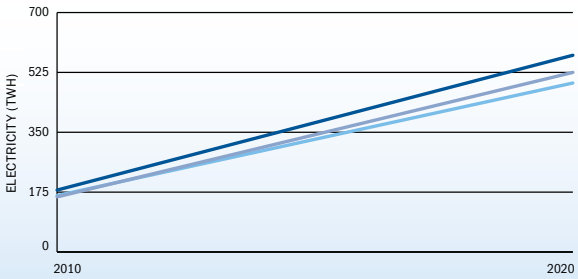


TABLE 1: WIND ENERGY SCENARIOS COMPARED: EWEA/EC PRIMES/NREAPS (EU-27) 2010 – 2050
TWH PRODUCTION/GW INSTALLED/SHARE OF ELECTRICITY CONSUMPTION (%)

	EWEA	EC PRIMES REF 2010	NREAPS (EU-27)
2010	181/84/5.3	161/86/4.9	165/82/5
2020	581/230/15.7	525/222/14.2	495/213/14
2030	1,155/400/28.5	694/280/17	
2050	2,015/600/50		

17 Consumption figures for 2020 vary from the NREAP figure of 3,529 TWh and PRIMES 3,795 TWh.

The SET – Plan: the European Wind Initiative[18]

The Strategic Energy Technology Plan (SET-Plan) is the technology pillar of the EU's energy and climate policy aiming to fight climate change, improve energy security, enhance Europe's competitiveness, and maintain technological leadership. As part of the SET-Plan, the European wind industry - together with the European Commission and Member States - has developed a ten year research and development programme called the European Wind Initiative (EWI).

The European Wind Initiative (EWI) is the high-tech roadmap to reduce the cost of wind energy. It will take the European wind industry to the next stage: it will develop the wind energy technology of the future, the necessary testing facilities, and streamlined manufacturing processes.

The EWI was launched in June 2010. Its implementation will pave the way for the large-scale deployment of wind energy worldwide, contribute to long-term European technological and market leadership.

The European Commission has highlighted that "more than 250,000 skilled jobs could be created" in the wind industry as a result. With a budget of €6 billion, approximately half of which will be provided by the industry, the strategic objectives of the EWI are:

- To maintain Europe's technology leadership in both onshore and offshore wind power;
- To make onshore wind the most competitive energy source by 2020, with offshore following by 2030;
- To enable wind energy to supply 20% of Europe's electricity in 2020, 33% in 2030, and 50% in 2050.

To reach these objectives, the EWI focuses on four main technology areas:

- New turbines and components;
- Offshore technology;
- Grid Integration;
- Resource assessment and spatial planning.

The EWI prioritises the following research activities:

- To ease the site assessment, and gather data for improved designs onshore and offshore;
- To develop the technology used in wind turbines, and their manufacturing - both for onshore and offshore - to reduce the cost of wind energy. A prototype of a large offshore wind turbine in the 10 - 20 MW range will be developed and demonstrated;
- To support the take-off of the offshore wind industry in the short to medium term and ensure long-term offshore technology leadership. This action is focused on turbine-support structures (including in deep waters), assembly, installation, operation and maintenance, decommissioning and environmental research;
- To enable the large-scale grid integration of onshore and offshore wind energy;
- To design the economic spatial planning instruments to deploy onshore and offshore wind energy technologies.

The implementation of the EWI requires a yearly investment of public and private resources of approximately €600 million (totalling €6 billion by 2020). It is therefore necessary to allocate the dedicated public funds in the current pre-2014 EU budgets as well as in the new EU financial period starting in 2014.

By doing so, the EU decision makers would show their commitment and political will towards the European wind industry, which will contribute significantly to meeting the EU's 2020 climate goals.

18 See The European Wind Initiative. Wind power research and development for the next ten years. A European Wind Energy Association briefing - June 2010. http://www.ewea.org/fileadmin/ewea_documents/documents/publications/EWI/EWI_2010_final.pdf

Photo: GWEC

5 BEYOND 2020: EU ENERGY POLICY 2020 – 2050

Science requires 80-95% emissions reductions by 2050

Four years after the IPCC's Fourth Assessment Report, scientific evidence shows an acceleration of climate change patterns and a deepening of the climate crisis: sea levels are rising, oceans are acidifying and ice caps are melting all much quicker than initially anticipated and current emission trends are steadily following the most serious of the IPCC scenarios, with dramatic implications. According to scientific evidence, the EU and other industrialised regions must reduce domestic greenhouse gas emissions by 25%-40% identified by the IPCC to give us a 50% chance of avoiding the 2°C temperature rise.[19] The cost of inaction is known to be much greater than the cost of early action. This recognition prompted EU Heads of State to agree to 80-95% emissions reduction by 2050.

Currently, the agreed framework for post-2020 consists of two elements: the Heads of States' commitment to reduce greenhouse gas emissions by 80-95% by 2050, and the directive on the EU Emissions Trading System, which will continue to reduce the emissions cap for the ETS sectors by 1.74% each year beyond 2020. Given the difficulty of reducing emissions to zero in sectors such as transport and agriculture, achieving the Heads of States' commitment is only certain if the power sector emits zero carbon well before 2050.

2050 may seem a long time from now but in the power sector, 2050 is only one investment cycle away, which means decision makers must act today and provide the markets with clear signals on technology choice. Due to the long lifetime of fossil fuel power plants, (35-45 years for coal and 30-35 years for gas[20]) the reality of the commitment made by Heads of State is that no new carbon-emitting power plant should be built after 2015.

Any post-2020 legislative framework should indicate the emission reduction pathway to reach 80-95% GHG reductions by 2050, including domestic greenhouse gas objectives for 2020 (of a 30% domestic reduction), 2030, 2040 and 2050 (of 80-95% domestic reduction). These pathways should be broken down by sector, including a carbon pathway for the electricity sector that reaches zero-carbon well before 2050. The pathways should be ambitious, achieve significant reductions earlier rather than later to give industry the right signals from the start, and enable Europe to achieve and then benefit from its first mover advantage in wind power and other renewable energy technologies.

The real power choice: the power sector as a priority

The pathway for the electricity sector should be accompanied by an analysis of the viable power technology mixes to follow the carbon pathway. It is crucial that this analysis takes into account the large amount of existing and ageing power plants that will be decommissioned over the coming decades. Necessary to achieving a zero-carbon power sector by 2050 is an EU regulatory framework for the post-2020 period. In order to provide the power sector with the necessary investment stability and predictability, the EU will need to decide during the course of the present Commission and Parliament – that is, by the end of 2014 - on a new regulatory framework for the power sector consisting of three key pillars:

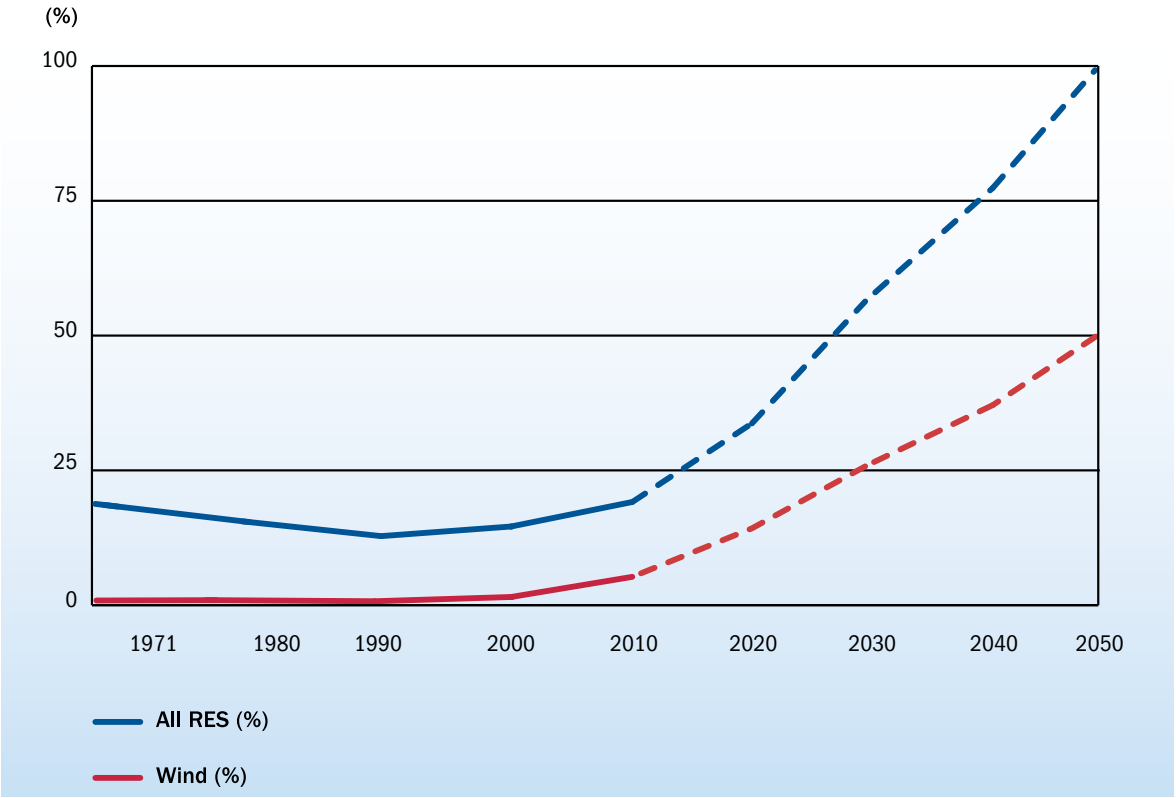
Core post-2020 pillar: ambitious, binding 2030 target for renewable energy

Given the proven success of the EU regulatory framework for renewables since 1997, EWEA considers the most effective post-2020 regulatory framework to be a binding 2030 renewable energy target. This would give the power sector a vital stepping stone, taking it from an expected 34% renewable electricity in 2020 to 100% renewables by 2050.

19 IPCC Fourth Assessment Report: Climate Chnage 2007 (AR4)

20 SRU German Advisory Council on the Environment. "Climate-friendly, reliable, affordable: 100% renewable electricity supply by 2050". Statement May 2010.

FIG 8: CONTRIBUTION OF ELECTRICITY FROM RENEWABLE ENERGY SOURCES AND WIND ENERGY 1970-2010 AND EXPECTED CONTRIBUTION 2011-2050 (% SHARE OF CONSUMPTION)



Sources: 1971-1989 3E/EWEA assumption; 1990-2008 Eurostat; 2009 EWEA assumption; 2010-2020 NREAPs; 2020-2030 EWEA (based on PRIMES consumption 2030); 2031-2050 EWEA

The EU's renewable energy policy - the 2001 Renewable Electricity Directive and the 2009 Renewable Energy Directive - is successfully transforming our power sector. Therefore the most effective post-2020 framework would be to replicate and continue the successful approach by setting an ambitious, binding 2030 target for renewable energy that is compatible with the necessary carbon reductions in the power sector.

Enhancing the post-2020 framework: an Emissions Performance Standard

The most effective way of ensuring a carbon-free power sector by 2050 would be to ban carbon emissions from new power plants installed after 2015. The simple way to do this would be to introduce a technology neutral Emissions Performance Standard (EPS) of zero g CO_2/kWh for new power plants, thereby letting the market decide the most cost efficient way of delivering carbon-free primary energy.

Given the challenge of developing a sufficiently flexible electricity system, the EPS could alternatively be set at around 350g CO_2/kWh in 2015, equivalent to the emissions of a new gas plant. The Standard should be gradually reduced for new plants over time in order to encourage progress in flexible gas plant technology.

Enhancing the post-2020 framework: tightening the Emissions Trading System (ETS)

Any post-2020 legislative framework should indicate the emission reduction pathway to reach 80-95% GHG reductions by 2050, including domestic greenhouse gas objectives for 2020 (of a 30% reduction), 2030, 2040 and 2050 (of 80-95% reduction).

Because of the low average price of carbon, and its fluctuation since the beginning of the ETS in 2005, analysts concur that the ETS mechanism has had, so far, close to no impact on the promotion of renewable energy technologies. On the other hand, renewables have had a major impact on the reductions in CO_2 achieved so far.

From the start of the EU ETS in 2005, and until 2010, 49,702 MW of new wind power capacity was installed, producing about 112 TWh of electricity annually, and avoiding 78 million tonnes (Mt) of CO_2 emissions. In 2010, the ETS annual cap was 2,083 Mt, down from 2,177 Mt of CO_2 in 2005, or a reduction of 94 Mt. Comparing these two figures, it is clear that new installed wind energy has been a main contributer to emissions reduction in ETS sectors during this period – equivalent to 83% of the total reduction.

Looking at EWEA scenarios for wind installed capacity to 2020, we estimate that emissions avoided by new wind power installed between 2005 and 2020 will be equivalent to 62% of the greenhouse gas reductions required by the ETS by 2020[21]. Given that these emissions are purely domestic, and given the 50% access to international credits currently, this represents 124% of the domestic ETS effort needed within the EU.

In order to establish an effective post-2020 framework, emission reductions should be increased from the current 20% to a 30% domestic reduction by 2020. There are three reasons for this.

Firstly, the IPCC stated that industrialised countries need to reduce domestic emissions between 25-40% by 2020 to give us a 50% chance of avoiding a 2°C temperature rise [22].

Secondly, the financial crisis has undermined the effectiveness of the ETS as a tool to shift Europe away from fossil fuels towards a renewable, zero-carbon power sector. Reduced electricity demand meant reduced production which in turn also meant reduced real emissions. Because real emissions were below the amount of freely allocated allowances companies received, it generated a surplus that could be sold or kept for later use, when auctioning makes emitting CO_2 more expensive. This has created vast windfall profits for heavy industry and cheap business-as-usual solutions for the power sector. To avoid oversupply on the carbon market and yet another price crash before 2020, the EU must raise the current GHG target to 30% domestic reductions by 2020.

Thirdly, reaching 2°C means that raising the cap to 30% domestic is necessary, since the current 20% reduction, which includes massive amounts of external credits, does not bring us on a path to an 80-95% economy-wide reduction, but merely to an 80% reduction in ETS sectors only. Compared with other sectors (such as agriculture and transport) it is easier to reduce emissions in the ETS sectors, and in particular the power sector. Therefore these sectors need to be carbon-free by 2050, to allow for unavoidable emissions in other sectors. Hence, a move to 30% domestic reductions by 2020 ensures that the defined linear factor (-1.74% emission reduction per year) brings us closer to 95% reduction by 2050.

While promoting renewables is not the main objective of the ETS, renewables, particularly wind power, have been so far the most efficient means of meeting the goal of the ETS: reducing emissions. Therefore, policies promoting renewables should be maintained and extended

21 The ETS requires a reduction of 21% compared to 2005 emissions.
22 IPCC 4th Assessment Report, 2007

alongside the ETS, as they will ensure that we reach our emissions reduction targets, regardless of any shortcomings of the ETS mechanism. It will also ensure that Europe develops a broad range of renewable technologies, including offshore wind. If the ETS were the sole driver for renewable energy investments, only the currently cheapest technologies would be deployed and developed, i.e. onshore wind and biomass, due to the structure of the mechanism, and Europe would lose the global race for renewable energy technology leadership. Revenue from the auctioning of EU allowances can provide ample resources to finance these new renewable targets, ideally within a coordinated EU strategy. 50% of auctioning revenue has already been earmarked for climate action[22]. It is essential that these new funds result in new funding opportunities, rather than disappearing into state budgets.

Critical to any post-2020 policy framework for the power sector is that companies which own or operate carbon-emitting power plants should fully bear the financial risk and cost of the early decommissioning of such power plants in order to meet the requirement of ambitious increasing greenhouse gas emission reduction targets for the power sector, reaching zero before 2050.

The successful post-2020 combination

Given the successful track record of the EU's past and existing renewable energy policies, it is clear that the most effective way of ensuring that the EU is able to continue reducing its greenhouse gas emissions beyond 2020 is to continue an existing, stable, predictable and successful EU policy by establishing a binding and ambitious renewable energy target for 2030. This policy should be complemented with other technology neutral policies - an ambitious EPS and ETS.

23 DIRECTIVE 2009/29/EC of the European Parliament and the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community

Transmission infrastructure, system operation and electricity market integration

An affordable 2050 zero-carbon power system is best achieved with a 100% renewable energy power system in Europe by that date. Wind energy alone could provide 50% of Europe's electricity by then. Wind power contributes to all of the EU's energy policy objectives – increased competitiveness, energy security and fighting climate change.

To achieve this level of ambition a number of actions need to be taken. Alongside an adequate transmission infrastructure, the power system will need to be operated more efficiently, and the electricity market run to take account, and advantage, of the low marginal costs and zero fuel and carbon cost of wind energy and other renewable sources. Both the development of physical infrastructure and market integration are therefore closely linked and must be carried out in a coordinated way.

For details on how EWEA sees the grid and its operation evolving in the years ahead please see "2050: Facilitating 50% Wind Energy. Recommendations on transmission infrastructure, system operation and electricity market integration"[24] and "Powering Europe: wind energy and the electricity grid"[25].

European renewable energy grid vision 2010-2050

Objective

In 2010, EWEA developed a grid map in order to depict the evolution of wind energy and other renewables in the European power system up to 2050. The maps overleaf identify the main renewable electricity production areas and consumption areas, and show where the major power corridors would be situated in an integrated electricity market.

The maps aim to outline the way to a 100% renewable, fully integrated European power system by 2050, provided that the necessary grid infrastructure is developed and the market is fully integrated.

The grid maps consist of maps for five different years: 2010, 2020, 2030, 2040 and 2050. Each of these maps shows the main production areas and consumption areas and the corresponding dominant power flows along the transmission corridors. In this way, the reader can analyse the evolution of the main power generation capacities, the principle transmission routes, and the dominant power flows of specific generation sources along those transmission routes over time.

24 EWEA 2010. "2050: Facilitating 50% Wind Energy. Recommendations on transmission infrastructure, system operation and electricity market integration" details how Europe's power system should develop over the coming years in order to integrate 50% wind energy penetration http://www.ewea.org/index.php?id=182

25 EWEA 2010. Powering Europe: wind energy and the electricity grid. http://ewea.org/fileadmin/ewea_documents/documents/publications/reports/Grids_Report_2010.pdf

Legend

The grid maps depict the evolution of renewable energy in the European power system up to 2050.

Production sources

The main on-land and offshore renewable energy producing areas are shown. Each source is represented by a different icon.


Onshore and offshore wind


Hydro

Ocean


Biomass


Solar

In order to indicate the general location of the generation sources, shaded bubbles have been incorporated into the map. These bubbles vary in size according to the relevance and penetration level of the corresponding generation source in the different areas and timeframes[26].


Wind energy production area

Hydro energy production area

Ocean energy production area


Biomass energy production area

Solar energy production area

The five countries with the highest electricity consumption were identified and a corresponding icon was added according to their approximate higher consumption area[27].


Main consumption area

Power corridors

The main transmission corridors[28] are coloured according to the dominant renewable energy source flowing across them; this does not mean that there are no other power production sources using those transmission routes.


Power corridor

26 The main sources of information were EWEA, OffshoreGrid, and the Greenpeace-EREC [R]evolution scenarios. Based on these sources, 3E identified the main types of power generation, their locations and possible penetration levels for the different years.

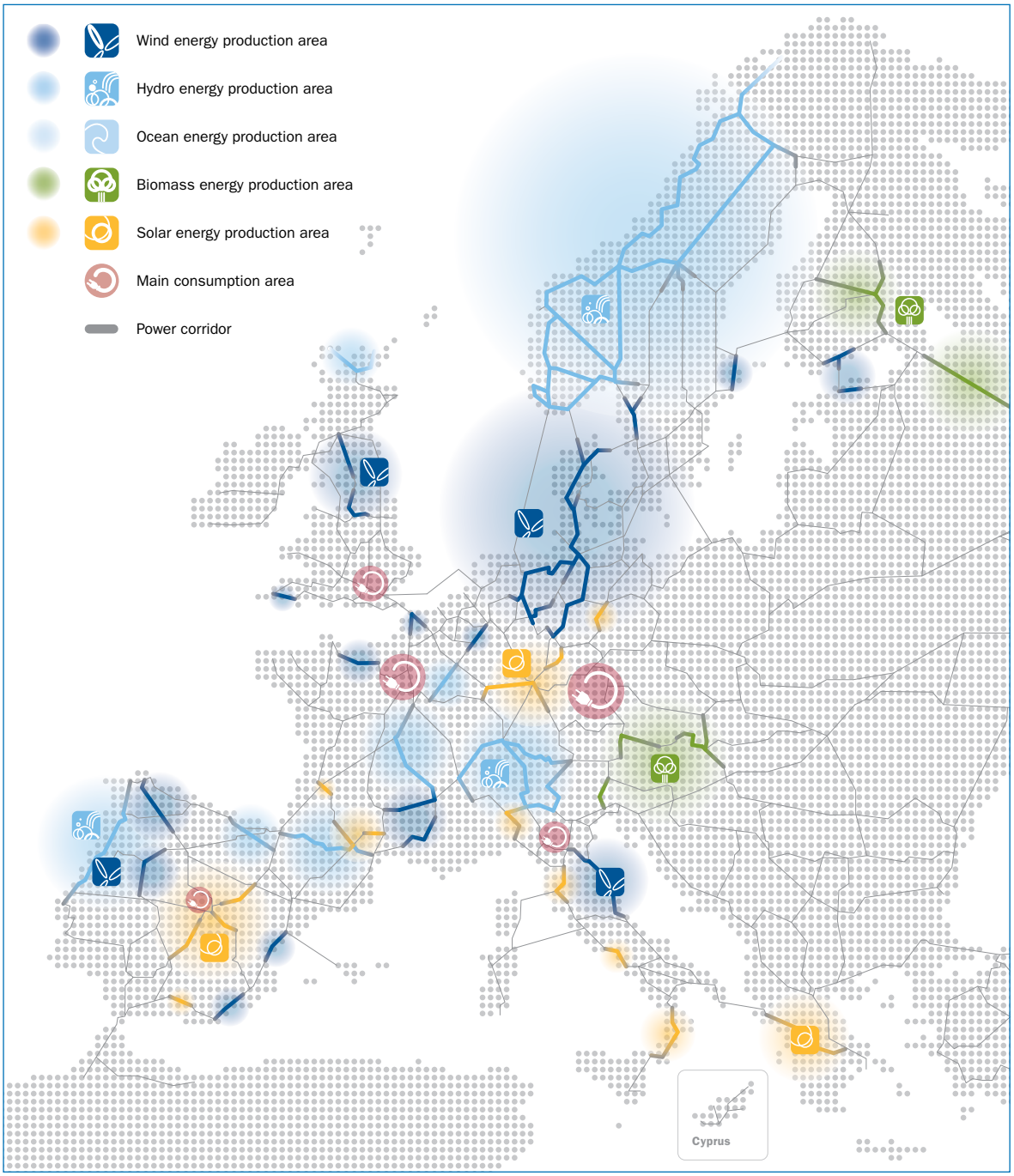
27 Data from European Commission, Directorate-General for Energy, EU Energy Trends to 2030 – Update 2009, ICCS-NTUA for EC, 4 August 2010.

28 Transmission lines were based on the current UCTE map, the ENTSO-E ten year development plan, and EWEA's 20 Year Offshore Network Development Master Plan.

European renewable energy grid

2010

This map shows the current role of renewable energy sources in a fragmented power system. After hydro, wind is the largest renewable power generation source,with around 4.8% of EU electricity demand. Wind energy already has a considerable share in the Northern German, Danish and Iberian power systems.

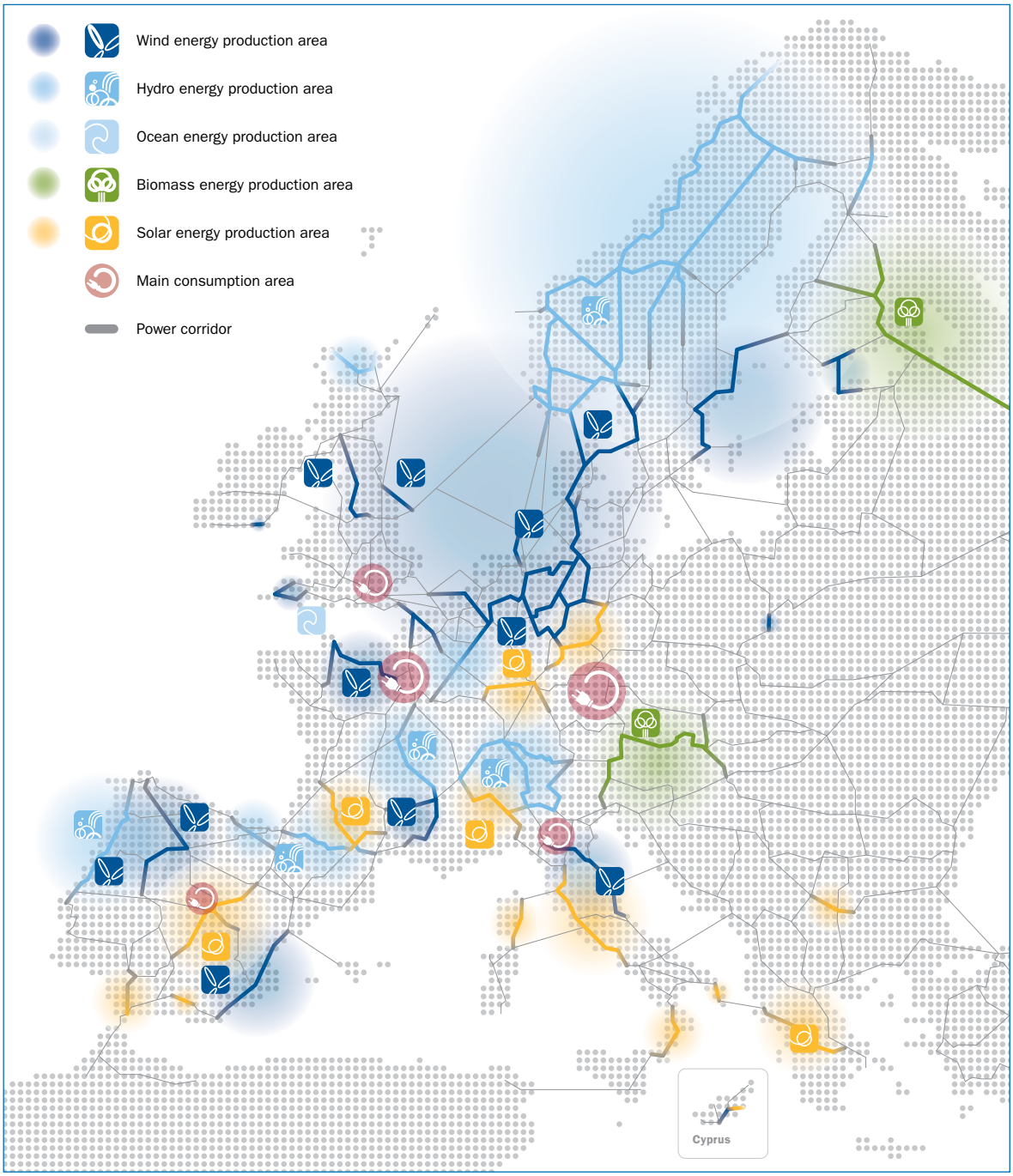


Design: www.onehemisphere.se

European renewable energy grid

2020

The map for 2020 – the target year of the 2009 Renewable Energy Directive - shows the increasingly important role of renewable energy. In 2020, 230 GW of wind power is expected to supply between 14 and 18% of EU electricity demand, of which 40 GW would be offshore. Wind energy becomes more significant in the North Sea neighbouring countries, the Baltic Sea and in the Iberian Peninsula.

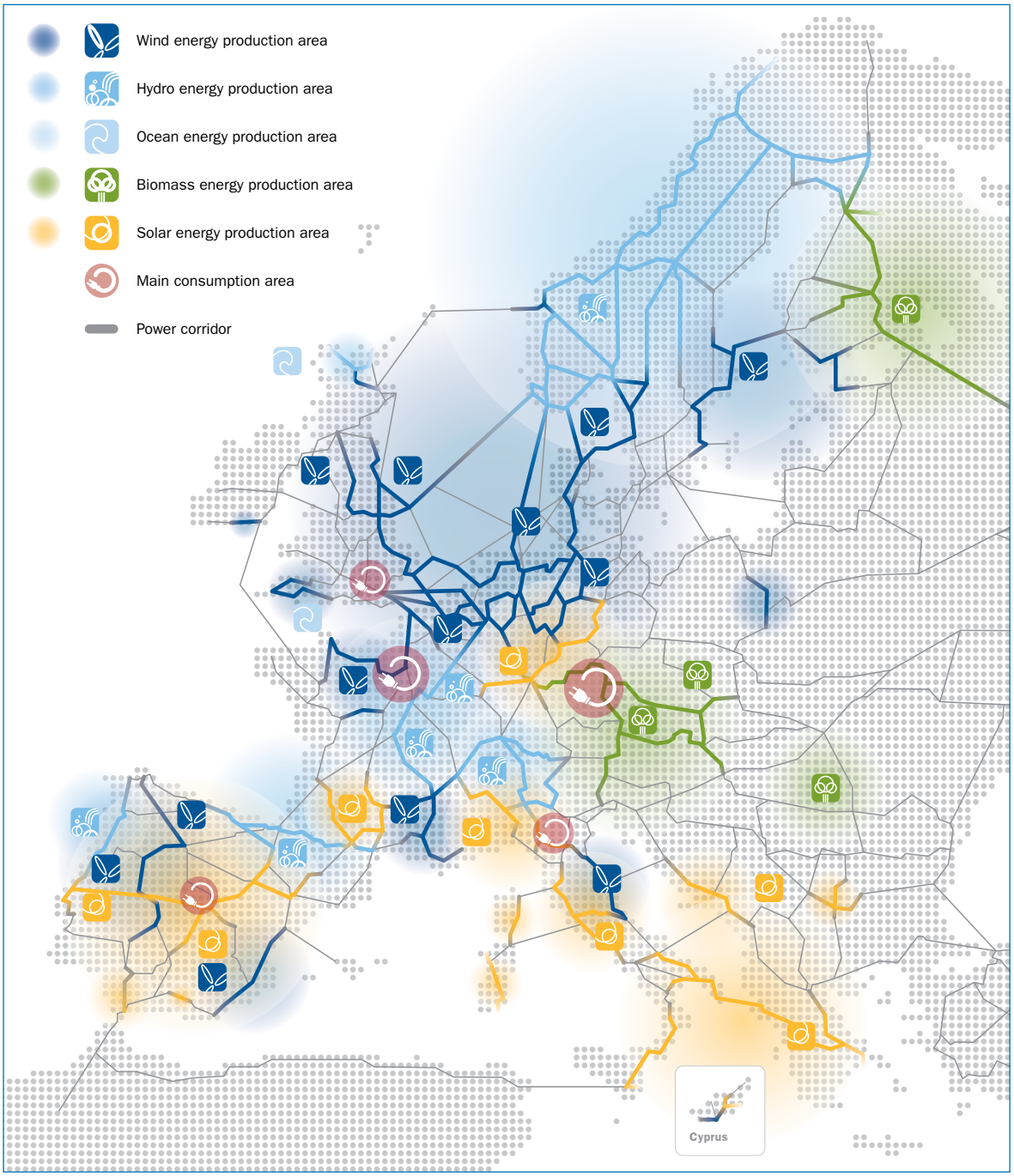


Design: www.onehemisphere.se

European renewable energy grid

2030

Renewable energy significantly increases from 2020 to 2030. This map shows the dominant role of wind power in the North Sea neighbouring countries, much facilitated by the development of the North Sea offshore grid. It also represents the growing role of photovoltaic (PV) and concentrated solar power (CSP) in the Southern European and biomass in Eastern European systems.

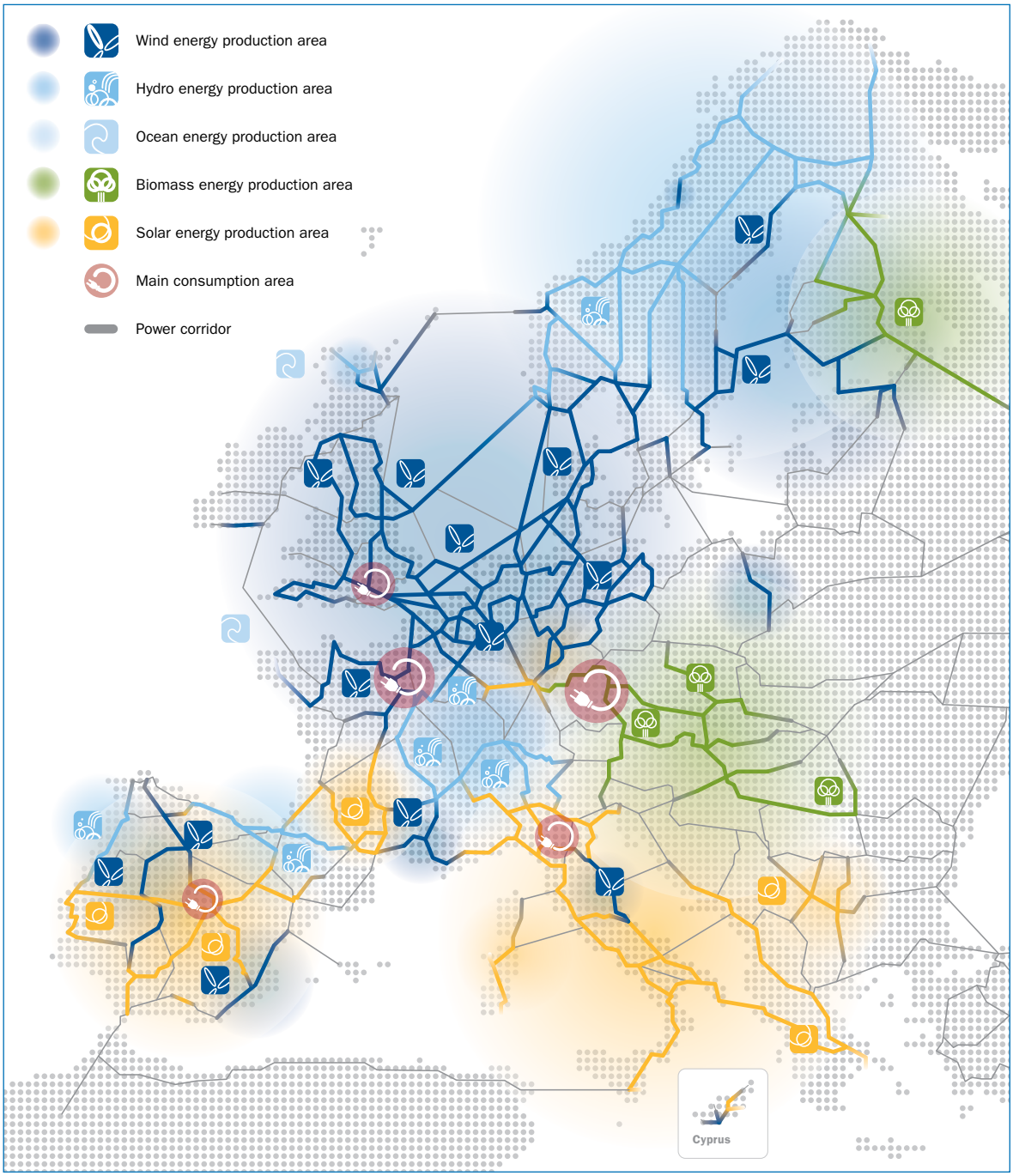


Design: www.onehemisphere.se

European renewable energy grid

2040

Due to increased power demand and a more integrated electricity market, renewable energy penetration levels increase significantly by 2040. Wind power in the North and Baltic sea neighbouring countries, hydro in Scandinavia and in the Alps, PV/CSP in Southern Europe, biomass in eastern Europe and marine renewables in the North Atlantic area, will all contribute.

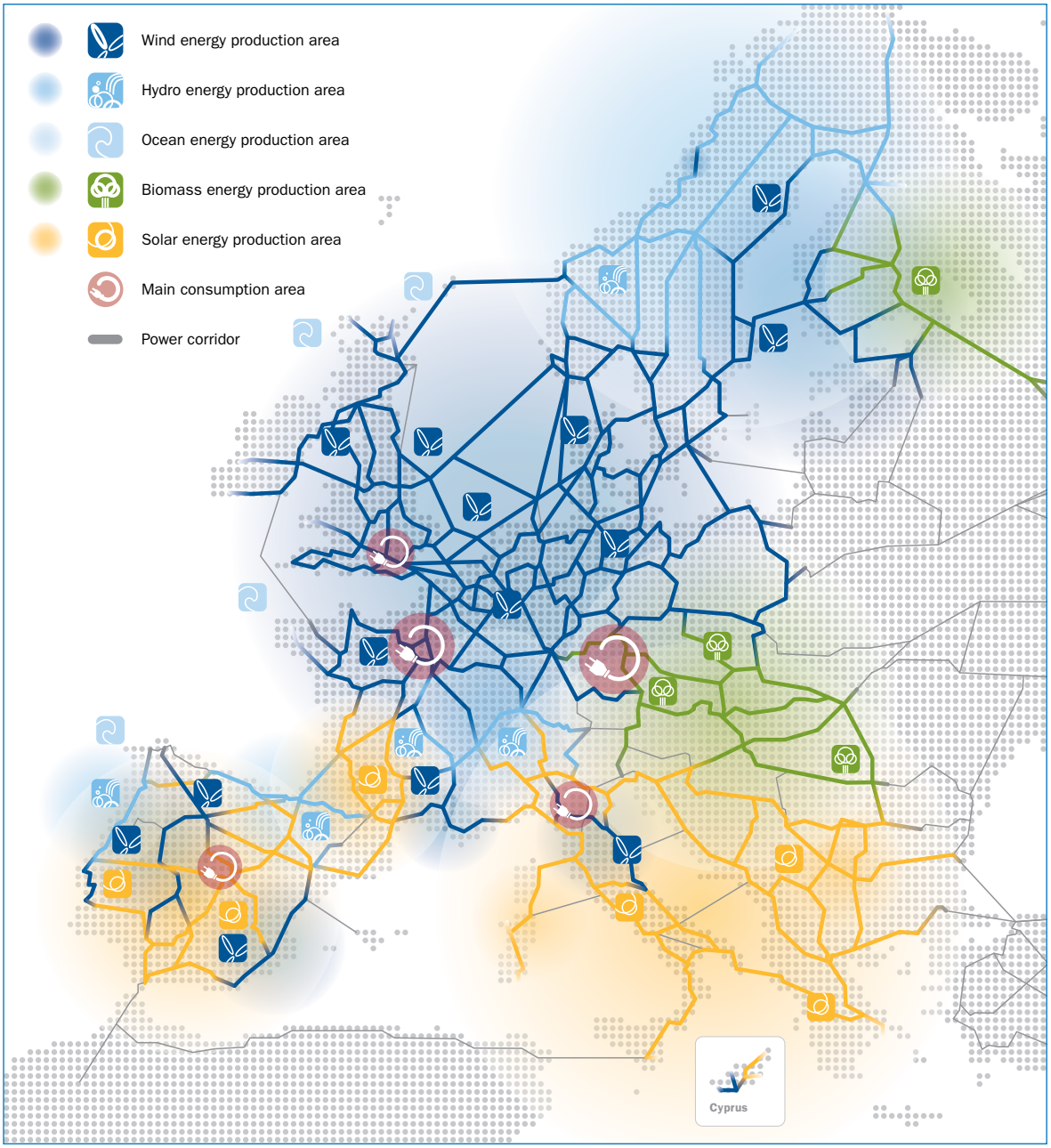


Design: www.onehemisphere.se

European renewable energy grid

2050

In 2050 the system operates with 100% renewables, with the necessary grid infrastructure in place and full market integration. Wind power will meet up to 50% of Europe's electricity demand, dominating in the North Sea and Baltic Sea areas, and the Iberian Peninsula, Southern France and Central Italy. Variable renewables will be balanced with hydro power production in Scandinavia, the Alps and the Iberian Peninsula. Photovoltaic and concentrated solar power will play a crucial role in the Southern European power market, and biomass generation in Central and Eastern European countries.



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6 NATIONAL RENEWABLE ENERGY ACTION PLANS: QUANTITATIVE ANALYSIS

The EU-27 NREAPs: key headline figures

- Renewable energy will meet 20.7% of the EU's energy needs in 2020, exceeding the EU's 20% target by 0.7 percentage points;
- Renewable energy will supply 1,217[28] TWh of electricity meeting 34% of Europe's total electricity demand in 2020;
- Renewable energy will supply 22.2% of heating and cooling, and 11.2% of transport;
- Wind energy will supply 14% (494.7 TWh from 213 GW installed capacity) of Europe's total electricity demand in 2020, up from 2.3% in 2005, and 5.3% in 2010;
  - Hydro will meet 10.5% of Europe's electricity demand (370.3 TWh from 136 GW of installed capacity);
  - Biomass will meet 6.7% of demand (232 TWh from 43 GW of installed capacity);
  - Solar PV will meet 2.4% of electricity demand (83.3 TWh from 84 GW of installed capacity);
  - Concentrated Solar Power will meet 0.5% of electricity demand (20 TWh from 7 GW of installed capacity);
  - Geothermal energy will meet 0.3% of electricity demand (10.7 TWh from 1.6 GW);
  - Tidal, wave and ocean energy will meet 0.2% of electricity demand (5.8 TWh from 2 GW of installed capacity).

Wind energy:

- Wind energy will supply 494.7 TWh of electricity meeting 14% of Europe's total electricity demand in 2020, up from 2.3% in 2005, and 5.3% in 2010;
  - Ireland will be the Member State with the highest wind energy penetration level in 2020 at 36.4% of its total electricity demand, followed by Denmark at 31%.
- Annual net installations of wind turbines will increase steadily from 11.5 GW in 2011 to 15.4 GW in 2020, an average increase of 3.1%;
  - The annual increase in onshore wind capacity will remain fairly constant, between 10 GW in 2011 to 8.9 GW in 2020, an average net decrease in installations of 1.5% per year
  - The annual net increase in offshore wind capacity will increase steadily from 1.1 GW in 2011 to 6.5 GW in 2020, an average net increase in installations of 21.5% per year
  - Onshore re-powering – which is not represented by the NREAPs – will, in EWEA's view, represent an increasing part of the annual market from 2010 onwards. The annual repowering market will grow by an average of 40.3% per year from 200 MW in 2011 to 4.2 GW in 2020
  - The annual wind power market – which is not made apparent by the NREAPs – would therefore grow by an average 6.1% per year from 11.6 GW in 2011 to 19.6 GW in 2020
- Cumulative installed capacity will more than double from 84.5 GW at the end of 2010 to reach 213.4 GW in 2020, a compound annual growth rate (CAGR) of 9.7% over 10 years;
  - Cumulative onshore capacity will increase steadily, from 92 GW in 2011 to 170 GW in 2020
  - Cumulative offshore capacity will increase steadily, from 3.7 GW in 2011 to 43.3 GW in 2020

Flexibility/cooperation mechanisms

Only two Member States indicate that they will not be able to meet their binding national target domestically: Luxembourg and Italy. However, their deficits (93 Ktoe and 1,127 Ktoe respectively in 2020) remain marginal compared to the surpluses forecast in the 15 Member States that indicate they will exceed their targets (8,991 Ktoe).

28 EWEA is aware of a discrepancy across the 27 NREAPs between renewable electricity production (1,217 TWh for EU-27) and Member States' reporting of "renewable energy contribution to final energy consumption" (the equivalent of 1,199 TWh expressed in Ktoe). This discrepancy can be due, inter alia, to rounding errors, miscalculations or Member States' taking into account grid losses. Therefore readers of this document and other analysis documents will come across the two different figures.

Renewable energy targets

Taking the National Renewable Energy Action Plans together, the EU's 20% renewable energy target by 2020 would be exceeded by 0.7 percentage points.

TABLE 2: NATIONAL RENEWABLE ENERGY TARGET (DIRECTIVE 28/2009/EC)

	SHARE OF ENERGY FROM RENEWABLE SOURCES IN FINAL CONSUMPTION 2005	EU TARGET: SHARE OF ENERGY FROM RENEWABLE SOURCES IN FINAL CONSUMPTION 2020	NREAP AGGREGATE SHARE OF RENEWABLE SOURCES IN FINAL CONSUMPTION 2020
EU	8.5%	20%	20.7%

Electricity from renewable sources represents the largest share of the overall target, forecast in the 27 NREAPs as meeting 34% of consumption. Heating and cooling is forecast at 22.2% and the 10% RES in transport target should be exceeded by 1.2 percentage points.

TABLE 3: SHARE OF RENEWABLES IN ELECTRICITY (RES-E), HEATING & COOLING (RES-H&C) AND TRANSPORT (RES-T) IN MEETING EU 2020 RENEWABLE ENERGY TARGET

RES-E	34%
RES-H&C	22.2%
RES-T	11.2%

The EU electricity mix

According to the National Renewable Energy Action Plans, wind energy will be the largest contributor to meeting the renewable energy targets in the electricity sector supplying 14% of EU electricity by 2020. The share of hydro in the electricity mix is set to drop slightly from its 2005 level, whereas onshore wind increases its penetration five-fold. The action plans forecast that biomass will meet 6.6% of electricity demand by 2020 and offshore wind 4% of EU electricity demand (a 65-fold increase compared to 2005).

FIG 9: EU ELECTRICITY MIX IN 2005 (SHARE OF TOTAL CONSUMPTION) – TOTAL 3,270.3 TWH

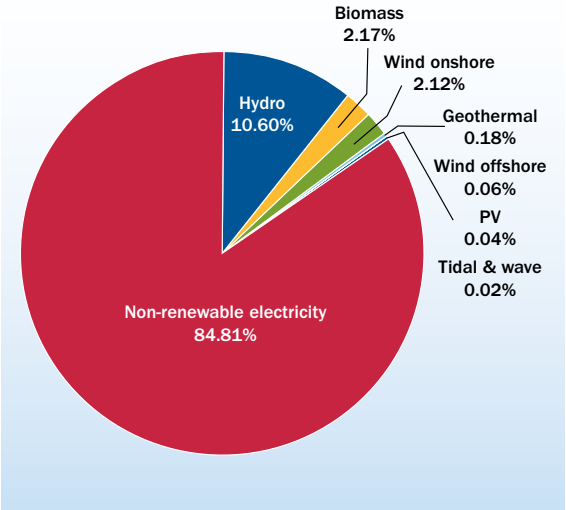
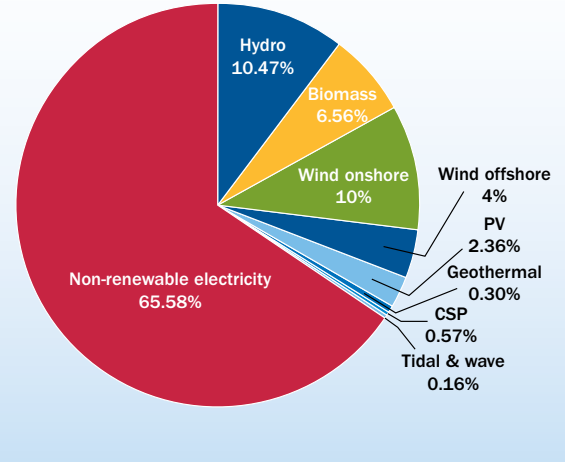


FIG 10: EU ELECTRICITY MIX IN 2020 (NREAP) (SHARE OF TOTAL CONSUMPTION) – TOTAL 3,537.3 TWH



The EU's renewable capacity mix 2005 – 2020

Onshore wind is set to have the largest installed capacity in the renewables sector (35% of total installed capacity) in 2020, followed by hydro at 28%. Solar photovoltaic installations will represent 17% of total renewable electricity capacity, followed by offshore wind and biomass. In all, total installed renewable electricity capacity is set to more than triple from 175 GW installed in 2005 to over 487 GW in 2020, including 213 GW of wind power capacity.

FIG 11: TECHNOLOGY SHARE OF EU INSTALLED RENEWABLE POWER CAPACITY IN 2005 (GW) - TOTAL 175.1 GW

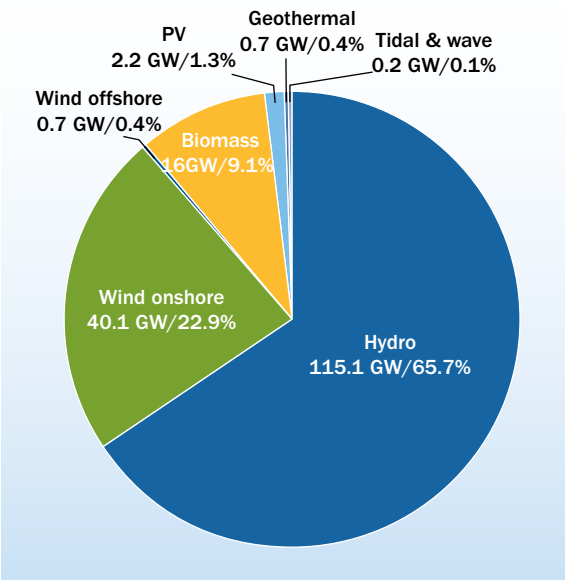
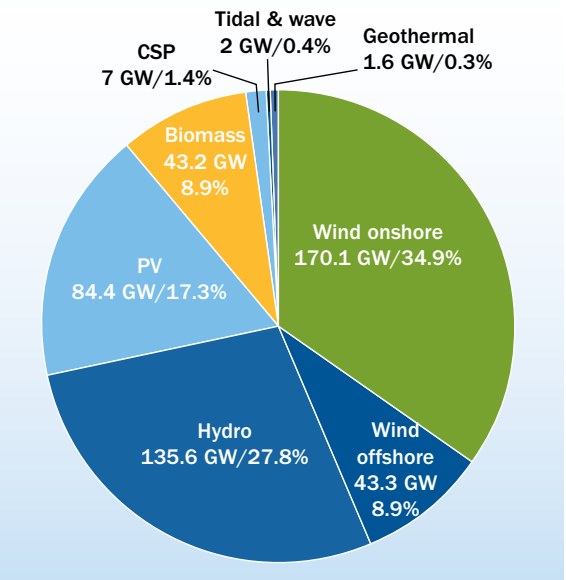


FIG 12: TECHNOLOGY SHARE OF EU INSTALLED RENEWABLE POWER CAPACITY IN 2020 (GW) – TOTAL 487.2 GW



Wind energy in the national power mix

According to the 27 renewable energy action plans, wind energy production will increase seven-fold from just over 70 TWh in 2005 to 495 TWh in 2020, meeting 14% of EU consumption.

Looking at the Member States individually, the Irish action plan shows wind meeting over 36% of the country's electricity demand. Denmark, currently the country with the largest wind energy penetration, is set to cover 31% of its electricity demand with wind power. Slovenia is the EU country with the smallest forecast penetration of wind power, with the NREAP assuming that only 1.3% of electricity consumption will be met by wind energy.

FIG 13: WIND POWER PRODUCTION IN THE EU – TWH/SHARE OF CONSUMPTION ACCORDING TO THE NREAPS

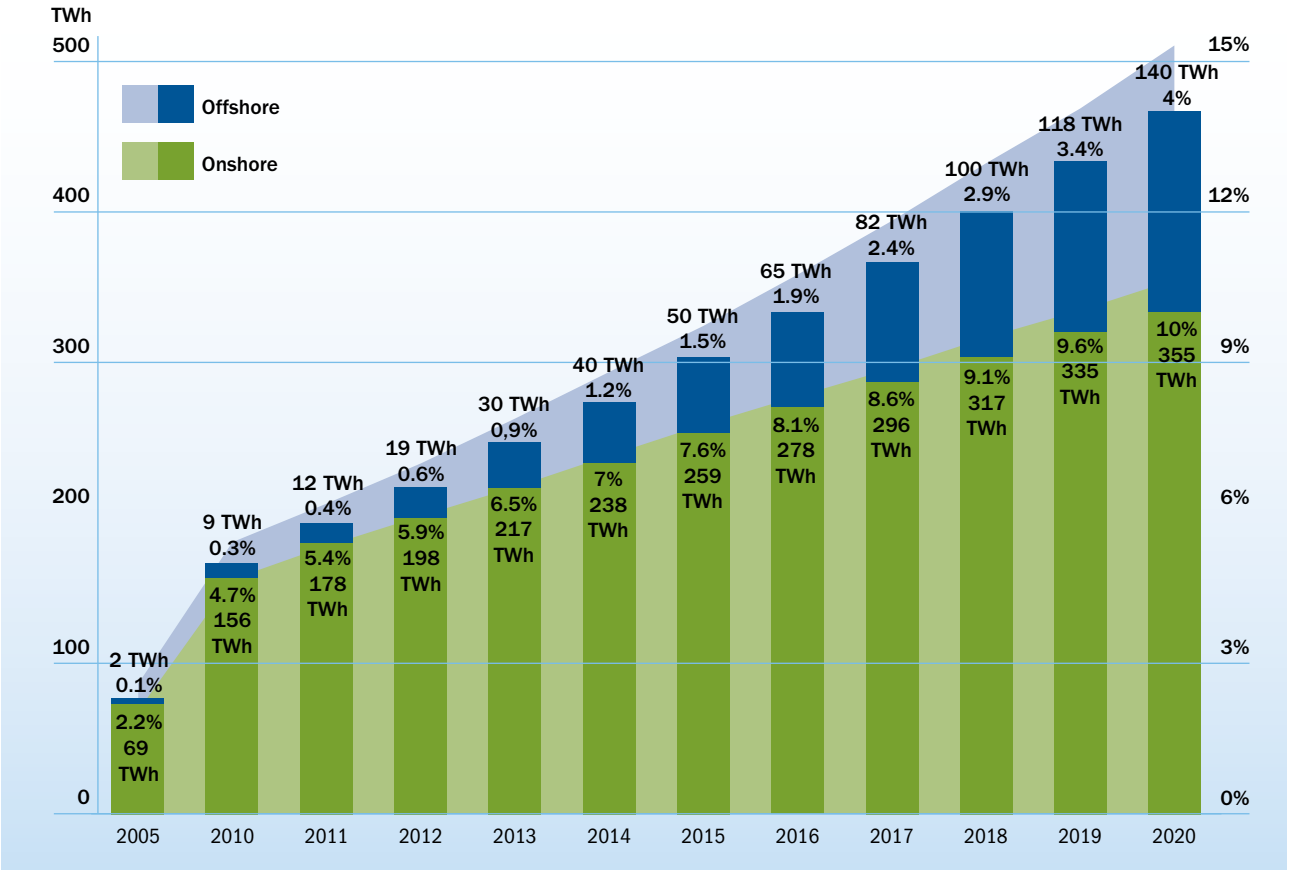
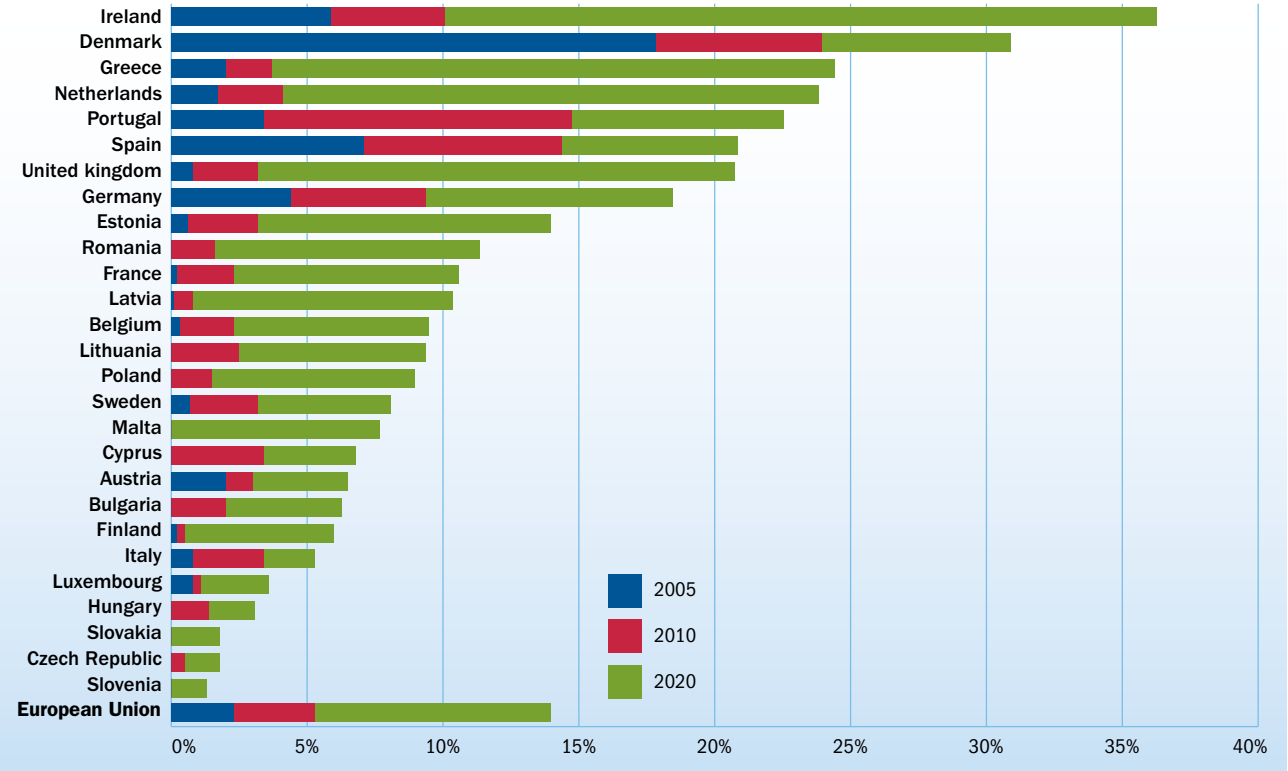


FIG 14: WIND ENERGY SHARE OF ELECTRICITY CONSUMPTION PER MEMBER STATE AND EU IN 2005, 2010 AND 2020



* 2005 and 2020 data from NREAPs, 2009 data is calculated on the basis of production in average wind year divided by energy supplied data from Eurostat, November 2010.

TABLE 4: WIND ENERGY SHARE OF ELECTRICITY CONSUMPTION PER MEMBER STATE AND EU

	2005	2010*	2020
Ireland	5.9%	10.1%	36.4%
Denmark	17.9%	24.0%	31%
Greece	2%	3.7%	24.5%
Netherlands	1.7%	4.1%	23.9%
Portugal	3.4%	14.8%	22.6%
Spain	7.1%	14.4%	20.9%
United kingdom	0.8%	3.2%	20.8%
Germany	4.4%	9.4%	18.5%
European Union	**2.3%**	**5.3%**	**14%**
Estonia	0.6%	3.2%	14%
Romania	0%	1.6%	11.4%
France	0.2%	2.3%	10.6%
Latvia	0.1%	0,8%	10.4%
Belgium	0.3%	2.3%	9.5%
Lithuania	0%	2.5%	9.4%
Poland	0%	1.5%	9%
Sweden	0.7%	3.2%	8.1%
Malta	0%	0%	7.7%
Cyprus	0%	3.4%	6.8%
Austria	2%	3.0%	6.5%
Bulgaria	0%	2.0%	6.3%
Finland	0.2%	0.5%	6%
Italy	0.8%	3.4%	5.3%
Luxembourg	0.8%	1.1%	3.6%
Hungary	0%	1.4%	3.1%
Slovakia	0%	0%	1.8%
Czech Republic	0%	0.5%	1.8%
Slovenia	0%	0%	1.3%

* 2010 data is calculated on the basis of provisional Eurostat data and may not be fully consistent with other figures in this document.

Renewable energy in the national power mix

Looking at the Member States individually, the Austrian action plan shows renewables meeting over 70% of the country's electricity demand. Hungary is the EU country with the smallest forecast penetration of renewables, with the NREAP assuming that only 11% of electricity consumption will be met by renewables.

FIG 15: RENEWABLE ELECTRICITY PRODUCTION PER MEMBER STATE IN 2020 - TOTAL 1,217 TWH

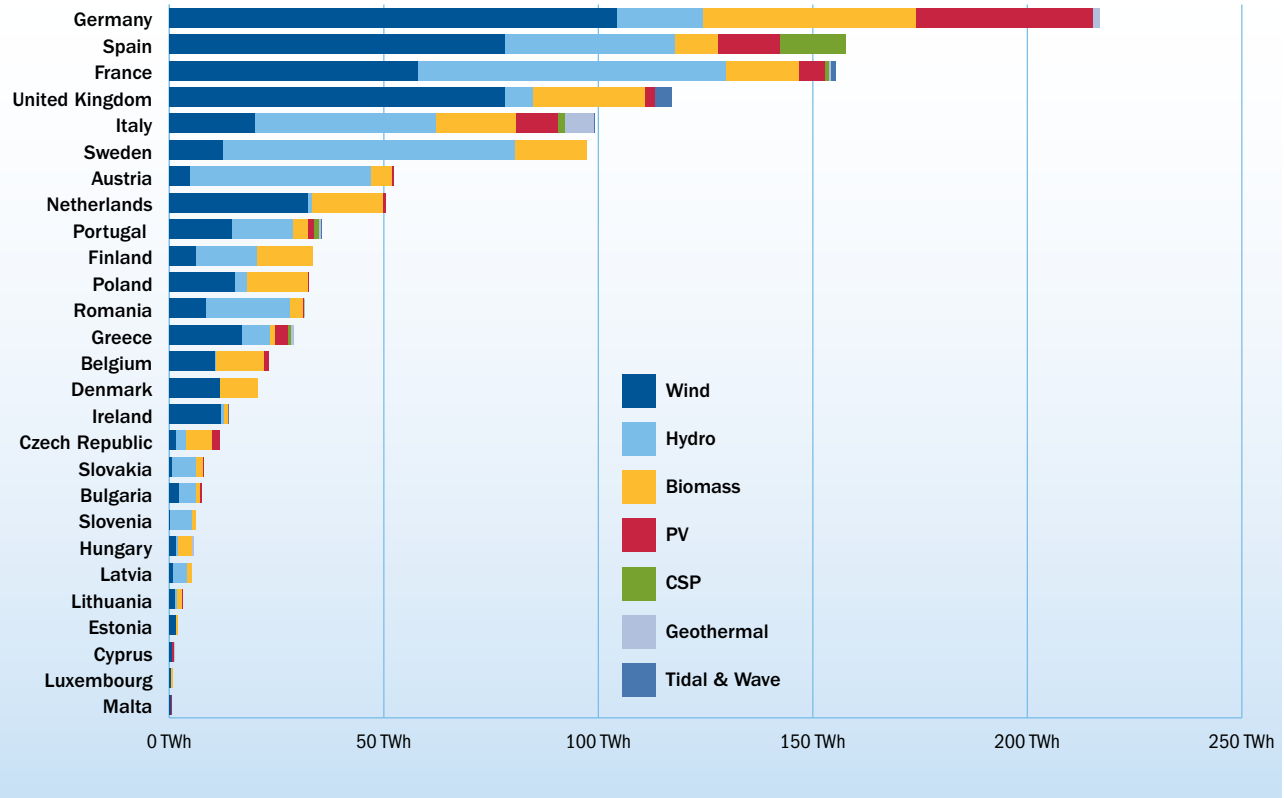


TABLE 4: RENEWABLE ELECTRICITY PRODUCTION PER MEMBER STATE IN 2020 (TWH)

MEMBER STATE	WIND	HYDRO	BIOMASS	PV	CSP	GEO-THERMAL	TIDAL & WAVE	TOTAL
Germany	104.43	20	49.46	41.39	0	1.65	0	216.9
Spain	78.3	39.6	10	14.3	15.4	0	0	157.6
France	57.9	71.7	17.2	5.9	1	0.5	1.2	155.4
United Kingdom	78.3	6.4	26.2	2.2	0	0	4	117.1
Italy	20	42	18.8	9.7	1.7	6.8	0.005	99
Sweden	12.5	68	16.7	0.004	0	0	0	97.2
Austria	4.8	42.1	5.1	0.3	0	0.002	0	52.3
Netherlands	32.4	0.71	16.7	0.57	0	0	0	50.4
Portugal	14.58	14.1	3.52	1.5	1	0.5	0.4	35.6
Finland	6.1	14.4	12.9	0	0	0	0	33.4
Poland	15.2	3	14.2	0.003	0	0	0	32.4
Romania	8.4	19.8	2.9	0.3	0	0	0	31.4
Greece	16.8	6.6	1.26	2.9	0.71	0.74	0	29
Belgium	10.5	0.44	11.04	1.14	0	0.03	0	23.1
Denmark	11.71	0.03	8.85	0.004	0	0	0	20.6
Ireland	11.97	0.7	1	0	0	0	0.23	13.9
Czech Republic	1.5	2.27	6.17	1.73	0	0.02	0	11.7
Slovakia	0.6	5.4	1.7	0.3	0	0.03	0	8
Bulgaria	2.26	3.95	0.87	0.45	0	0	0	7.5
Slovenia	0.2	5.1	0.7	0.1	0	0	0	6.1
Hungary	1.55	0.24	3.32	0.08	0	0.41	0	5.6
Latvia	0.91	3.1	1.22	0.004	0	0	0	5.2
Lithuania	1.25	0.47	1.22	0.02	0	0	0	3
Estonia	1.53	0.03	0.35	0	0	0	0	1.9
Cyprus	0.5	0	0.14	0.31	0.22	0	0	1.17
Luxembourg	0.24	0.12	0.33	0.08	0	0	0	0.8
Malta	0.26	0	0.14	0.04	0	0	0	0.4
EU	494.7	370.3	232	83.3	20	10.7	5.8	1,216.8

FIG 16: RENEWABLE ELECTRICITY SHARE OF CONSUMPTION PER MEMBER STATE IN 2020 (%)

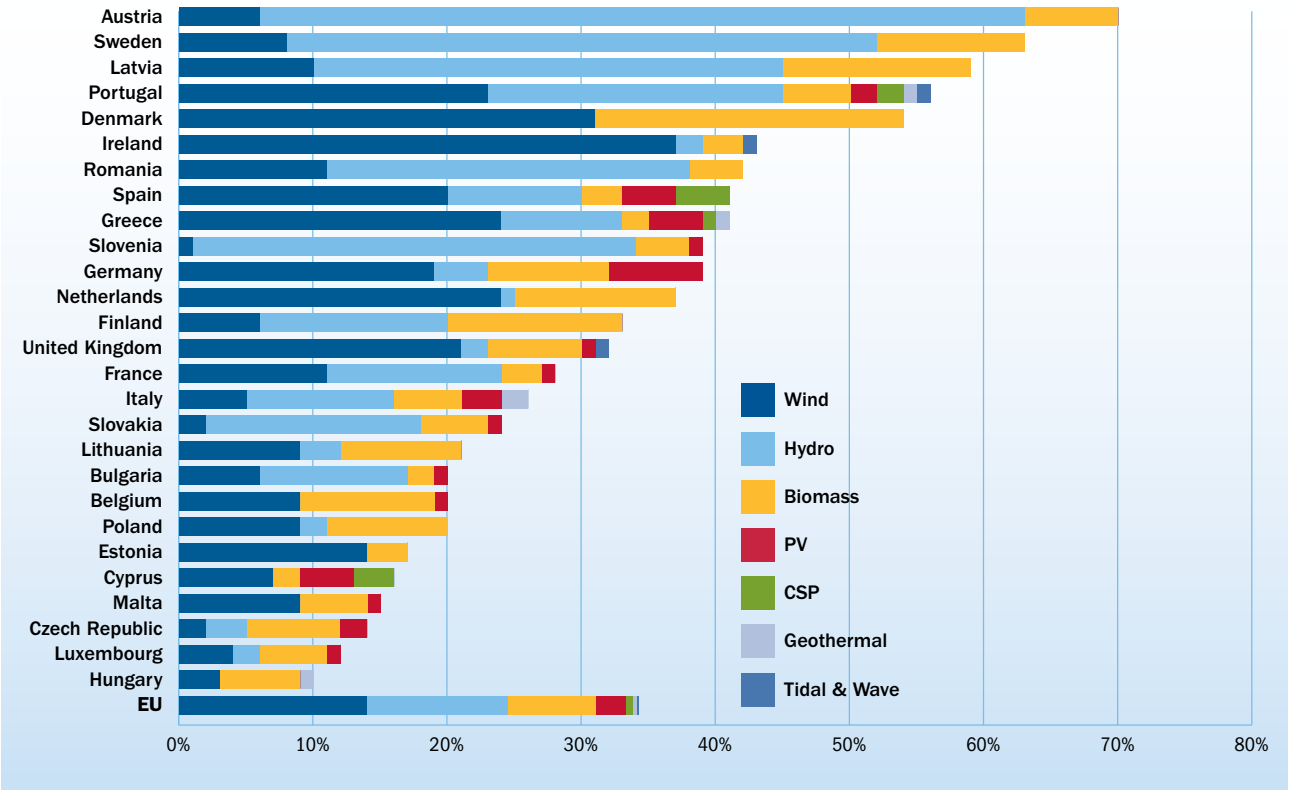


TABLE 5: **RENEWABLE ELECTRICITY CONSUMPTION PER MEMBER STATE (%)**

MEMBER STATE	WIND	HYDRO	BIOMASS	PV	CSP	GEO-THERMAL	TIDAL & WAVE	TOTAL
Austria	6%	57%	7%	0%	0%	0%	0%	70%
Sweden	8%	44%	11%	0%	0%	0%	0%	63%
Latvia	10%	35%	14%	0%	0%	0%	0%	59%
Portugal	23%	22%	5%	2%	2%	1%	1%	56%
Denmark	10%	0%	23%	0%	0%	0%	0%	33%
Ireland	37%	2%	3%	0%	0%	0%	1%	43%
Romania	11%	27%	4%	0%	0%	0%	0%	42%
Spain	20%	10%	3%	4%	4%	0%	0%	41%
Greece	24%	9%	2%	4%	1%	1%	0%	41%
Slovenia	1%	33%	4%	1%	0%	0%	0%	39%
Germany	19%	4%	9%	7%	0%	0%	0%	39%
Netherlands	24%	1%	12%	0%	0%	0%	0%	37%
Finland	6%	14%	13%	0%	0%	0%	0%	33%
United Kingdom	21%	2%	7%	1%	0%	0%	1%	32%
France	11%	13%	3%	1%	0%	0%	0%	28%
Italy	5%	11%	5%	3%	0%	2%	0%	26%
Slovakia	2%	16%	5%	1%	0%	0%	0%	24%
Lithuania	9%	3%	9%	0%	0%	0%	0%	21%
Bulgaria	6%	11%	2%	1%	0%	0%	0%	20%
Belgium	9%	0%	10%	1%	0%	0%	0%	20%
Poland	9%	2%	9%	0%	0%	0%	0%	20%
Estonia	14%	0%	3%	0%	0%	0%	0%	17%
Cyprus	7%	0%	2%	4%	3%	0%	0%	16%
Malta	9%	0%	5%	1%	0%	0%	0%	15%
Czech Republic	2%	3%	7%	2%	0%	0%	0%	14%
Luxembourg	4%	2%	5%	1%	0%	0%	0%	12%
Hungary	3%	0%	6%	1%	0%	1%	0%	11%

Wind power annual and cumulative installations

Adding up the 27 NREAPs, total wind power capacity increases from just under 84.5 GW in 2010 (actual 84.3 GW) to 213.4 GW in 2020. From 2.5 GW forecast in 2010 (actual 2.9 GW), 43.3 GW of offshore wind energy capacity is set to be operating by 2020.

The increase in onshore wind power capacity will peak in 2011 and then decline on average by just over 1.5% per year. The increase in offshore wind capacity, on the other hand, is forecast to grow steadily up to 2020 with annual increases starting at 1.1 GW in 2011 and reaching 6.5 GW in 2020; an annual increase in capacity of 21.5%.

Based on EWEA's calculations, onshore re-powering (the replacement of old turbines with new models) – which is not made apparent by the NREAPs - will represent an increasing part of the annual market from 2010 onwards. Re-powering hits 1 GW in 2015 and continues to grow steadily to over 4 GW by 2020. EWEA foresees no offshore repowering during the period.

In this document EWEA analyses the cumulative figures provided by EU member states in their National Renewable Energy Action Plans. The EWEA Members' Lounge provides more in-depth analysis of the individual NREAPs and is available to European policymakers and EWEA members only.

While much remains to be done to achieve the 20% target EWEA believes that it will be exceeded. Indeed, EWEA's "baseline" scenario assumes a total installed capacity of wind power in the EU by 2020 of 230 GW, producing 581 TWh of electricity, meeting between 15.7% and 16.5% of EU electricity demand. This compares to 213 GW installed capacity producing 494.7 TWh according to the NREAPs.

FIG 17: ESTIMATE OF THE TOTAL MARKET FOR WIND POWER 2011-2020 BROKEN DOWN BY ANNUAL NET ONSHORE AND OFFSHORE WIND POWER INSTALLATIONS IN THE EU AND EWEA ESTIMATE OF REPOWERING INSTALLATIONS IN THE EU (MW)

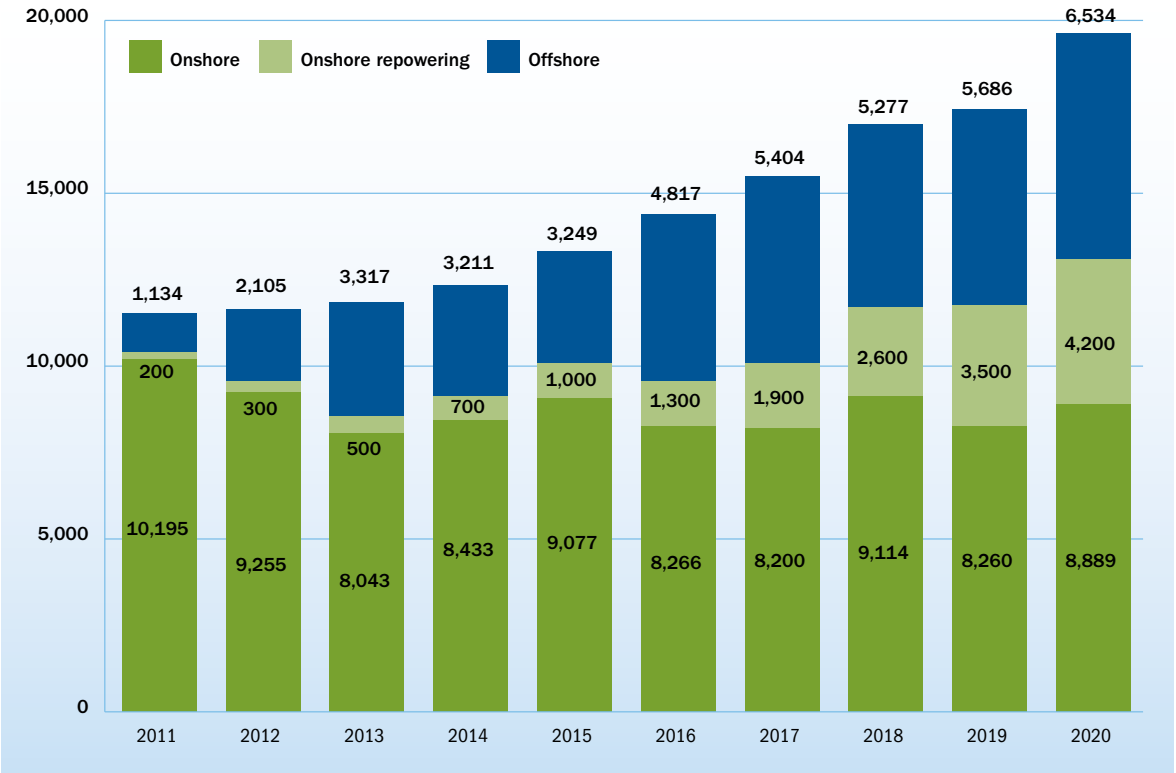
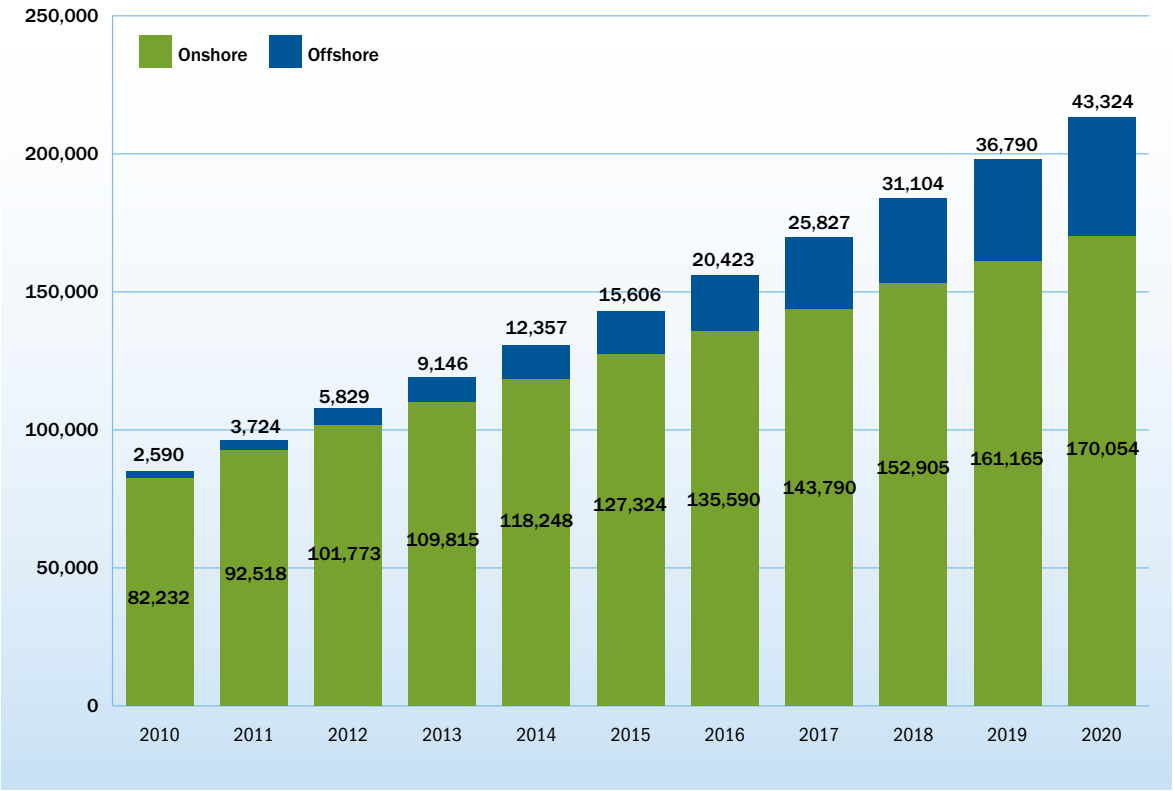


FIG 18: CUMULATIVE WIND POWER INSTALLATIONS IN THE EU (MW)



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7 NATIONAL RENEWABLE ENERGY ACTION PLANS: QUALITATIVE ANALYSIS

Introduction

Directive 28/2009/EC on the promotion of the use of energy from renewable sources sets each EU Member State a binding 2020 target for the share of renewables in gross energy consumption. The directive also sets each Member State an indicative trajectory to be followed between 2010 and 2020 to reach the final binding target.

Importantly, the directive requires each Member State to submit a National Renewable Energy Action Plan (NREAP) detailing all legislation affecting renewables (from spatial planning to grids and support mechanisms) and explain what measures will be taken to streamline procedures and generally promote energy from renewable energy sources.

The NREAPs, which follow a binding template, also indicate separate or 'sectoral' targets for electricity, heating, and cooling and transport. Within these sectoral targets, Member States are required to indicate the contribution of each renewable energy (RES) technology and its share of consumption estimated using a high energy efficiency scenario.

The following section gives a brief overview of the 27 NREAPs and how Member States' targets for wind compare with EWEA's 2009 forecast[29]. The 27 NREAPs differ significantly in quality and level of detail. However, it remains to be seen how Member States implement the planned measures to increase installed renewable energy capacity and whether they will exceed, reach or fall short of their targets.

Nevertheless, analysing the action plans, it is clear the EU-wide ambition for wind energy in 2020 is to reach over 213 GW cumulative capacity (of which 43 GW offshore), producing 495 TWh and meeting 14% of the EU's power consumption. Given the weaknesses identified in the national actions plans concerning potential wind power installations, in particular onshore, EWEA maintains its baseline scenario of 230 GW, and its high scenario of 265 GW.

29 Pure Power – wind energy targets for 2020 and 2030, EWEA (2009) http://www.ewea.org/fileadmin/ewea_documents/documents/publications/reports/Pure_Power_Full_Report.pdf

Austria

With large hydro resources, Austria intends to meet its overall 34% renewables (RES) target largely through the increase of renewables in the power mix. As such, Austria has set itself the highest target of electricity from renewables (RES-E) of any EU Member State: 71% in 2020.

Overall, the Austrian National Renewable Energy Action Plan expects to slightly exceed its 2020 target. However, as the authors of the document have increased the 2005 baseline by over 1 percentage point, the established indicative trajectory has become significantly easier to follow. The authors of the plan expect Austria to exceed 30% RES as early as 2010. The document does not foresee any use of cooperation mechanisms with other Member States.

According to the plan, with a cumulative installed capacity of 2.6 GW, wind should represent less than 10% of the RES-E target, covering just below 7% of total electricity consumption in 2020. This is significantly below EWEA's 2009 scenario, which put Austria's 2020 wind potential between 3.5 GW and 4 GW, meeting 9.5% to 11% of electricity consumption.

After several years of stagnation in the Austrian wind power market, the action plan expects a handful of new wind power megawatts to come online in 2010, increasing to over 220 MW by 2011. From 2012 onwards, the increase in net annual capacity is expected to diminish by 10 MW to 20 MW per year, reaching 107 MW annually in 2020.

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
34%	34.2%	71%	1,011 MW	2,578 MW	4.8 TWh	6.5%

Belgium

Belgium has an overall 13% RES target from 2020, up from just over 2% in 2005, the directive's base year. The National Renewable Energy Action Plan indicates that Belgium expects to be slightly above its indicative trajectory throughout, and end in 2020 producing a small excess of 5.4 Kilotonne Oil Equivalent (Ktoe). The Belgian authorities forecast that renewable electricity (RES-E) will represent the largest share of RES in 2020 (20.9%). With an annual production in 2020 estimated at 10.5 TWh, wind energy will cover 9.5% of all electricity consumption. RES in the heating and cooling sector (RES-H) is forecast at 11.9% and renewables in transport (RES-T) at 10.1%.

The NREAP does not respect the Commission's binding template and does not present an onshore/offshore breakdown for either installed capacity or power production. However, information obtained by EWEA suggests that Belgium's offshore wind target will be 2 GW by 2020.

Nevertheless, net annual wind installations are forecast to grow steadily from just over 200 MW in 2012 to over 480 MW in 2018, 2019 and 2020. It is estimated that by 2020, cumulative capacity will be 4,320 MW, matching EWEA's 2009 forecast.

In terms of legislative framework at both regional and national level, the NREAP does not announce significant changes with some new measures foreseen at regional level.

Given the recent growth in the wind energy sector, the NREAP's target seems easily achievable.

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
13%	13%	20.9%	911 MW	4,320 MW	10.5 TWh	9.5%

Bulgaria

Bulgaria's action plan highlights the country's desire to exceed its indicative trajectory and binding target by almost three percentage points - the biggest excess of any EU Member State. The Bulgarian authorities have clearly earmarked this excess for use in co-operation mechanisms with other Member States.

It may be difficult for Bulgaria to achieve its targets in the power sector (21% RES-E up from 11% in 2005), however, given the power mix forecast in the plan. According to the NREAP, more hydro capacity will be installed throughout the ten year period, yet it will apparently produce less electricity than before. Wind power will be the main new RES technology in the power mix, yet its capacity increase is unambitious - from just over 330 MW at end 2010 to 1,250 MW in 2020 (2.3 TWh) - and little solar and biomass capacity is planned.

Furthermore, the action plan forecasts virtually no increase in energy consumption from 2005 to 2020, and does not indicate whether the current feed-in system for RES will be extended beyond the current 2015 deadline.

With this in mind, the implementation of the Bulgarian National Renewable Energy Action Plan will need further development. Moreover, EWEA considers that by 2020, a cumulative wind capacity of 3,000 MW to 3,500 MW should be achieved.

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
16%	18.8%	21%	375 MW	1,256 MW	2.3 TWh	6.3%

Cyprus

With the introduction of a feed-in tariff for large wind power plants, the Cypriot National Renewable Energy Action Plan expects the largest contribution to the renewable electricity target to come from wind power in 2020.

The plan estimates that in 2020, 300 MW of new onshore wind power, producing 0.5 TWh, will cover 6.8% of total electricity consumption. In terms of installed capacity, the targets are in line with EWEA's 2009 scenario. However, the low capacity factors in the Cypriot document (averaging around 20%) may be underestimating wind's electricity production and share of the power mix.

Overall, the Cypriot action plan expects the country to meet its 13% RES target in 2020, with 16% RES in the power sector. The plan does not expect Cyprus to participate in co-operation mechanisms with other Member States.

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
13%	13%	16%	82 MW	300 MW	0.5 TWh	6.8%

Czech Republic

The Czech National Renewable Energy Action Plan forecasts that the country will exceed its 2020 13% RES target by half a percentage point. Electricity from renewables should represent 14.3% of consumption by then according to the plan, despite an almost 20% increase in electricity consumption from 2010.

The action plan banks on a net growth in wind capacity of 50 MW per year to 2020. Whereas such a capacity increase is consistent with past net average annual growth rates, it would result in an un-ambitious 2020 cumulative capacity of 743 MW; less than half of EWEA's scenario of 1,600 to 1,800 MW.

Consequently, the NREAP estimates that wind power will cover less than 2% of gross electricity consumption, well below EWEA's 3.4% to 3.8% estimate.

Although the NREAP is lower than EWEA's estimate, even its unambitious targets will be difficult to meet with the changes in the support mechanism and the insufficient simplification of the long authorisation procedures outlined in the plan.

Finally, the authors do not expect the Czech Republic to participate in co-operation mechanisms with other Member States or third countries.

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
13%	13.5%	14.3%	215 MW	743 MW	1.8 TWh	1.5%

Denmark

In 2020, the Danish Renewable Energy Action Plan expects almost 52% of total electricity consumption to be met by renewables. Almost 60% of this will be wind, with biomass, essentially, making up the rest. The NREAP thus indicates that Denmark is on track to meet and, indeed, exceed its 30% RES target by 0.4 percentage points. In the long term, Danish plans are for 100% renewables. The document indicates that the excess RES is available for use in co-operation mechanisms with other Member States.

Denmark's action plan focuses to a large extent on managing consumption, and only a very slight increase in electricity demand is expected between 2010 and 2020. Moreover, the plan indicates that future policies aim to reduce energy consumption in 2020 by 4% compared to 2006.

However, the Danish action plan forecasts a decrease in total installed onshore capacity from over 2,800 MW in 2009 to around 2,600 in 2020. This decrease is barely offset by the expected increase in offshore capacity which is forecast at 1,339 MW in 2020, up from 854 MW cumulative capacity at end 2010. Consequently, overall capacity increases are forecast up to 2013; beyond that, apart from small net capacity additions in 2016 and 2017, all other years see more capacity being decommissioned than put online.

The plan contrasts with EWEA's scenario, where capacity is expected to reach between 6 and 6.5 GW by 2020. The Danish action plan does not fully exploit the country's re-powering opportunities onshore and downplays the offshore potential. With over 850 MW of offshore capacity online at end 2010, a net capacity increase of less than 500 MW is foreseen. In February 2011, the Danish government published a more ambitious new energy strategy, which aims at meeting 40% of Denmark's 2020 electricity demand with wind.

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
30%	30.4%	51.9%	3,752 MW	3,960 MW	11.7 TWh	31%

Estonia

Estonia has a 2020 RES target of 25%. The National Renewable Energy Action Plan indicates that in the electricity sector renewables should reach 17.6%. Onshore and offshore wind are the main renewable energy technologies that will contribute to the target, and are forecast to cover 14% of total electricity consumption by 2020 (9% and 5% respectively).

With 400 MW of onshore wind power and 250 MW offshore planned for 2020, the Estonian NREAP is above EWEA's forecast of 500 MW. However, EWEA's scenario did not take into account offshore capacity in Estonia. Whereas it should not be problematic for Estonia to reach its onshore target, the offshore target seems more challenging, but feasible.

The build-out rates for wind energy are, on the other hand, uneven across the period with new annual capacity onshore peaking in 2012 at over 130 MW and subsequently dropping to less than 40 MW in 2013. No new onshore capacity is foreseen in the action plan after 2014. The first 100 MW of offshore capacity are programmed to come online in 2016.

The uneven onshore growth rate and the sudden stop foreseen in just four years' time do not ensure long-term stability in the wind energy sector.

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
25%	25%	17.6%	149 MW	650 MW	1.5 TWh	14%

Finland

The Finnish authorities submitted an incomplete National Renewable Energy Action Plan to the European Commission.

Nevertheless, the document indicates that Finland expects to meet its 2020 target of 38% RES. The power sector is forecast to meet 33% of electricity consumption from RES. To achieve this, a target of 2,500 MW of wind capacity is set, producing 6.1 TWh or 6% of total electricity consumption.

From 2011 to 2015, installed onshore wind power capacity is expected to grow by about 100 MW a year net. In the five subsequent years, net annual increase in wind capacity is forecast to be between 300 and 400 MW. The action plan does not expect any offshore wind installations by 2020 although some 26 MW of near-shore shallow water offshore capacity is currently grid connected in Finland.

The wind power target is consistent with EWEA's overall 2020 scenario for Finland of 1,900 to 3,000 MW. The action plan, however, does not take Finland's offshore potential into account in contrast to EWEA's scenario, which includes 400 MW to 1,000 MW of offshore wind capacity.

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
38%	38%	33%	197 MW	2,500 MW	6.1 TWh	6%

France

The French National Renewable Energy Action Plan expects around 11% of all electricity consumption in 2020 to be met by onshore and offshore wind power. With regards to France's overall 23% RES target for 2020, 27% of power consumption is planned to be met by renewables. After hydro, with a planned 25 GW, of which 6 GW offshore, wind power is the main renewable technology in the NREAP.

The NREAP foresees net annual installations of onshore wind power remaining over the 1 GW mark in 2010 and reaching almost 1.3 GW in 2011. These installation rates are consistent with 2008 and 2009 growth. Net increase in onshore wind power subsequently drops to around 770 MW in 2012 and then grows in a linear fashion to 2020.

With a first offshore wind call for tender already announced in early 2011, the French NREAP expects offshore wind build-out to start as early as 2012. Although such timing is necessary to reach the 6 GW offshore wind objective by 2020, it seems overly optimistic considering that there are currently no offshore turbines in French waters.

Moreover, a five wind turbine minimum size for onshore wind farms has been introduced and an obligation for wind turbines to be classified under rules governing dangerous industries (ICPE) could jeopardise the development of wind power in the more densely populated areas of the country, characterised to date by small wind projects, and increase administrative burdens.

Overall, the French NREAP's projections for wind development are in line with EWEA's 2009 scenario of 23 GW to 26 GW of installed wind capacity, of which 4 GW to 6 GW offshore. However, without improvements to administrative procedures, and given the late start in developing offshore, achieving the targets could be a challenge

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
23%	38%	27%	5,660 MW	25,000 MW	57.9 TWh	10.6%

Germany

The German National Renewable Energy Action Plan was published before the authorities had completed discussions on the national energy strategy to 2050 (Energiekonzept). Therefore, the document indicates that changes in some of the future activities or the figures could occur.

Nevertheless, the NREAP indicates that Germany will meet its binding 2020 target of 18% RES domestically and, moreover, exceed it by 1.6 percentage points. However, the authors of the document increased the 2005 baseline figure by 0.7 percentage points for statistical reasons, consequently making it easier to follow the outlined trajectory and meet the end target. The document underlines the authorities' intention to use the excess in co-operation mechanisms with other Member States.

Energy efficiency is highlighted as a key factor in the plan with consumption set to decrease. Renewables in the power sector play a dominant role in the action plan with 38.6% of electricity demand expected to be met by RES in 2020. Wind has the largest share with onshore and offshore capacity accounting for 52% of the target, or almost 20% of all electricity consumption.

In terms of build-out, the action plan expects new net annual onshore capacity to decrease steadily from over 1.6 GW in 2011 to less than 300 MW in 2020. Conversely, new offshore capacity increases steadily from under 300 MW in 2010 to over 1,700 MW in 2020.

Overall the plan forecasts 45,750 MW in 2020, 10,000 MW of which offshore. Consequently the onshore ambition is lower than in EWEA's scenario,

whilst offshore is in line with the scenario's higher end. The action plan, therefore, seems to under-estimate Germany's onshore wind development potential and the effects of re-powering.

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
18%	19.6%	38.6%	27,214 MW	45,750 MW	104.4 TWh	18.6%

Greece

Greece has a binding RES target of 18% by 2020, up from 6.9% in 2005. The Greek authorities have planned to overshoot the target by over two percentage points. To reach the overall target, the National Renewable Energy Action Plan focuses on the power sector. Almost 40% of electricity consumption is forecast to be met by RES in 2020. Onshore and offshore wind power should represent the lion's share of the renewable power market and are forecast to meet 24.5% of the country's electricity consumption in 2020.

To achieve this, the action plan banks on reaching 7.5 GW of total installed wind capacity, of which 300 MW from offshore installations, by 2020. The net annual increase in wind power capacity is expected to be constant at around 600 MW. Offshore deployment is not expected to start before 2016 and is projected to grow consistently by 50 MW a year. In 2020, offshore build-out is expected to increase to 100 MW.

The Greek action plan's forecasts for wind capacity and share of the power mix are in line with EWEA's scenarios.

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
18%	20.2%	39.8%	1,208 MW	7,500 MW	16.8 TWh	24.5%

Hungary

The authors of the Hungarian National Renewable Energy Action Plan forecast that the country can reach 14.7% renewables in gross energy consumption by 2020, exceeding their 13% binding target by 1.7 percentage points. The heating and cooling sector is seen in the NREAP as the biggest contributor (18.9% RES in consumption), with the electricity sector meeting just under 11% of consumption with renewables.

Biomass and wind are the two main renewable technologies in the electricity sector, with wind scheduled to meet over 3% of total consumption.

The build-out rate for new wind power throughout the period is, however, extremely uneven with new annual capacities peaking in 2013 and 2017 at over 100 MW and with troughs in 2015 and 2016 of around 10 MW.

The action plan forecasts that cumulative capacity for wind power will reach 750 MW in 2020. This is an unambitious target that suggests that only around 400 MW of new wind capacity will be built between 2010 and 2020. EWEA's 2009 forecast expects Hungary to reach 1.2 GW of installed wind capacity in the same timeframe.

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
13%	14.7%	10.9%	295 MW	750 MW	1.6 TWh	3.1%

Ireland

The country's National Renewable Energy Action Plan banks on the power sector to meet its binding target. The plan aims to meet 42.5% of electricity consumption from RES. Wind is the technology of choice in the plan, accounting for 86% of the RES-E target and some 35% of total electricity consumption.

Over 4.6 GW of installed wind capacity are forecast in the Irish plan, of which 555 MW from new offshore installations, which is lower than in EWEA's scenario. Both the onshore and offshore build-out rates vary significantly from one year to the next, following no particular growth pattern.

Net capacity increase oscillates year on year from 240 MW to 40 MW in the period between 2011 and 2015. Subsequently, there is a two-year lull with 31 MW and 41 MW net capacity increase in 2016 and 2017 respectively. This is followed by a considerable increase in 2018, a further slump with net capacity increasing by 25 MW in 2019, and a 740 MW net peak in 2020.

Indeed, the build-out will be continuously stopping and starting, an issue that should be addressed in order to provide the industry with greater stability.

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
16%	16%	42.5%	1,248 MW	4,649 MW	11.9 TWh	36.4%

Italy

Italy is one of the two Member States to indicate in its National Renewable Energy Action Plan that it will not meet its 17% RES target domestically, forecasting a shortfall of 0.85 percentage points in 2020. Consequently, the Italian authorities intend to turn to the co-operation mechanisms, indicating a preference for physically imported RES from countries outside the EU.

Nevertheless, the Italian action plan intends to meet some 27% of the country's electricity consumption with renewables by 2020, with onshore and offshore wind power providing just over 5% of total electricity consumption, requiring a cumulative capacity of just below 13 GW, of which 680 MW from offshore installations. The onshore target is significantly (3 GW to 5 GW) lower than what EWEA considers the Italian market can deliver and, indeed, the action plan suggests an annual build-out rate greatly inferior to that which the Italian market has delivered for the past four consecutive years.

However, the NREAP highlights delays in the authorisation procedures for new RES plants and grid development without offering a solution to end them. Moreover, the document announces revisions of the support scheme which may result in an undermining of investor confidence. These weaknesses in the plan could result in investor caution unless improved with the introduction of future policies.

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
17%	16.2%	26.4%	5,797 MW	12,680 MW	20 TWh	5.3%

Latvia

The Latvian National Renewable Energy Action Plan expects the country to reach its overall 2020 target of 40% RES with almost 60% RES in the power mix.

The plan sets ambitious targets for both on- and offshore wind energy - to meet 6% and 4% of total electricity consumption respectively. With over 230 MW of cumulative onshore wind capacity and 180 MW of offshore capacity foreseen by 2020, Latvia is above EWEA's scenario of 200 MW to 300 MW.

Onshore build-out is expected to remain steady until 2015 then drop dramatically. In 2017, annual capacity increase is expected to pick up again. Offshore, the first megawatts are expected in 2016 following a steady annual build-out to 2020.

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
40%	40%	59.8%	31 MW	416 MW	0.9 TWh	10.4%

Lithuania

The Lithuanian National Renewable Energy Action Plan aims to exceed the country's binding 23% RES target in 2020 by one percentage point. The 2020 target should be met as early as 2017. Electricity from renewables is expected to reach 21% of total consumption. The technology of choice is wind power, which, according to the projections, would produce 1.3 TWh a year and contribute to almost half the renewable electricity target or 9.4% of gross electricity consumption.

The plan expects installed wind power capacity to reach 500 MW by 2016. No increase in wind power capacity is forecast from then on. In terms of build-out, installed capacity is expected to double in 2010 to reach almost 180 MW. 2011 is expected to deliver significantly less new wind capacity whereas the subsequent three years would see a steady annual build-out of 50 MW net. Following a slight slow-down in 2015, a new boom of over 110 MW is expected in 2016.

The action plan's projections for wind capacity are half of EWEA's scenario, an indication that wind power's full potential may not have been taken into account.

The Lithuanian NREAP indicates, finally, that the country is willing to use its projected surplus RES production in co-operation mechanisms with other Member States.

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
23%	24%	21%	154 MW	500 MW	1.3 TWh	9.4%

Luxembourg

According to its National Renewable Energy Action Plan, Luxembourg will not meet its 11% RES target by 2020 due to lack of resources in the country. Consequently, the Luxembourgish authorities are looking into co-operation mechanisms with other EU Member States to set up joint projects in order to make up a forecast 2.1 percentage point shortfall.

Nevertheless, wind power is considered in the action plan as a key technology for increasing RES penetration. Almost 100 MW of new capacity are forecast, bringing cumulative capacity in 2020 to 131 MW. Wind power is forecast to cover 3.6% of electricity consumption, a third of all electricity from renewables.

According to EWEA's scenario, on the other hand, 300 MW of installed wind capacity in Luxembourg could cover up to 14% of the country's electricity consumption, more than the sum of all the RES-E technologies in the NREAP.

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
11%	8.9%	11.8%	42 MW	131 MW	0.2 TWh	3.6%

Malta

Starting from no renewable energy at all in 2005, the Maltese National Renewable Energy Action Plan aims to slightly exceed the country's 2020 target of 10% RES. The power sector is due to play the most significant role, achieving 13.8% of consumption covered by RES. Offshore wind is the technology of choice, planned to meet 7% of total electricity consumption.

The Maltese NREAP highlights three planned government calls for tender for 110 MW of installed wind power capacity. There is one tender for a 95 MW offshore project, and two onshore tenders totalling 14.5 MW.

The planned onshore wind capacity is scheduled to be built between 2012 and 2015, whereas offshore build-out is scheduled for 2016 and 2017.

Malta's overall installed capacity target is similar to EWEA's scenario (100 MW to 200 MW) although EWEA considers that Malta could develop its onshore potential more thoroughly than planned in the NREAP.

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
10%	10.2%	13.8%	0 MW	109.5 MW	0.24 TWh	7.6%

Netherlands

The Netherlands intends to exceed its 2020 RES target by half a percentage point to reach 14.5% RES in energy consumption. The National Renewable Energy Action Plan, furthermore, indicates that this surplus is not intended for co-operation mechanisms with other Member States as it is a first step to setting a more ambitious national target.

To reach the overall target, the Dutch plan estimates that 37% of renewable electricity is required. Two-thirds of this sectoral target is to be met by onshore and offshore wind power, which will supply 10% and 14% of total electricity consumption respectively, according to the plan.

Two offshore licensing phases are scheduled to deliver almost 6 GW of new offshore capacity, 5,178 MW of which to be operational by 2020. Onshore, the action plan aims to triple installed capacity to 6 GW. The document, however, does not indicate any new capacity in 2010 or 2011.

Onshore build-out is scheduled to pick up from 2012 to 2015 with net annual additions varying between 415 MW and 800 MW. From 2016, new onshore additions are forecast to stabilise at 320 MW net per year. New offshore capacity is expected by 2013, with annual build-out reaching its cruising speed at 800 MW net from 2016 onwards.
The Dutch NREAP's forecasts for wind energy broadly match EWEA's high scenario.

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
14%	14.5%	37%	2,245 MW	11,178 MW	32.4 TWh	23.9%

Poland

According to the Polish National Renewable Energy Action Plan, the country will exceed the RES penetration trajectory set by the EU directive and exceed its 2020 binding 15% target by 0.5 percentage points.

Renewable electricity will account for over 19% of all electricity consumption according to the document, meaning that the sector will have a larger contribution to the overall target than renewables in heating and cooling (17%) and renewables in transport (10.1%).

Wind will be the technology of choice, with onshore generation meeting 8% of total electricity consumption and offshore generation covering a further 1%. Biomass is forecast to meet 8% of gross electricity consumption. Other technologies such as hydro and solar PV will play a more marginal role.

However, with a cumulative capacity target of 6.7 GW, up from over 1 GW in 2010, the Polish NREAP lacks ambition for wind. EWEA's 2009 forecast suggests that installed wind capacity in Poland could reach between 10 GW and 12 GW in the same time frame.

Build-out rates for new onshore wind capacity are forecast as stable between 450 MW and 520 MW per year, only slightly above the 382 MW installed in 2010. The first 500 MW of offshore capacity should come online in 2020 - in line with EWEA's forecast.

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
15%	15.5%	19.1%	1,104 MW	6,650 MW	15.2 TWh	9%

Portugal

Portugal's binding 2020 RES target is 31% up from 20.5% in 2005, although the authors of the National Renewable Energy Action Plan have reduced the 2005 starting point to 19.8%. The overall target has been split into 55.3% electricity from RES, 30.6% heating and cooling from RES and 10% RES in transport.

According to the plan, with an annual production of 14.6 TWh, wind power should be the country's leading RES technology covering almost 23% of electricity consumption with a cumulative installed capacity of 6,800 MW onshore and 75 MW offshore by 2020. These targets are below EWEA's scenario whereas wind's share of the power mix is similar in the two forecasts, although the NREAP indicates a 17% increase in electricity consumption between 2010 and 2020.

The forecast build-out rates in 2011 and 2012 are similar to recent developments in the Portuguese market (around 670 MW net annual increase). Subsequently there is a two year lull in new wind build-out, with a further 500 MW net capacity coming online in 2015. 2016 and 2017 are also forecast by the plan to be quieter years. Offshore build-out is seen as starting in 2015, with the first 25 MW installed and the remaining 50 MW all being installed in 2020.

Furthermore, capacity factors for wind turbines seem to have been underestimated in the document. Therefore, production could be above what is projected and could lead to a future re-think of RES-E targets.
The NREAP indicates that more RES-E production could be achieved with improved cross-border interconnection. Consequently no excess RES for use in co-operation mechanisms with other Member States is currently envisaged in the plan. Should interconnectivity with the rest of Europe be increased, the Portuguese authorities could review their position and exceed their trajectory and 2020 targets.

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
31%	31%	55.3%	3,898 MW	6,875 MW	14.6 TWh	22.6%

Romania

The National Renewable Energy Action Plan for Romania expects the RES share to increase but stay below the trajectory determined by the RES directive. The "indicative trajectory" is a series of target average levels of renewable energy production over two-year periods up to 2020. As Romania intends to reach its target level only in the second year of the two-year periods, its averages will be below target. Nevertheless, the final 2020 target of 24% RES is considered achievable. The Romanian NREAP, however, makes no mention resorting to the flexibility mechanisms to compensate for the forecast deficit.

Wind power is expected to benefit from a spectacular growth rate up to 2013, adding over 600 MW net a year. The net annual increase slows down from 2014 onwards, especially from 2016 as the support mechanism is scheduled to be discontinued. Overall, however, the Romanian action plan expects some 4,000 MW of capacity to be installed by 2020. This would cover almost 11.5% of total electricity consumption and position wind as the main RES power technology after hydro.

The Romanian NREAP's projections for wind power are above EWEA's scenario, which estimates 3,000 MW to 3,500 MW of cumulative capacity meeting 7.7% to 9% of electricity consumption by 2020. However, considering the wind and land resources, investor interest and banking on the final adoption of the

new RES law early in 2011, the action plan's targets do not appear overly ambitious. The Romanian Wind Energy Association has a more ambitious scenario for 2020, reaching 5 GW of installed wind capacity.

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
24%	24%	42.6%	462 MW	4,000 MW	8.4 TWh	11.4%

Slovakia

Slovakia's National Renewable Energy Action Plan indicates that the country could exceed its 2020 RES target of 14% by 1.3 percentage points. The power sector is expected to contribute the most to the overall target by increasing the share of renewables from around 16% in 2005 (mainly hydro) to 24% in 2020.

After hydro and biomass, wind is forecast to make the biggest contribution to the renewable power mix in 2020, with a planned 350 MW which would feed 600 GWh into the grid and cover around 2% of total electricity consumption.

Slovakia's ambitions fall short of EWEA's scenario. EWEA's scenario estimates that 800 MW to 1.000 MW of wind power could be installed by 2020, meeting up to 5% of the country's electricity demand. Moreover, the build-out of wind power set out in the action plan is irregular, with two large chunks of around 150 MW net expected to come online in 2012 and 2015, and a further 50 MW net in 2018.

Exceeding its indicative trajectory and binding 2020 target, the action plan indicates that some excess RES is available for use in co-operation mechanisms with other Member States.

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
14%	15.3%	24%	3 MW	350 MW	0.6 TWh	1.8%

Slovenia

Slovenia is set to meet its 25% 2020 RES target and, indeed, slightly exceed it according to its National Renewable Energy Action Plan. In the power sector, renewables are forecast to meet almost 40% of the country's electricity consumption, with onshore wind meeting an un-ambitious 1.3% of overall electricity demand.

In all, the plan indicates just over 106 MW of installed wind capacity in 2020, a fifth of EWEA's scenario. EWEA's calculations show that by 2020 wind could cover between 6% and 9% of electricity demand.

Build-out of wind projects is not expected to be constant, rather the action plan indicates that new wind capacity will be installed in 2010, 2013, 2015 and 2019. The newly adopted feed-in tariff limiting support to projects of 5 MW and under may be hindering perspectives for wind power development.

The action plan indicates that Slovenia is not planning to participate in co-operation mechanisms with other EU Member States. However, rules on how such co-operation should be envisaged are being drafted.

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
25%	25.3%	39.3%	0.03 MW	106 MW	0.2 TWh	1.3%

Spain

Spain's National Renewable Energy Action Plan aims to exceed the country's binding 20% target by almost three percentage points. The authorities clearly intend to use the excess in co-operation mechanisms with other Member States.

The document emphasises the role of the power sector in reaching the overall target and forecasts that 41% of all electricity consumption will be met by RES in 2020, with wind power alone expected to meet half this amount.

Surprisingly, however, the action plan has reduced wind power capacity ambitions to 35 GW onshore, with build-out rates below what the Spanish market has delivered in recent years. This is 4-5 GW less than in EWEA's scenario.

The 3 GW offshore target, on the other hand, is more ambitious than expected, with first capacity scheduled to come online in 2014. The feasibility of this amount of offshore in a six-year time frame – two to three times higher than in EWEA's scenario - remains to be verified.

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
20%	22.7%	40%	20,676 MW	38,000 MW	70.5 TWh	20.8%

Sweden

Sweden has the highest RES target of any EU Member State, set at 49%, up from 39.8% in 2005. The Swedish National Renewable energy Action Plan, furthermore, raises the country's RES ambitions to 50.2% RES in final energy consumption with 63% RES in electricity consumption.

With a forecast cumulative wind power capacity of just over 4.5 GW in 2020, wind should cover 8% of final electricity consumption. Onshore build-out is forecast as being stable at just under 260 MW net a year.

With no offshore-specific support mechanism foreseen in the action plan, little increase in offshore capacity is forecast. In fact, the Swedish NREAP indicates that in 2010 there will be 76 MW of offshore wind capacity, growing by 10–11 MW net per year up to 2020 to reach a cumulative capacity of 182 MW. According to EWEA, at the end of 2010, there were already 164 MW of offshore wind capacity in five wind farms: Bockstigen, Utgrunden 1, Yttre Stengrund, Lillgrund and Gässlingegrund (an inland lake). Moreover, the projected build-out rate of 10/11 MW per year seems unlikely considering the average size of offshore wind projects.

Concerning offshore, therefore, the Swedish action plan looks inaccurate. Overall, EWEA's scenario put wind capacity in Sweden at around 6 GW to 8 GW onshore in 2020, with a further 3 GW offshore.

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
49%	50.2%	62.9%	2,163 MW	4,547 MW	1.5 TWh	8.1%

United Kingdom

The United Kingdom has an overall 15% RES target for 2020, up from just over 1% in 2005 and its National Renewable Energy Action Plan expects the target to be met. The largest contribution to the overall target is expected from the power sector (30% of total electricity consumption).

The document forecasts that around 70% RES-E in consumption will come from onshore and offshore wind, with onshore wind representing 9% of total electricity consumption and offshore wind 12%.

To achieve this, the NREAP foresees an increasing build-out of onshore projects from the beginning of the period until 2018, followed by a slightly smaller – yet still over 1 GW net - onshore market for 2019 and 2020. Cumulative capacity in 2020 is estimated at almost 15 GW.

For offshore, on the other hand, the NREAP assumes a constant increase in the annual market from just under 600 MW net in 2011 to almost 1,700 MW net annually in 2020, to reach a cumulative target of 13 GW. Both projections are broadly in line with EWEA's scenario, however the scenario, unlike the NREAP, does not expect more capacity onshore than offshore. The NREAP, therefore, seems to lack offshore ambition, where the national wind industry body, RenewableUK, considers 20 GW of offshore capacity an achievable target for 2020.

2020 RES target in Directive 28/2009/EC	2020 RES target in NREAP	2020 RES-E target in NREAP	Wind capacity installed at end 2010	2020 wind capacity in NREAP	2020 wind Production in NREAP	2020 wind share of electricity consumption in NREAP
15%	15%	30%	5,204 MW	27,880 MW	78.3 TWh	20.8%

EWEA

THE EUROPEAN WIND ENERGY ASSOCIATION

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About EWEA

EWEA is the voice of the wind industry, actively promoting the utilisation of wind power in Europe and worldwide. It now has over 650 members from almost 60 countries including manufacturers with a 90% share of the world wind power market, plus component suppliers, research institutes, national wind and renewables associations, developers, electricity providers, finance and insurance companies and consultants.

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