

Special Report

Wind and solar power for electricity generation: significant action needed if EU targets to be met

(pursuant to Article 287(4), second subparagraph, TFEU)



EUROPEAN
COURT
OF AUDITORS

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Executive summary

I Between 2005 and 2017, the share of renewables in the generation of electricity in the EU doubled, from around 15 % to almost 31 %. The main driver for this growth was the increase in wind and solar photovoltaic (PV) power.

II Through this audit, we assessed whether the share of renewables in the gross final energy consumption has progressed enough for the EU to meet the 20 % target by 2020 as set by the directive on the promotion of the use of energy from renewables, and the effectiveness of EU and Member State support for electricity generation from wind and solar PV power. The publication of this audit report will coincide with the issuing in 2019 of the next in the series of renewable energy progress reports by the European Commission, which will detail the progress of Member States towards achieving their 2020 targets. These reports will afford a final chance to take corrective action and inform discussions on the post-2020 renewables situation.

III The first catalyst towards the progress in renewables was the directive itself, and the second the Member States' support schemes to incentivise investment. However, the significant progress since 2005 was followed by a deceleration in both wind and solar PV sectors after 2014. By 2017, half of the Member States had either already reached or were close to reaching their 2020 targets. For the other Member States, attaining their national targets remains a significant challenge that will require further effort.

IV We found that the initial support schemes oversubsidized wind and solar PV deployment, but that decreasing the levels of support served to deter potential investment. Encouraging auctions and the use of citizen participation are crucial for increasing investment and enhancing conditions for deployment, such as overcoming restrictive spatial planning rules, lengthy administrative procedures and grid insufficiencies.

V Looking ahead to 2030, we found that the Commission's 2016 'Clean Energy' package lays the groundwork for a better investment environment. However, the lack of national targets might jeopardise the achievement of the EU target of at least 32 % for 2030.

VI As a result of our audit, we recommend:

- a focus on closing gaps to meet the 2020 targets;
- an improvement in timeliness of statistical data on renewables;
- the holding of sufficient auctions to increase renewable capacity for electricity;
- the creation of a more favourable environment for renewable electricity generation through simplification of administrative procedures;
- the promotion for investment in grid infrastructure and interconnectors; and
- better monitoring to mitigate the absence of binding national targets.

Introduction

01 Between 1990 and 2017, the consumption of electricity in the EU grew on average by 1 % per year, from below 2.2 billion GWh¹ to almost 2.8 billion GWh per year. In the period until 2020, consumption is forecast to increase by less than 0.3 % per year if specific energy efficiency measures are implemented, and by 0.7 % per year if no new efficiency policies are put in place in the 2020-2050 period².

02 Electricity can be generated either from non-renewable sources, which include fossil fuels (coal, natural gas, crude oil), non-renewable waste and nuclear materials in conventional reactors; or from renewable sources (hydropower, wind, solar, biomass, biogas, bioliquid, waste, geothermal, wave, tidal and ocean energy). Apart from electricity, renewables are also used to produce energy which is converted to heating and cooling, and fuel for transport. *Table 1* presents the main renewable technologies and their application.

Table 1 – The main renewable technologies and their application to electricity, heating and cooling and transport sectors

Renewable technology	Energy conversion	Application
Hydropower	Water flow and waterfalls to electricity	Electricity
Wind turbines	Wind to electricity	
Solar ³ power (photovoltaic ⁴ and thermal (which includes concentrated solar power))	Sunlight to electricity	

¹ GWh: A measure of the output of large electricity power stations. A kWh is equivalent to a steady power of one kilowatt running for one hour.

² Eurostat, 'EU reference scenario 2016, energy, transport and GHG emissions, trends to 2050', July 2016, p. 53.

³ Although solar photovoltaic (PV) and solar thermal for electricity are usually grouped together, solar PV accounts for 98 % of capacity in the EU as a whole. International Renewable Energy Agency (IRENA), 'Renewable capacity statistics 2018', January 2018, pp. 21 to 27.

⁴ Solar PV concerns the conversion of sunlight into electricity using photovoltaic panels.

Biomass / Biogas / Bioliquids	Biomass / Biogas / Bioliquids to electricity	
Waste incineration	Waste to electricity	
Wave, tidal and ocean	Waves and tides to electricity	
Geothermal	Temperature differences to electricity	
Solar thermal	Sunlight to heating and cooling	Heating and cooling
Biofuels / Biogas	Biomass to liquid fuel or gas	
Waste incineration	Waste to heating and cooling	
Geothermal	Temperature differences to heating and cooling	Transport
Biofuels / Biogas	Biomass to liquid fuel or gas	

Source: ECA, based on SHARES tool manual, Eurostat, 2018.

03 Depending on the energy source used, electricity generation can have a negative effect on the environment, human health and climate. Of the EU's total greenhouse gas emissions, 79 % comes from the use of fossil fuels to generate energy⁵. The Commission estimates that a higher share of renewable electricity will help the EU to achieve its objective of reducing greenhouse gas emissions by 40 % in 2030⁶, and by 80 % to 95 % in 2050⁷. In addition, using more renewables to meet its electricity needs will lower the EU's dependence on imported fossil fuels.

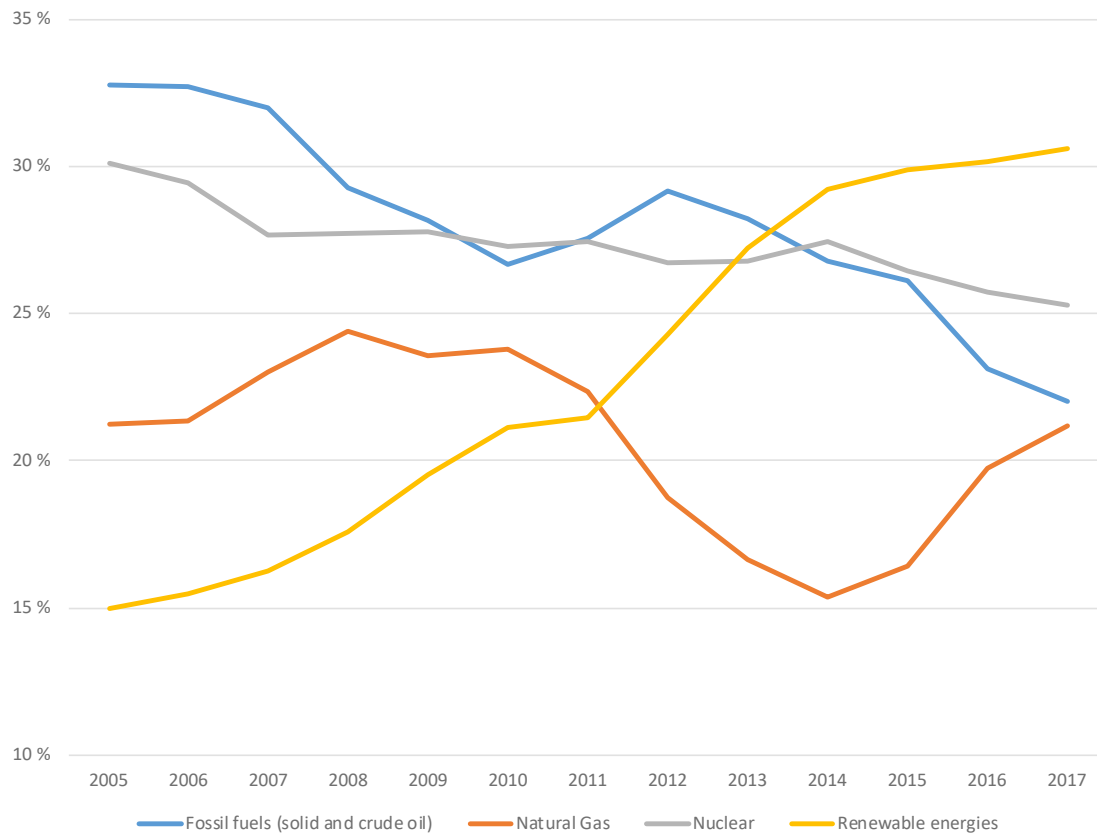
⁵ European Environment Agency, 'EEA greenhouse gas - data viewer', 2017, <https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer>.

⁶ COM(2014) 15 final, 'A policy framework for climate and energy in the period from 2020 to 2030'.

⁷ COM(2011) 112 final, 'A roadmap for moving into a competitive low carbon economy in 2050'.

04 Between 2005 and 2017, the share of renewables in the generation of electricity in the EU doubled, from around 15 % to almost 31 % (see [Figure 1](#)).

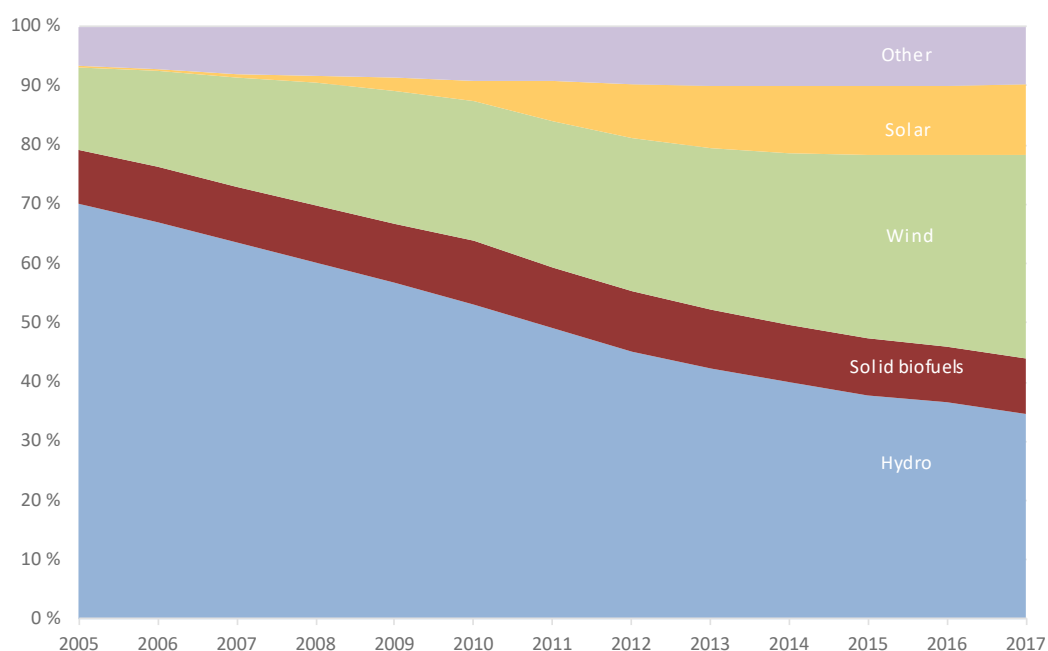
Figure 1 – Share of renewables in electricity generation in the EU, 2005-2017



Source: ECA, based on Eurostat data.

05 The main renewable energy technologies responsible for this growth are wind and solar power. Although still behind hydropower in terms of volume, from 2005 to 2017 the annual volume of electricity generated from wind rose by 414 %. The corresponding figure for solar was a 8 086 %. Meanwhile, the volume of electricity from hydropower remained largely constant. In 2017, hydropower accounted for a 35 % share of all EU renewable electricity production, while wind and solar represented 34 % and 12 % respectively (see [Figure 2](#)).

Figure 2 – Share of electricity generated from renewables in the EU-28, 2005-2017



Source: ECA, based on Eurostat data.

06 Because of reductions in the cost of technology, wind and solar photovoltaic (PV) are now economically far more competitive with fossil fuels than in the past (see [Box 1](#)).

Box 1

Cost of electricity generation from wind and solar PV is now comparable with fossil fuels

The electricity generation industry uses the levelised cost of electricity (LCOE) indicator to calculate the cost for producing electricity under different renewable and non-renewable technologies. It represents the per MWh cost of building and operating an electricity generation plant over an assumed financial life⁸.

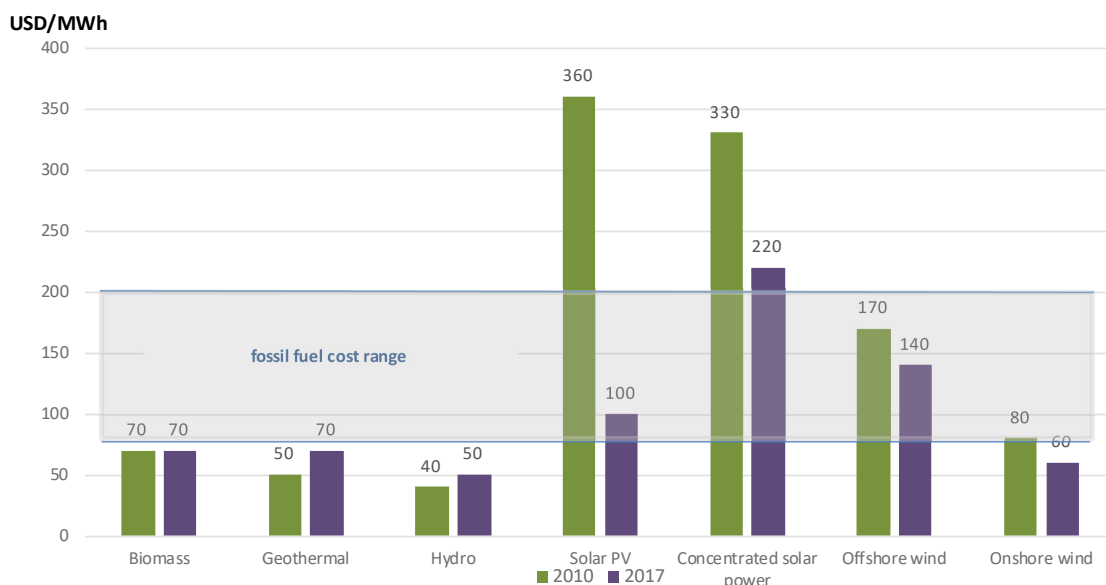
According to IRENA⁹, in 2017 the cost of electricity generated using renewables was often comparable with that of fossil fuels (see [Figure 3](#)). The global LCOE for wind

⁸ US Energy Information Administration, 'Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook 2018', March 2018.

⁹ IRENA, 'Renewable power generation costs in 2017', January 2018, p. 5. IRENA is an intergovernmental organisation that supports countries in their transition to a sustainable energy future. It is supported by United Nations and comprises of 160 full members

has been within the fossil fuel cost range for some years now. More recently, the LCOE for solar PV installations has also sunk to comparable levels, driven by an 81 % decrease in the cost of panels and other installation items since the end of 2009.

Figure 3 – Global LCOE from renewable power generation technologies, 2010-2017 (in US dollars/MWh)



Source: ECA, based on IRENA report 'Renewable power generation costs in 2017', page 17.

EU policies on electricity generation from renewables

07 The Treaty on the Functioning of the European Union (TFEU) provides for the EU and its Member States to have shared competence in the field of energy. However, Member States retain the right to decide how best to exploit their energy resources, which energy sources to use and how to structure their energy supply. Article 194 TFEU lists the four core objectives of EU energy policy, which include the development of new and renewable forms of energy.

(including 27 of the EU Member States and the EU itself) and 23 accession members (including Austria).

08 The policy objectives specifically relating to the development of renewable energy were defined in the 2009 Renewable Energy Directive (RED I)¹⁰. RED I obliged Member States to ensure that, for the EU as a whole, a minimum of 20 % of the gross final energy consumption will come from renewables by the end of 2020 (see [Box 2](#)).

Box 2

National targets for the share of gross final energy consumption from renewables

With the view to achieving the 2020 global EU target of 20 %, RED I set specific national targets for the share of gross final energy consumption coming from renewables. These national targets ranged from 10 % to 49 %, and were defined taking due account of variables such as the renewable shares achieved in 2005, flat rate contribution¹¹ and GDP per capita. To monitor the progress towards the targets, RED I presented a mathematical formula to specify intermediate biennial targets that prescribed an indicative renewable trajectory¹² for each Member State. If a Member State fails to meet its national target by 2020, the Commission may take legal action through an infringement procedure.

The national target defined by RED I concerned the combined consumption of energy from three different sectors: the electricity, heating and cooling, and transport sectors. The directive did not define specific EU or national targets for the electricity or the heating and cooling sectors, but it set a uniform target of 10 % for the transport sector. Member States had to establish their own overall and sectoral trajectories for electricity and heating and cooling sectors in their national renewable energy action plan (NREAP), which also included the policies and measures for 2020 concerning renewables. Member States had also to set capacity trajectories per renewable technology.

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 (OJ L 140, 5.6.2009, p. 16).

¹¹ By the 'flat rate contribution' it is meant a fixed number of percentage points of increase in renewables attributed to each Member State, based on a set of objective criteria (most importantly GDP per capita). In general terms, this factor ensures that renewable energy targets reflect the economic strength of the Member States rather than the potential for, or the cost of increasing, the share of renewable energy.

¹² The indicative trajectory was made more ambitious in the final years owing to the expected benefits of technological progress and economies of scale. Member States were left to determine their own more linear national trajectory.

09 On 30 November 2016, the Commission published the ‘Clean Energy for all Europeans’¹³. Of the eight legislative proposals in the package four entered into force in 2018. Political agreement on the remaining four was reached during November and December 2018. RED II set a binding EU target of at least 32 % by 2030¹⁴, with an option to increase the target again in 2023. However, at least 32 % will have to be achieved without setting binding national targets.

National support schemes and other measures for meeting the 2020 targets

10 RED I encouraged Member States to set up national support schemes for renewables, based on incentives for private sector investors, in order to achieve their 2020 targets (see **Box 3**). RED I also required renewable electricity to be granted ‘priority access’ to the network as a way of guaranteeing the sale of the electricity produced.

¹³ COM(2016) 860 final, ‘Clean Energy For All Europeans’. It proposed four regulations: on energy union governance (entered into force 24.12.2018), the internal market for electricity (scheduled to enter into force in May 2019), risk-preparedness in the electricity sector (scheduled to enter into force in May 2019), and the establishment of a European Union Agency for cooperation among energy regulators (scheduled to enter into force in May 2019). It also proposed four directives: on the energy performance of buildings (entered into force 9.7.2018), renewable energy (RED II) and energy efficiency (both entered into force 24.12.2018) and common rules for the internal market in electricity (scheduled to enter into force in May 2019).

¹⁴ Initially, the Commission proposed a 2030 EU target of 27 %, but the European Parliament and the Council increased this share to 32 %.

Box 3

Types of support to renewables

Support is generally offered through guaranteed selling prices (feed-in tariff, FIT) or top-up premiums over and above market prices (feed-in premiums, FIP). Both offer a guaranteed tariff/premium for a considerable number of years. For these two support options, the most common way for a Member State to allocate new capacity for renewables is either through calls for interest (participants apply for a contract to produce electricity) or auctions (participants are contracted through a competitive procedure).

An alternative support mechanism is the use of tradable certificates of origin, which the state issues as proof that electricity has been generated from renewable sources. Utility companies that generate electricity with fossil fuels are obliged to buy such certificates and this brings renewables producers additional income. Unlike with FIT/FIP schemes, producers are not guaranteed a price for their electricity production, as the value of certificates fluctuates with supply and demand. However, the state can define measures to guarantee a minimum profit for renewables producers.

Member States may also attract investors by offering loan guarantees, low interest loans, investment grants and a variety of tax incentives.

11 As a general rule, national schemes are not EU co-financed and are subject to state aid rules. The directorate-general for Competition (DG COMP) analyses these schemes to ensure compatibility with the internal market rules. Until 2016, Member States could select any type or combination of schemes they considered appropriate for their market. Most set up a scheme based on FITs through calls for interest, either alone or in combination with another incentive type. Since 2016, under the Commission's state aid guidelines¹⁵, all new renewable electricity generation aid schemes have been required to operate through FIPs and, since 2017, to be allocated mainly through auctions¹⁶ open to all electricity producers on a non-discriminatory basis¹⁷.

¹⁵ 'Guidelines on state aid for environmental protection and energy 2014-2020', 2014/C 200/01.

¹⁶ Nonetheless, FITs can still be used for new small-scale installations up to 500 kW and wind installations up to 3 MW (or three turbines) and for contracts signed before 2016.

¹⁷ Member States may limit tendering procedures to specific technologies where opening support schemes to all producers of electricity from renewable sources would lead to a suboptimal result.

12 Finally, RED I encouraged Member States to cooperate to meet their 2020 targets. Potential mechanisms for cooperation include joint projects and joint support schemes, and bilateral agreements on transfer of a share of energy from renewables by a Member State producing more renewable energy to another producing less, called ‘statistical transfer’.

Support for wind and solar from the ERDF and CF

13 EU funds can provide additional financing to strengthen Member State actions, complementing national or regional support schemes through investment aid.

14 For the 2007-2013 and 2014-2020 programme periods, approximately €8.8 billion was allocated to renewable energy projects through cohesion policy funding from the European Regional Development Fund (ERDF) and the Cohesion Fund (CF). As shown in [Table 2](#), since 2007 approximately €972 million has been allocated to wind energy investments, and €2 868 million has been allocated for solar projects. The ERDF and CF allocations by Member State to wind and solar investments during both periods are provided in [Annexes I](#) and [II](#).

Table 2 – Allocations from ERDF and CF to investments in renewables in the EU, 2007-2020, in € million

Renewable technology	Programme period		Total	%
	2007-2013	2014-2020		
Wind	541	431	972	11 %
Solar	1 064	1 804	2 868	33 %
Biomass	1 267	1 576	2 843	33 %
Other renewables	851	1 195	2 046	23 %
Total renewables	3 723	5 006	8 729	100 %

Source: ECA, based on Commission data, extracted on 9.4.2019.

15 For the 2021-2027 period, the Commission has proposed for Cohesion policy 30 % from the ERDF and 37 % from the CF to contribute to operations supporting

climate objectives, which include the promotion of renewable energy¹⁸. If calculated based on the overall proposed amounts for ERDF/CF (excluding the CF contribution to the Connecting Europe Facility Transport), it represents €60.2 billion from the ERDF and €11.6 billion from the CF¹⁹. The impact assessment for the RED II proposal concluded that investment of around €254 billion was necessary for the initial 2030 EU target of 27 %²⁰. In other words, the total financial contribution of around €71.8 billion for support to climate objectives from the ERDF and CF will need to be complemented by a significant amount of public and private national funding, as well as other EU funding to meet the current 2030 EU target of at least 32 %.

¹⁸ COM(2018) 372 final, 'Proposal for a regulation of the European Parliament and of the Council on the European Regional Development Fund and on the Cohesion Fund', explanatory memorandum section 4, and recital 14, pp. 7 and 12 respectively.

¹⁹ Rapid case review: 'Allocation of Cohesion policy funding to Member States for 2021-2027', Figure 1 and Table 9. ECA, March 2019.

²⁰ SWD(2016) 418 final, 'Impact assessment accompanying the document Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (recast)', COM(2016) 767 final, part 2, p. 190.

Audit scope and approach

16 We addressed the effectiveness of EU and Member State support for electricity generation from wind and solar PV power, which were the biggest drivers in the increase of the renewables share. To do this, we examined:

- whether the share of renewables in the gross final energy consumption has progressed since 2005 in line with the targets set;
- whether the national support schemes have managed to attract investment in electricity generation coming from wind and solar PV power;
- whether other necessary conditions for renewables, including grid expansion and upgrade, affect their deployment;
- whether the cohesion funding available for wind and solar PV investments has delivered sustainable outputs and results, with appropriate levels of support;
- whether the revised EU legal framework for 2021-2030 creates a supportive environment for the development of wind and solar PV installations.

17 The subject of the audit is highly relevant, given that climate change and energy sustainability are high on the political and economic agenda. The publication of this audit report will coincide with the issuing in 2019 of the next in the series of renewable energy progress reports by the Commission, which will detail the progress of Member States towards achieving their 2020 targets. These reports will afford a final chance to take corrective action and inform discussions on the post-2020 renewables situation.

18 The audit covered the use of ERDF and CF funding for the 2007-2013 and 2014-2020 programme periods. At EU level, we examined the work of the five Commission directorates-general with a significant role in the deployment of wind and solar PV and of Eurostat²¹. We also visited a number of stakeholders in Brussels and the Member States in the field of wind and/or solar PV power, and the European Environment Agency in Copenhagen.

19 We visited four Member States: Germany, Greece, Spain and Poland. These Member States represent an allocation of around 50 % of the total ERDF and CF funds

²¹ Directorates-general for Energy (DG ENER), Regional and Urban Policy (DG REGIO), Competition (DG COMP), Climate Action (DG CLIMA), and Environment (DG ENV).

allocated to wind and solar renewable energy for the periods 2007-2013, and 2014-2020, and respectively 52 % and 47 % of the installed wind and solar PV capacity in 2017. In these countries we examined 24 projects (nine wind, 12 solar PV and three mixed wind/solar PV installations) receiving ERDF or CF co-financing, based on materiality and relevance to the audit field of wind and solar PV. *Annex III* contains a list of those projects.

20 Lastly, we benefited from the comments of renewables experts on our findings when drawing up the conclusions and recommendations of this report.

Observations

The increased share from renewables in the gross final energy consumption is not enough to reach targets

21 We reviewed the progress made since 2005²² for the EU as a whole and by the four Member States examined, towards the overall target from renewables as well as sector-specific targets for electricity (see **Box 2**). We also examined the role played by the 2009 Renewable Energy Directive (RED I), and we assessed the Commission's monitoring of Member States' progress towards their targets and its actions to address slow development.

Significant progress, particularly in electricity, might not be enough to meet the EU 2020 target

22 RED I set a minimum indicative trajectory for each country, specifying intermediate targets to be achieved for the overall share of renewables by 2020. In addition, it obliged each Member State to define their own overall and sector-specific trajectories (for electricity, heating and cooling, and transport) in its NREAP (national renewable energy action plans)²³.

23 In 2017, the share of energy from renewable sources in the EU's gross final energy consumption reached 17.5 %, compared with the overall 2020 target of 20 %. This was almost twice the share in 2005 (9.1 %)²⁴. Eleven of the 28 Member States have already reached their 2020 target. These are: Bulgaria, the Czech Republic, Denmark, Estonia, Croatia, Italy, Lithuania, Hungary, Romania, Finland and Sweden. Of the remaining 17 Member States:

- Greece, Latvia and Austria will most probably meet their 2020 target if they continue to implement measures targeting renewables at the current pace. These

²² 2005 is the year that data on the share of renewables in the gross final energy consumption is first available.

²³ The Member States could set a more ambitious national overall target and a sectoral target for transport than those defined in RED I.

²⁴ <https://ec.europa.eu/eurostat/web/energy/data/shares>.

three need less than 2 percentage points (pp) increase in the share from renewables for 2020;

- the share of renewables in another eight Member States (Belgium, Germany, Spain, Cyprus, Malta, Portugal, Slovenia and Slovakia) should increase between 2 pp and 4 pp to meet the 2020 target (i.e. at a pace higher than previously attained); and
- six Member States are unlikely to meet their 2020 target as they need an increase in the share from renewables by: the Netherlands 7.4 pp, France 6.7 pp, Ireland 5.3 pp, the United Kingdom 4.8 pp, Luxembourg 4.6 pp and Poland 4.1 pp. We present the average progress made so far and the average progress needed to meet the targets for each Member State in [Annex IV](#).

24 The rate of increase towards the overall EU target has slowed between 2014 and 2016, while it went up slightly in 2017. The year-on-year increase was 5.1 % from 2013 to 2014, then 3.3 % to 2015, 1.8 % to 2016 and 2.9 % to 2017 (see the incremental increases in [Table A](#) in [Annex V](#)).

25 The electricity sector has contributed most towards the overall target in relative terms. It doubled from around 15 % in 2005 to almost 31 % in 2017, whereas the respective shares for heating and cooling, and transport in 2017 were 19.5 % and 7.6 % (see [Table A](#) in [Annex V](#)). However, in absolute terms, it is the heating and cooling sector, which provides the largest renewable energy contribution at EU level. In 2017, heating and cooling provided a total of 102 Mtoe²⁵, while renewable electricity provided 86.7 Mtoe, and the transport sector 23.7 Mtoe.

26 The 2020 electricity targets of the four Member States we examined, as set out in their respective NREAPs, are: 38.6 % in Germany, 39.8 % in Greece, 39 % in Spain and 19.1 % in Poland. Between 2010 and 2017, Germany and Spain remain above their respective national trajectories for renewable electricity. Poland was below target in some years and Greece fell short in all years: at the end of 2017, it was 7 percentage points below target. Whereas, in Greece the lower than expected increase in the electricity share was compensated for by an increase in the heating and cooling share, the opposite is true for Germany and Spain, where renewable electricity compensates for heating and cooling. An annual breakdown for these Member States is provided in [Tables B](#) and [C](#) in [Annex V](#).

²⁵ 'Millions of tonnes of oil equivalent (Mtoe)': the amount of energy released by burning one million tonnes of crude oil.

RED I increased the deployment of renewables, but reporting is insufficiently timely to take corrective action

27 RED I helped to increase the deployment of renewables, by setting an overall national target and a minimum indicative trajectory for each Member State, obliging them to define trajectories and implement measures for the three sectors contributing to the target. The national trajectories and targets have provided a useful long-term perspective for investment planning. The national trajectories are also a point of reference for the Commission for reporting and monitoring.

28 The legal framework should ensure that Member States provide up-to-date information so that the Commission can identify whether or not they need to take corrective action. The regulation on energy statistics²⁶ stipulates that all energy data is to be reported to Eurostat once a year, and no later than 11 months after the year end²⁷. The regulation provides Eurostat with two months to interact with Member States and validate these data; and the directorate-general for Energy (DG ENER) then takes a further two months to produce its biennial report on renewable energy policy developments, which is a stipulation of RED I. If the report indicates that a Member State is not meeting its indicative trajectory set in the directive, DG ENER can require the Member State to submit an amended NREAP and set up remedial actions to regain the trajectory.

29 So far, DG ENER has published four of these progress reports: in 2013, 2015, 2017 and 2019²⁸. The last report, published in April 2019, covers the situation in 2015-2017. Ultimately, it will only be clear in the spring of 2022 whether or not Member States have achieved their overall 2020 targets. Since reporting is based on data that is two years old, this does not allow the Commission and policy-makers to take timely corrective action when and where it is most needed.

30 In addition, RED I restricts the Commission's mandate to monitoring each Member State's achievement of its two-yearly indicative trajectory. It does not require the Commission to monitor the Member States' achievement of their NREAPs overall or sectoral targets. So far, the Commission was only once required to ask for corrective action when the Netherlands did not meet its 2015-2016 indicative trajectory target.

²⁶ Regulation (EC) No 1099/2008 of the European Parliament and of the Council of 22 October 2008 on energy statistics (OJ L 304, 14.11.2008, p. 1).

²⁷ Regulation (EC) No 1099/2008 of the European Parliament and of the Council of 22 October 2008 on energy statistics (OJ L 304, 14.11.2008, Annex B, p. 48).

²⁸ https://ec.europa.eu/commission/publications/4th-state-energy-union_en.

However, the Netherlands did not submit an amended NREAP, which was the corrective action required.

Member States visited incentivised investment in wind and solar PV installations, but reducing support schemes slowed deployment

31 We examined whether the national support schemes in the four Member States visited had effectively contributed to the development of projects in wind and solar PV power, and whether there was cooperation among Member States. We also examined who bears the costs of support to renewables and how subsequent reductions in the level of support, especially for solar PV investments, have influenced the deployment of new projects. In addition, we assessed whether auctions (which is the main tool for allocating new capacity since 2017, see paragraph 11) and citizen participation (either as ‘prosumers’²⁹ or organised in ‘energy communities’³⁰) could be a way forward to address the slow growth in the wind and solar PV sectors.

The four Member States examined incentivised investment in wind and solar PV power, though they made little use of cooperation mechanisms

32 RED I called on Member States to develop support schemes based on incentives for private sector investors to boost the new ‘green economy’. It also required them to incorporate the concept of ‘priority access’ of renewable electricity into national law, and suggested that they make use of cooperation mechanisms to create synergies with other energy markets.

33 All four of the Member States we examined had set up support schemes. Until the Commission made auctions compulsory for large scale installations (see paragraph 11 and footnotes 16 and 17), Germany and Spain were using FITs and FIPs and Greece almost exclusively FITs, all three through calls of interest. Poland used the system of tradable certificates. *Annex VI* presents timelines for each Member State showing the take-up of support schemes and the evolution of wind and solar PV capacity from 1999 to 2017.

²⁹ Owners of renewable micro-installations who produce and consume electricity to meet some or all of their own needs, with the option of feeding excess electricity into the grid.

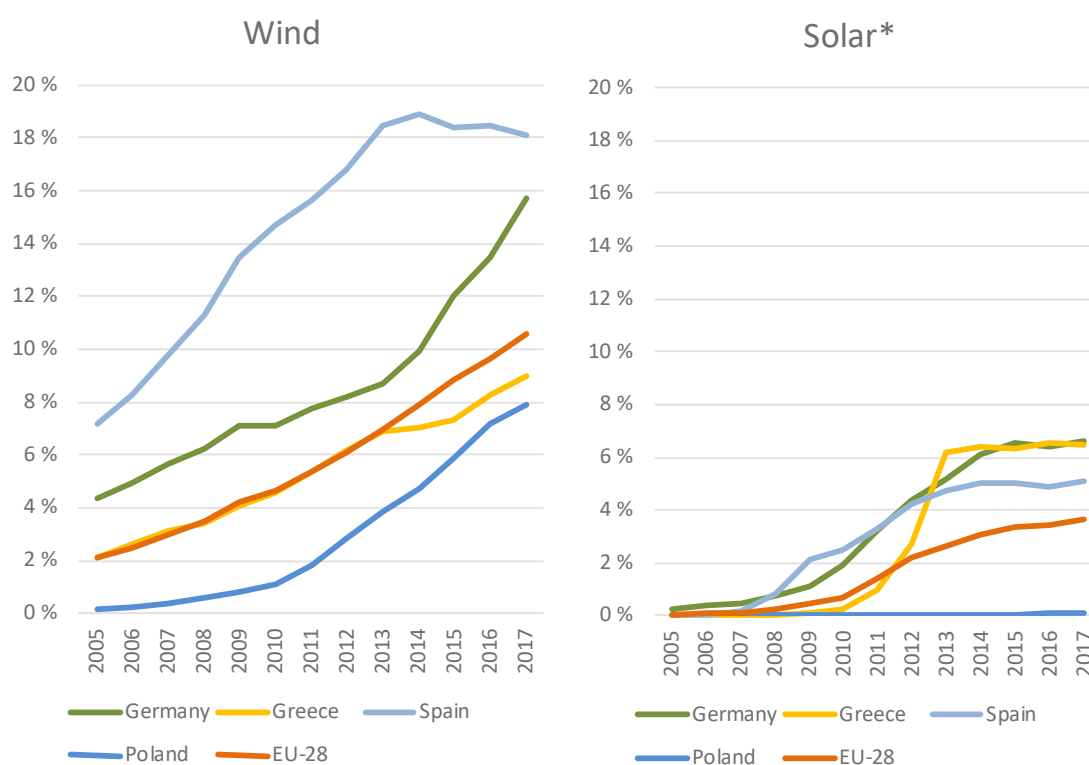
³⁰ Groupings set up by owners of renewable installations to sell and manage the energy produced by those installations.

34 Investors spotted the new business opportunity, which offered two advantages:

- (a) the tariff/premium per kWh produced was set in contracts of at least 20 years' duration, thus providing investors with certainty for a long period; and
- (b) despite the large upfront capital requirement, subsequent operating costs, including staff costs, are generally low.

35 Deployment followed rapidly once a Member State had introduced provisions on support for renewables into national law. Since the schemes began, the share of wind power in total electricity generation has shown a constant and fairly linear increase, with the exception of Spain, where wind capacity has stagnated since 2014 (see [Figure 4](#)). The share for solar increased rapidly in Germany, Greece, and Spain from around 2008-2010, before stagnating in Greece and Spain after 2013, because of the measures taken to combat the initial high support. In Poland, solar energy has contributed next to nothing to the generation of electricity, as Poland did not set ambitious targets for solar PV (see [Table E](#) in [Annex V](#)).

Figure 4 – Share of wind and solar in total electricity generation in the four Member States and the EU-28, 2005-2017



* The figure for solar relates to both solar PV and solar thermal for electricity. However, solar PV accounts for 98 % of the two technologies in the EU as a whole (see footnote ³).

Source: ECA, based on Eurostat data.

36 Although all four Member States wrote the ‘priority access’ of renewable electricity into national law, they made little use of the cooperation mechanisms referred to in the directive. Cooperation mechanisms have been used only three times: a joint tender procedure for solar PV investments between Germany and Denmark; a joint certificate scheme operated by Sweden and Norway; and statistical transfer agreements between Luxembourg and Lithuania and Estonia (both of which had already achieved their 2020 targets by 2014), for a price of approximately 15 €/MWh transferred. The apparent unpopularity of cooperation mechanisms was pointed out in November 2016 by the ‘REFIT’ evaluation of RED I³¹. We have already reported that the EU faces a challenge in getting the local, regional and national energy markets to work together for the development of the internal energy market³².

Adjustment of the high initial levels of support, especially for solar PV, deterred potential investors

37 Favourable support conditions allow a ‘green economy’ to grow. However, Member States need to regularly monitor the market, so that when it becomes self-regulating, support may be adjusted downwards to avoid overcompensation, high electricity prices for consumers and a drain on public finances.

Oversubsidisation of projects by Member States

38 An efficient support scheme should encourage investment without providing overcompensation. To achieve this goal the levelised costs of electricity (LCOE, see [Box 1](#)) should be used to define the renewables generation costs and help to determine the FITs/FIPs offered to potential investors³³.

39 In 2010, the LCOE for solar PV installations was 360 US \$/MWh (approximately 270 €/MWh, see [Figure 3](#)). For example, between 2008 and 2010, the FIT for solar PV installations in Germany, Greece and Spain was between 18 % and 67 % higher than the LCOE, leading to sizeable profits for producers (see [Box 4](#)).

³¹ SWD(2016) 417 final, ‘Regulatory Fitness and Performance evaluation of Directive 2009/28, accompanying the proposal for a Directive on the promotion of the use of energy from renewable sources (recast)’, p. 5.

³² Special Report No 16/2015: ‘Improving the security of energy supply by developing the internal energy market: more efforts needed’.

³³ Ecofys, ‘Design features of support schemes for renewable electricity’, 27.1.2014.

Box 4

Examples of the level of tariffs for solar PV projects in the three Member States examined that used FITs

In 2009, the FIT for a 20-year contract in Germany ranged from 430 €/MWh for small installations up to 30 kWp³⁴, to 319 €/MWh for large ground-mounted installations.

In 2009 and 2010, Greece offered a 20-year FIT of 450 €/MWh for installations between 10 and 100 kWp, and 400 €/MWh for installations above 100 kWp.

In 2008, Spain was signing 25-year contracts with a FIT of 440 €/MWh for installations of less than 100 kW, and 418 €/MWh for installations between 100 kW and 10 MW.

In 2010, the LCOE for solar PV installations was approximately 270 €/MWh.

40 Poland's pricing of tradable certificates was also very attractive until 2011: the certificate value per MWh produced was on average equal to 59 % of the producers' revenue. In 2011, certificates were priced at 282 zł/MWh (approximately 60 €/MWh), while the price paid for electricity was on average 199 zł/MWh (approximately 50 €/MWh).

41 During the same period, technological innovation boosted the production capacity of new installations and drove down material and ancillary costs, especially for solar PV. In Germany, according to the federal ministry of economic affairs and energy, the cost of a typical 10 kWp to 100 kWp rooftop solar PV system dropped by approximately 27 % (from 4 100 €/kWp to 3 000 €/kWp) between 2008 and 2009. In Greece, according to the ministry of environment and energy, the cost of the same type and size of installation dropped by 70 % between 2009 and mid-2013.

42 Germany, Greece and Spain also offered tariffs/premiums for onshore wind power, ranging from 80 €/MWh to 100 €/MWh, for more than a decade. In 2010, onshore wind power was much more economical per MWh produced compared to that of solar PV. [Annex VI](#) shows how tariffs have evolved in the four Member States for both wind and solar PV.

³⁴ Kilowatt peak (kWp): the peak power of a solar PV panel. Solar PV panels, when in operation, produce in kilowatt-hours (kWh). For example, PV panels with a peak power of 300 kWp when working at their maximum capacity for one hour will produce 300 kWh.

43 In the early years, generous FIT/FIP schemes, high prices of tradable certificates and falling technology costs combined to mean significant profits, especially for solar PV installations. The situation became even more advantageous whenever, on top of an attractive FIT/FIP, a project was awarded investment aid (a grant partly covering installation costs). We found that a number of the projects we examined were breaking even within four to six years and would therefore have been implemented even with lower levels of support (see paragraph 72).

High level of support has driven up electricity prices and contributed to national public deficits

44 The cost of incentivising renewables through FITs/FIPs is covered either directly by the final consumer or by the state budget. In Germany, the cost of supporting renewables is a major component of electricity bills, and takes the form of a ‘surcharge’ (see **Box 5**). Studies show that the ‘surcharge’ will decrease only when the current 20-year FIT/FIP contracts come to an end³⁵.

Box 5

Support for renewables has significantly increased electricity bills in Germany

German electricity prices (including all taxes and levies) for households³⁶ and non-household³⁷ consumers are traditionally above the EU average (44 % and 39 % higher respectively for the first semester of 2018), partly due to the ‘surcharge’. Furthermore, regulations allow an 80 % to 85 % exemption from the ‘surcharge’ for certain industries as a competition measure. The 4 000 companies concerned represent one fifth of the country’s total power consumption, and their €4.8 billion exemption has to be made up by all other consumers.

45 In Spain support for renewables is primarily covered by the national budget. Thus, high FITs/FIPs led to a significant drain on public finances. The government has managed to stabilise the cost of FIT/FIP support for all renewables at around €6.5 billion/year since 2013, through a series of measures which targeted the producers. In Greece, the initial intention was to cover the support through the national budget. However, because of the economic crisis, the cost for the support was

³⁵ Agora Energiewende, ‘Die Energiewende im Stromsektor: Stand der Dinge 2017. Rückblick auf die wesentlichen Entwicklungen sowie Ausblick auf 2018’, figure 7-4, p. 46.

³⁶ http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nrg_pc_204&lang=en.

³⁷ http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nrg_pc_205&lang=en.

passed to producers and to a lesser extent to consumers through the increase of a special duty for renewables. The public finance deficit chargeable to renewables was entirely offset by January 2018.

46 The situation is different for tradable certificates, where oversupply directly affects the income of renewables producers, especially when there is no state intervention guaranteeing a minimum price for the certificates, as was the case in Poland (see [Box 6](#)).

Box 6

Ineffective national aid scheme conditions led to many Polish wind farms operating at a loss

In Poland, the high launch price of certificates, combined with attractive levels of investment aid, encouraged numerous investors to enter the renewables market. This in turn contributed to an oversupply of certificates, whose price steadily fell, with a knock-on effect on the income of producers. By 2017, certificates were worth 86 % less than in 2011³⁸. According to the Energy Market Agency data for the first half of 2017, 70 % of Polish wind farms over 10 MW were operating at a loss.

The reduction of support levels by Member States affected the growth rate of the share of wind and solar PV in electricity generation

47 To reduce the cost of support for renewables, Member States have adopted several measures directly targeting producers. Depending on the scale of the measures and the way they were applied (retroactively, with immediate effect or after a transitional time period) the deployment of renewables has been significantly affected in three out of the four Member States examined, as also highlighted in the REFIT evaluation of RED I³⁹.

48 Germany was one of the first to lower its tariffs: an initial drop in 2009 was followed in 2012 by an even more drastic cut that included changes to the tariff calculation formula to take account of the previous year's installed capacity. However,

³⁸ In 2017, certificates were worth less than 39 zł (9 €)/MWh, while the electricity price averaged 164 zł (39 €)/MWh. In other words, just 19.2 % of producers' average revenue of 202 zł (48 €)/MWh came from their certificates.

³⁹ REFIT evaluation of RED I, page 6.

because the lowering of tariffs was transparent and predictable and included transitional periods, it did not discourage investors (see [Box 7](#)).

Box 7

Transparency and predictability of support have sustained the increase in investment in both wind and solar PV in Germany

During 2012-2016, when wind deployment was slowing down and solar PV was stagnating in most Member States, Germany's wind and solar PV capacity continued to increase, albeit for solar PV at a slower pace than before (see [Figure 4](#)). The slower rate of increase since 2014 can be attributed, however, to a new measure in the form of annual upper and lower capacity limits (the so-called 'deployment corridors').

49 However, severe tariff cuts have discouraged solar PV investors in Greece. In 2010, the country first lowered its FITs for solar PV, even if no clause for price amendments was included in the contracts signed with the producers. Since then it has lowered tariffs again several times, in two cases with retroactive effect. Between 2013 and 2016, when Greece organised its first pilot auctions, virtually no new solar PV capacity was installed. By contrast, the Greek wind sector has never experienced tariff cuts and wind capacity has shown an almost linear increase of around 10 % per year, even during the years of the Greek economic crisis.

50 Changes in the Spanish legal framework brought investment in wind and solar PV to a complete stop for several years. In 2010, the Spanish government started limiting the number of hours for which renewable production could be remunerated and even required producers to pay a fee for feeding electricity into the grid; by 2012 it offered no subsidies for new wind or solar PV installations. The FIT/FIP model was finally abandoned in 2013 in favour of a compensation system that offered a return on investment based on defined criteria. The new measures, which were retroactive in some cases, affected investor confidence and brought wind (2012) and solar PV (2011) investments in Spain to a complete stop. Until 2015, when the first pilot auctions were launched, the country implemented no new capacity at all.

51 In Poland, strict location requirements have damaged investment in wind. The 2016 law on investment in wind turbines set strict location requirements, prohibited any modernisation of existing turbines not meeting the new location requirement and drastically increased the tax levied on wind installations (the modernisation and tax clauses were eventually repealed in mid-2018). The tradable certificates system was closed to new entrants in mid-2016, and no auctions were held for standard-size wind

installations until mid-2018. As a result, from mid-2016 until mid-2018 wind capacity in Poland increased only marginally.

The growth of renewable electricity is hindered by insufficient auctions and practical barriers for producers

52 As part of our audit, we assessed whether auctions and citizen participation could address the slow growth in the wind and solar PV sectors — auctions by lowering levels of state support and citizens by providing an additional source of private funding.

In two of the Member States examined the capacity scheduled to be auctioned will not be sufficient to ensure that 2020 targets are met

53 We found that all four Member States visited, in compliance with the most recent state aid guidelines (see paragraph 11), have organised auctions when allocating new renewable capacity. The results of auctions held in 2016 and 2017 have shown that some wind and solar PV investments in Germany (and, according to DG ENER, in the Netherlands) are now undertaken without state support — although grid connections are state-funded. In Spain too, recent contracts were awarded without public support other than a guarantee to cover electricity price falls below a certain threshold. By contrast, recent auctions in Greece⁴⁰ and Poland⁴¹ resulted in prices that are still higher than the fossil fuel equivalent, but in Greece to a far lesser extent than under the FIT scheme.

54 However, Spain has not scheduled any auctions, and the new capacity of around 8 500 MW which was auctioned between 2015 and 2017 is not enough to offset the recent years' slowdown. Poland did not organise auctions for wind and solar PV installations of more than 1 MW capacity (the equivalent of a 1985 onshore wind turbine⁴²) until mid-2018. These facts raise further concerns as to whether these two

⁴⁰ The weighted average prices bid in the 2018 auctions in Greece were: solar PV (max. 1 MW) 78.4 €/MWh; solar PV (1 to 20 MW) 63.8 €/MWh; and wind (3 to 50 MW) 69.5 €/MWh.

⁴¹ The prices bid in the 2017 auctions in Poland fluctuated between 195 zł (47 €/MWh) and 390 zł (93 €/MWh) for solar PV (max. 1 MW); and between 285 zł (68 €/MWh) and 320 zł (76 €/MWh) for wind (max. 1 MW).

⁴² According to the wind energy association WindEurope, in 1985 the average capacity of an onshore wind turbine was under 1 MW; by 2012 this had risen to 2.5 MW; and in 2018 it was between 2.5 and 3 MW. Today there are turbines of 7.5 MW capacity, 15 MW turbines are planned and 20 MW is theoretically possible in the near future.

Member States will be in a position to meet their 2020 targets, taking into consideration the necessary timespan for the implementation of wind projects. In Germany and Greece, auctions have been planned and are taking place as scheduled. However, deployment corridors in Germany continue to limit the auction capacity, and Greece still faces the challenge of attracting enough investors to participate in its auctions.

55 The key part of the success of any auction is to gain investor trust by allowing participants to determine the bidding price in a transparent way (see [Box 8](#)).

Box 8

Transparency in auctions fosters competition: the Greek regulatory authority's IT platform

Greece's regulatory authority has developed an online platform for contracting by auction. Each auction lasts for 30 minutes, and participants bid in real time and can see their competitors' bids. In the wind auction held in July 2018, a total of 14 participants submitted 342 bids; during the auction the price dropped from 90 €/MWh to 68.2 €/MWh.

Citizen participation in wind and solar PV investments, either as prosumers or organised in energy communities, face barriers

56 We found that all four Member States visited have enacted legislation, in line with RED I, to allow the production of electricity for self-consumption by prosumers or energy communities. In 2017, in Germany private individuals and farms owned 49 % of its solar and 41 % of its onshore wind installed capacity⁴³. In most of these cases, the private individuals were organised in energy communities. Some Spanish regions have even set self-consumption targets. However, in some cases development of this segment faces barriers. For example, to obtain payment for the excess electricity they feed into the grid, prosumers in Spain are required to participate in the spot energy market. This is cumbersome for small producers, as it requires multiple licences and participation costs. In Poland, prosumers, even if they face certain limitations (such as taxation and limited benefits for feeding energy into the grid), are the most rapidly developing renewables segment.

⁴³ Magazin für Wind-, Solar- und Bioenergien, 'Bürger sind die wahren Treiber der Energiewende', February 2018.

Various limitations delay wind and solar PV investments

57 We examined whether spatial planning and administrative rules support investment in wind and solar PV. We also assessed how grid insufficiencies influence the deployment of renewables projects, how poor interconnection capacity with neighbouring countries limits cooperation and how important it is to invest in both in the near future.

Spatial planning rules limit the development of wind installations in two of the Member States examined

58 Spatial planning constraints can significantly limit the development of new projects. Provisions for determining the minimum distance between a wind park and residential areas can be particularly restrictive. The challenge is for Member States to put in place spatial planning provisions which protect urban areas and nature reserves while allowing the deployment of wind and solar PV power.

59 We found that this was an issue in two of the Member States we examined. For example, ever since one German region set the minimum permissible distance separating a turbine from the nearest housing at 10 times the total height of the turbine (reaching the distance of 2 km), it has received no new applications to build wind installations. The impact of the measure was to reduce the land that could be used for wind parks to approximately 0.3 % instead of the envisaged area of 2 % to 3 % of the region's area. The same provision was introduced in Poland in 2016. There has been no official impact assessment, but studies⁴⁴ have shown that this provision reduced the land eligible for wind investments to just 0.1 % of the national territory instead of the envisaged area of 2.6 % when a 1-kilometre wide buffer zone is kept between the installations and settled areas.

Lengthy administrative procedures complicate the business environment for new wind projects in particular

60 Administrative rules for renewable wind installations typically require authorities to issue permits or take decisions relating to environmental aspects, construction works, grid connections or licences to generate and sell electricity. Member States should put in place procedures with a minimum of administrative hurdles to attract

⁴⁴ For example, EARSeL 34th Symposium Proceedings, 'Spatial consequences of adopting selected criteria for wind farm siting', June 2014.

investors to the renewables market while at the same time safeguarding issues such as health and environment in rural and urban areas.

61 On average, and depending on size, an onshore wind installation can be physically completed in five years (including time for the issue of administrative documents), an offshore wind park in eight years, and a solar PV installation in two years; rooftop solar PV projects require less than a year. However, we found that Germany's 'one-stop shop' approach is an effective way of minimising administrative hurdles (see [Box 9](#)).

Box 9

Eliminating administrative hurdles: the 'one-stop shop' in Germany

To avoid lengthy administrative procedures and speed up deployment, Germany introduced a 'one-stop shop'. This is an office which provides support for obtaining a single authorisation covering all the necessary permits. In the case of one onshore wind park we examined, a 43-page permit requiring the approval of eight authorities and five departments was issued in less than six months.

62 Although Member States have set maximum time limits for their administrative procedures, we found that these were not met in Greece and Spain for wind projects. In both countries, it can take up to seven years to implement an onshore wind project. In Spain, we also found lengthy procedures for small-scale self-consumption installations, where licensing took a year on average.

Delays in grid investment, including interconnection infrastructure, have held back deployment

63 Electricity reaches consumers through the transmission and distribution grid. The main challenges of the grid in relation to the deployment of wind and solar PV installations are its capacity to absorb intermittent electricity⁴⁵, the remoteness of areas with high wind and solar PV potential, and the long distances between areas of

⁴⁵ Electricity from energy sources which do not continuously produce due to some extraneous factor is described as intermittent. For example, wind turbines do not generate electricity when no wind is blowing; solar PV installations do not produce at night, or when a thick cloud layer hides the sun.

high potential and those of high electricity demand⁴⁶. Another challenge is to ensure that interconnection capacity⁴⁷ is sufficient to allow cross-border flows whenever they are needed or most economical.

Delays in grid investment impact the deployment of renewables

64 Grid investment has been considerably delayed in all four Member States. However, the issue is most urgent in Germany, where less than 10 % of the planned grid extension within the country (just 750 km out of 7 900 km) had been completed by the end of 2017. Germany's under-developed grid results in loop flows of energy⁴⁸ with neighbouring countries when the German network cannot cope with excess power transfers. For example, when wind parks in the north of Germany generate excess power, the grid is at times unable to carry all electricity to the south of the country and Austria, where the main demand is located. Electricity must be re-routed through Poland, the Czech Republic and Slovakia. As a consequence, in 2017 the Polish grid received over eight times more electricity than planned from Germany, despite the fact that the Polish authorities often reduced the German power flows.

65 We found grid insufficiencies that impeded the development of renewables in areas with high wind and solar potential in Greece (Peloponnese) and Spain (Andalusia), where new renewable plants cannot be installed. According to the Greek transmission system operator (TSO)⁴⁹, some Greek islands are not expected to be fully connected with the mainland before 2023, although this would save the national budget €350 million/year, by reducing for example the transport cost of petroleum to the islands.

⁴⁶ The integration of intermittent renewable energy sources, such as wind and solar PV, into the grid will also require a significant increase in the use of energy storage technologies to help balance supply and demand. However, our Briefing Paper on 'EU support for energy storage', published in April 2019, highlights a number of challenges to the development and deployment of energy storage technologies in the EU.

⁴⁷ Interconnection capacity is defined as the ratio between a country's net transfer capacity to its installed generation capacity.

⁴⁸ Loop flows denote deviations between scheduled flows of energy (defined by market transactions) and physical flows of energy (the actual flows in the electricity grid). Thema consulting group, 'Loop-flows Final advice', October 2013, p. 4.

⁴⁹ A national or regional public or private entity responsible for transporting energy in the form of natural gas or electrical power, using fixed infrastructure.

66 The Commission has estimated that renewables will need to account for around half of all electricity generation if the initially proposed 2030 overall target of 27 % of gross final energy consumption is to be achieved⁵⁰; IRENA has calculated that the adopted 2030 target of 32 % will necessitate a 55 % share of generated electricity⁵¹. Given that renewables currently have almost a 31 % share of the electricity sector and that this already poses a take-up challenge for the grid, investment is urgently needed. To this end, renewable energy management centres can help maximise the absorption of renewables (see [Box 10](#)).

Box 10

An example of a grid management to maximise the absorption of renewables: the CECRE IT management system in Spain

The Renewable Energies Control Centre (CECRE) in Spain has created an IT management tool that can process information in real time (every 12 seconds) on the production and grid connection status of each renewable electricity generation facility in the country. The tool verifies whether the electricity generated from renewables can be fed into the system and anticipates what measures are needed to maintain the system's balance and safeguard security of supply. CECRE's monitoring capability allows Spanish wind parks to participate in the regulatory energy market, and around half of them do so.

The level of interconnection between Member States is not sufficient to support renewables deployment

67 The 2002 Barcelona Council set an electricity interconnection target for Member States of 10 % by 2020, as a measure to increase renewables deployment allowing cross-border flows whenever they are needed or most economical. However, in 2015 the grids in 12 Member States were not yet ready for this target⁵². Spain is one of those Member States. With a transfer capacity to France of just 5 % of installed capacity in 2017, Spain (and with it the Iberian Peninsula) remains largely an energy

⁵⁰ COM(2017) 718 final, 'Strengthening Europe's energy networks'.

⁵¹ IRENA, 'Renewable Energy Prospects for the European Union', February 2018, p. 117.

⁵² In descending order of percentage attained, these Member States are: Ireland, Italy, Romania, Portugal, Estonia, Latvia, Lithuania, the United Kingdom, Spain, Poland, Cyprus, and Malta. COM(2015) 82, 'Energy Union Package, Achieving the 10 % electricity interconnection target: making Europe's electricity grid fit for 2020', p. 5.

island. Projects already approved will increase the level to around 8 %, but not before 2025.

68 The European Council of October 2014⁵³ endorsed the Commission's proposal of May 2014⁵⁴ to extend the 10 % interconnection target to 15 % by 2030, but with no infringement proceedings in case it is not met. A 2017 report⁵⁵ by the Commission's expert group on electricity interconnection targets included Germany, Greece and Spain among eight Member States that more urgently need to invest.

Cohesion policy funding helped increase wind and solar PV capacity, but also involved cases of oversubsidisation

69 We examined whether the cohesion policy funding (ERDF and CF) available for wind and solar PV investments has delivered sustainable outputs and results. In particular, we assessed how well a sample of 24 co-financed projects, supported from nine OPs in one of the two periods (2007-2013 or 2014-2020), were implemented and what results they achieved. Nine were wind projects, 12 were solar PV and three were mixed installations combining the two technologies (see [Annex III](#)).

70 Of the 24 projects we examined, we evaluated those that were completed and operational at the time of the audit. For those 20 completed projects we found that in all cases the projects were implemented in line with the project application (the expected capacity had been installed with no cost overruns), were in operation at the time of the audit, had no sustainability issues and were making profits.

71 We found that 13 of the completed projects are producing the anticipated volumes of electricity. Of the other seven projects, two wind projects in Greece were producing less than planned and five small off-grid installations for self-consumption in Spain did not provide us data. 17 of the completed projects had been implemented without significant delays (i.e. not exceeding three months). Two projects in Poland and one in Greece, were completed a little less than a year late.

⁵³ Council Conclusions of 23 and 24.10.2014.

⁵⁴ COM(2014) 330 final, 'European Energy Security Strategy'.

⁵⁵ Report of the Commission expert group on electricity interconnection targets 'Towards a sustainable and integrated Europe', November 2017, Annex 3.

72 We found that Cohesion policy funding as investment aid for wind and solar PV projects involved cases of oversubsidisation. Nine of the 24 audited projects (three in Germany, four in Greece, one in Spain and one in Poland⁵⁶) had a very attractive internal rate of return (IRR)⁵⁷, which was 3 to 11 percentage points greater than the 10-year government bond yields⁵⁸ of the month that they were approved. This was mainly because they were benefiting from investment aid on top of a very generous FIT to support their operating costs (see paragraph 39). Also, for another four off-grid projects in Spain that received only investment aid in the form of an EU grant, the return on investment⁵⁹ represented by energy savings at the time of the project application, was reached very quickly (in 3.6 to 6.2 years).

73 We highlighted the oversubsidisation of a number of renewable energy projects in our previous special report on renewable energy⁶⁰; it has also been raised in several audit reports by national Supreme Audit Institutions⁶¹.

In comparison with RED I, the revised EU regulatory framework further supports the expansion of renewables but important deficiencies remain

74 In 2016, the Commission proposed the ‘Clean Energy’ package (see paragraph 09) which aims to establish reinforced links between the different policy areas related to

⁵⁶ For this one Polish project, it later turned out that the forecasted IRR did not materialise (see **Box 6**).

⁵⁷ An interest rate which, compared to the cost of the capital involved, is used to determine a project's viability.

⁵⁸ OECD, ‘Long-term interest rates’, data.oecd.org/interest/long-term-interest-rates.htm, as of 9.1.2019.

⁵⁹ The number of years that the earnings from an investment will pay the cost of the investment.

⁶⁰ Special Report No 6/2014: ‘Cohesion policy funds support to renewable energy generation — has it achieved good results?’, paragraph 43.

⁶¹ The Czech Republic, ‘Finances earmarked for the support of energy production from renewable energy’, Nejvyšší kontrolní úřad, 2014; Denmark, ‘Report on the amendment of the legislation concerning the support for photovoltaics’, Rigsrevisionen, 2014; Cyprus, ‘Renewable energy sources’, Ελεγκτική Υπηρεσία της Δημοκρατίας της Κύπρου, 2016; and the United Kingdom, ‘Early contracts for renewable electricity’, National Audit Office, 2014.

energy. The most relevant parts of this package to renewables are RED II⁶² and the governance regulation⁶³. We examined the legislation to assess the extent to which it addressed some of the issues highlighted in the previous sections of this report and whether it creates a supportive environment for the development of renewables, including wind and solar PV for electricity generation.

75 We found that the RED II directive includes support for electricity generation from renewables, in particular from wind and solar PV power:

- the directive requires improvement in the design and stability of the support schemes. Member States must ensure that these schemes are not revised in a way that negatively impacts the rights of the renewables producers and undermines the economic viability of installations already receiving support, as we found to be the case in three of the Member States we examined (see paragraph 47);
- it enshrines the two principles of self-consumption of renewable energy and energy communities. We found limitations in two of the Member States we examined (see paragraph 56);
- by requiring Member States to set up a one-stop shop to coordinate the entire licensing procedure for new renewable installations and setting limits to the time needed to grant all the necessary permits, it contributes to simplifying administrative procedures. In two of the Member States we examined, we found that complicated administrative procedures hindered the development of new wind and solar PV installations (see paragraph 62); and
- it encourages the set-up of financial instruments addressed to projects that:
 - (a) aim to improve grid stability, manage grid congestions and increase the flexibility of the transmission system, including projects that will help to reach the 15 % electricity interconnection target by 2030, all issues for which we have reported findings (see paragraphs 64 to 68); and
 - (b) enhance cooperation

⁶² Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast) (OJ L 328, 21.12.2018, p. 82).

⁶³ Regulation (EU) 2018/1999 of 11 December 2018 on the governance of the Energy Union and climate action and amending Regulations (EC) No 663/2009 and (EC) 715/2009 and Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU, 2013/30/EU, 2009/119/EC and 2015/652 and repealing Regulation (EU) No 525/2013 (OJ L 328, 21.12.2018, p. 16).

mechanisms, which were little used in RED I, between Member States and between Member States and third countries (see paragraph 36).

76 Our assessment of the governance regulation shows that better monitoring of the Member States' efforts to increase the share of renewables in the three sectors of electricity, heating and cooling, and transport should result from the Commission's extended mandate to:

- monitor the integrated national energy and climate plans (NECPs) that the Member States will have to submit every ten years, and update at least once in 2024, covering the policies and measures towards the five energy dimensions⁶⁴. In other words, it does not limit the Commission's role predominantly to the monitoring of the indicative trajectory as RED I did (see paragraph 30); and
- monitor and report to the European Parliament every three years on the performance of support granted by means of auctions, currently the main tool for increasing renewable energy capacity, and which appears to minimise state support (see paragraph 53).

77 We also noted that some new deficiencies have been created and a previous one continues. Although the Commission noted in 2016 that the national targets of RED I were considered to be the most important driver for renewable energy policies and investments in many Member States⁶⁵, RED II replaces these with a binding target of at least 32 % at European level only. This creates the risk of Member States being either high-achievers or under-achievers in renewables and the risk of a gap between Member States renewables deployment and the EU trajectories.

78 The governance regulation requires the Commission to monitor the EU's overall indicative trajectory into 2022, 2025 and 2027. However, the new legislation does not resolve the weakness we reported on timely reporting towards insufficient progress (see paragraphs 28 to 29). This further undermines the effectiveness of monitoring. As a result, the Commission may not be able to react in time to ensure progress if some Member States fall short in reaching their targets.

79 RED II and the governance regulation were adopted by the European Parliament and the Council two and a half years before the expiry of RED I on 1 July 2021. Member

⁶⁴ (a) energy security; (b) the internal energy market; (c) energy efficiency; (d) decarbonisation of the economy; and (e) research, innovation and competitiveness.

⁶⁵ REFIT evaluation, page p. 5.

States have until 30 June 2021 to transpose all new elements of RED II into national law. We found that all four Member States we examined transposed the previous directive into national law with delays, notably in the case of Poland, which needed more than four years.

Conclusions and recommendations

80 Overall, we found that half of the EU Member States are at risk of not generating enough electricity from renewable energy to meet their 2020 targets. We also found that the initial support schemes oversubsidized wind and solar PV deployment, but that decreasing the levels of support served to deter potential investment.

Encouraging auctions and the use of citizen participation are crucial for increasing investment and enhancing conditions for deployment, such as overcoming restrictive spatial planning rules, lengthy administrative procedures and grid insufficiencies.

81 Between 2005 and 2017, the share of renewables in the gross final energy consumption has increased significantly from 9.1 % to 17.5 %, with half of the Member States either already reaching or being close to reaching their 2020 target. However, meeting the national target for the remaining half remains a significant challenge. Therefore, there are concerns as to whether the results of the high-achievers in renewables will be enough to compensate for the under-achievers and to meet the overall EU target of 20 % (see paragraphs [22](#) to [24](#)).

82 The main contributor in the increase of the share of renewables in the gross final energy consumption was the electricity sector, which has doubled from around 15 % to almost 31 %, between 2005 and 2017. The technologies responsible for the growth in the electricity sector have been mainly wind and solar PV (see paragraphs [25](#) to [26](#)).

Recommendation 1 – Focus on closing gaps to meet the 2020 targets

The Commission should examine which Member States are at risk of not meeting their 2020 targets; and advise them to take effective action to close the capacity gap for renewables. These actions should also include consideration of auction planning, simplification of administrative procedures and investment in grid infrastructure and interconnectors.

Timeframe: by end of 2019.

83 RED I has played an important role in the development of renewables, setting binding targets to be achieved by 2020, both at EU and Member State level. However, the legal framework does not provide for timely reporting on progress of renewables or for a mandate for the Commission to address slow progress where the indicative trajectories are not being met (paragraphs [27](#) to [30](#)).

Recommendation 2 – Improve timeliness of statistical data on renewables

The Commission should prepare an amendment of the relevant parts of the energy statistics regulation, so that the Member States provide Eurostat with annual energy statistics including renewables within nine months of the year-end.

Timeframe: by mid-2021.

84 National support schemes boosted investment in renewables, however, the reluctance of Member States to cooperate on energy issues sustains a fragmented energy market (paragraphs [31](#) to [36](#)).

85 The decrease in the cost of technology and the high degree of interest in investing in the new ‘green economy’ grew at such a pace that it has led to oversubsidisation of projects, paid for through higher electricity prices and/or state deficits. To reduce the burden on consumers and national budgets, Member States introduced corrective actions, which dampened investor confidence and contributed to a market slowdown in the two sectors. We found that EU-led actions, such as auctions and citizen participation in renewable projects by incentivising prosumers and energy communities can contribute to increasing new wind and solar PV capacity and cover a part of the investment needs required for meeting the 2030 target (paragraphs [37](#) to [56](#)).

Recommendation 3 – Ensure sufficient auctions are planned to increase renewable capacity for electricity

The Commission should:

- (a) identify the Member States that have not scheduled auctions for renewables that allow for the additional capacity required for meeting the 2020 targets, and encourage them to define one; and
- (b) monitor and regularly report on the results of auctions held by these Member States.

Timeframe: by end of 2019.

86 Restrictive spatial planning rules limit deployment of new installations and lengthy administrative procedures complicate the business environment for new wind projects in particular (paragraphs [57](#) to [62](#)).

Recommendation 4 – Simplify procedures to create a more favourable environment for renewable electricity generation

The Commission should ask Member States to consider simplifying their current administrative procedures in the area of renewables with a view to expediting deployment and encouraging investment.

Timeframe: by end of 2019.

87 On RED II the binding EU target for the share of renewables in gross final energy consumption is set to be at least 32 % by 2030. This target will necessitate an electricity sector share of 55 % of electricity coming from renewables. In 2017, the share of electricity coming from renewables was almost 31 %. The delays in grid investment, including in interconnection infrastructure, impede the deployment of renewables and the development of synergies among Member States (paragraphs [63](#) to [68](#)).

Recommendation 5 – Promote investment in grid infrastructure and interconnectors

The Commission should:

- (a) examine for which Member States the grid is a limiting factor for further deployment of renewables;
- (b) advise Member States for which the grid potentially impedes deployment of renewables to take actions to resolve grid insufficiencies; and
- (c) encourage Member States to focus available ERDF and CF support related to climate change operations on grid development and management, and interconnectors.

Timeframe: by mid-2020.

88 Co-financed projects generally delivered planned outputs and results in terms of electricity generation, and are likely to be sustainable. However, there have been cases of oversubsidisation (paragraphs [69](#) to [73](#)).

89 Looking ahead, RED II and the governance regulation of the ‘Clean Energy’ package, introduce measures which can contribute to a better investment environment for electricity generation from renewables, if transposed in a proper and timely manner (for example, improving the design and stability of national support schemes and enshrining the principle of self-consumption). However, the lack of national targets, together with the failure to address the weaknesses related to the timely monitoring by the Commission jeopardises the achievement of the new EU target (paragraphs [74](#) to [79](#)).

Recommendation 6 – Improve monitoring to mitigate the absence of binding national targets

The Commission should monitor and urge Member States to transpose the ‘Clean Energy’ package, including RED II, into national legislation in a proper and timely manner and should regularly publish progress made in this regard.

Timeframe: by end of June 2021.

This Report was adopted by Chamber II, headed by Ms Iliana Ivanova, Member of the Court of Auditors, in Luxembourg at its meeting of 30 April 2019.

For the Court of Auditors

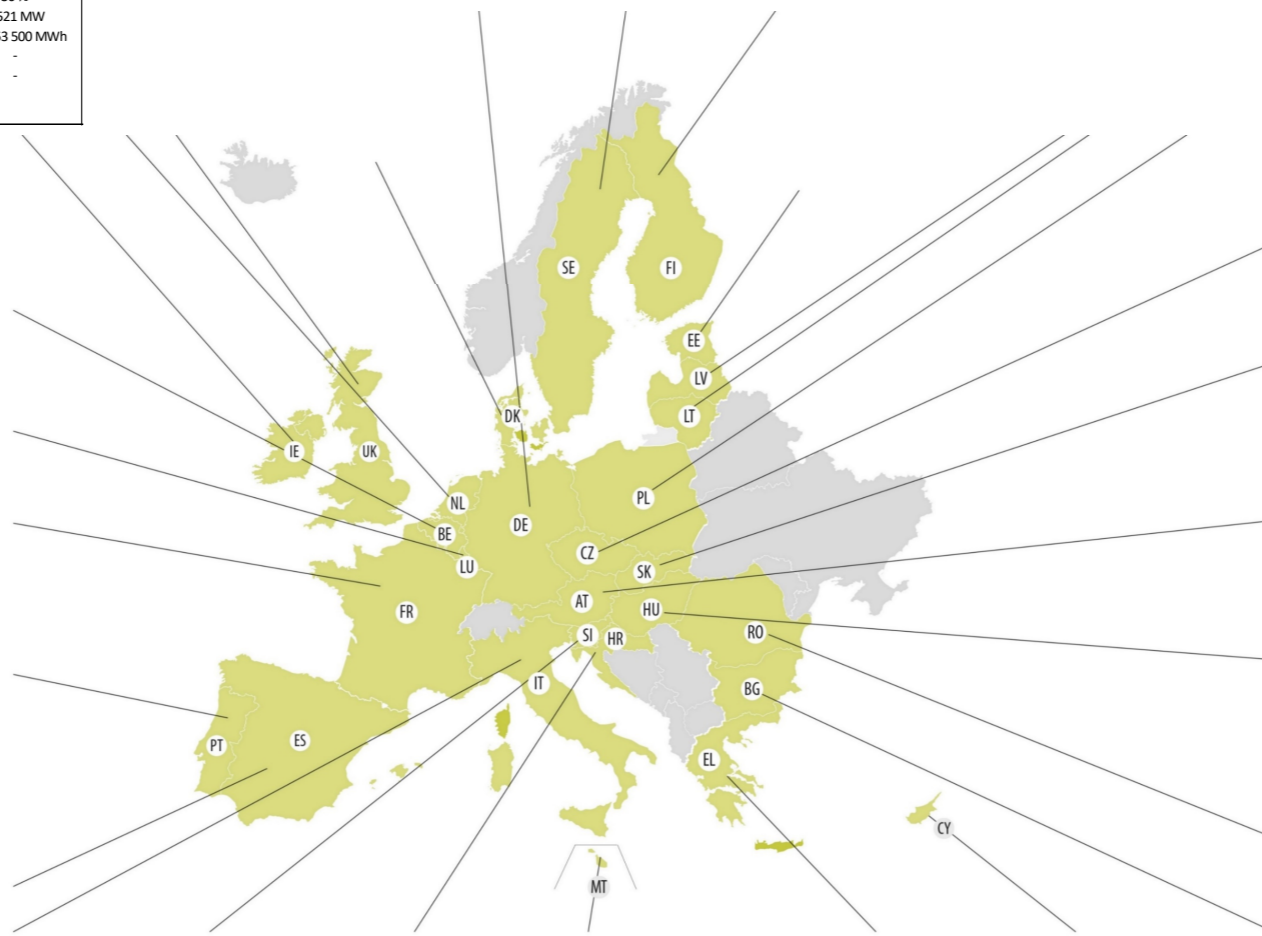
Klaus-Heiner Lehne
President

Annexes

Annex I — Data for wind in the EU-28

2020 target¹, 2017 capacity², 2016 final energy consumption³, ERDF/CF financing for 2007-2013 and 2014-2020⁴ and main national schemes⁵

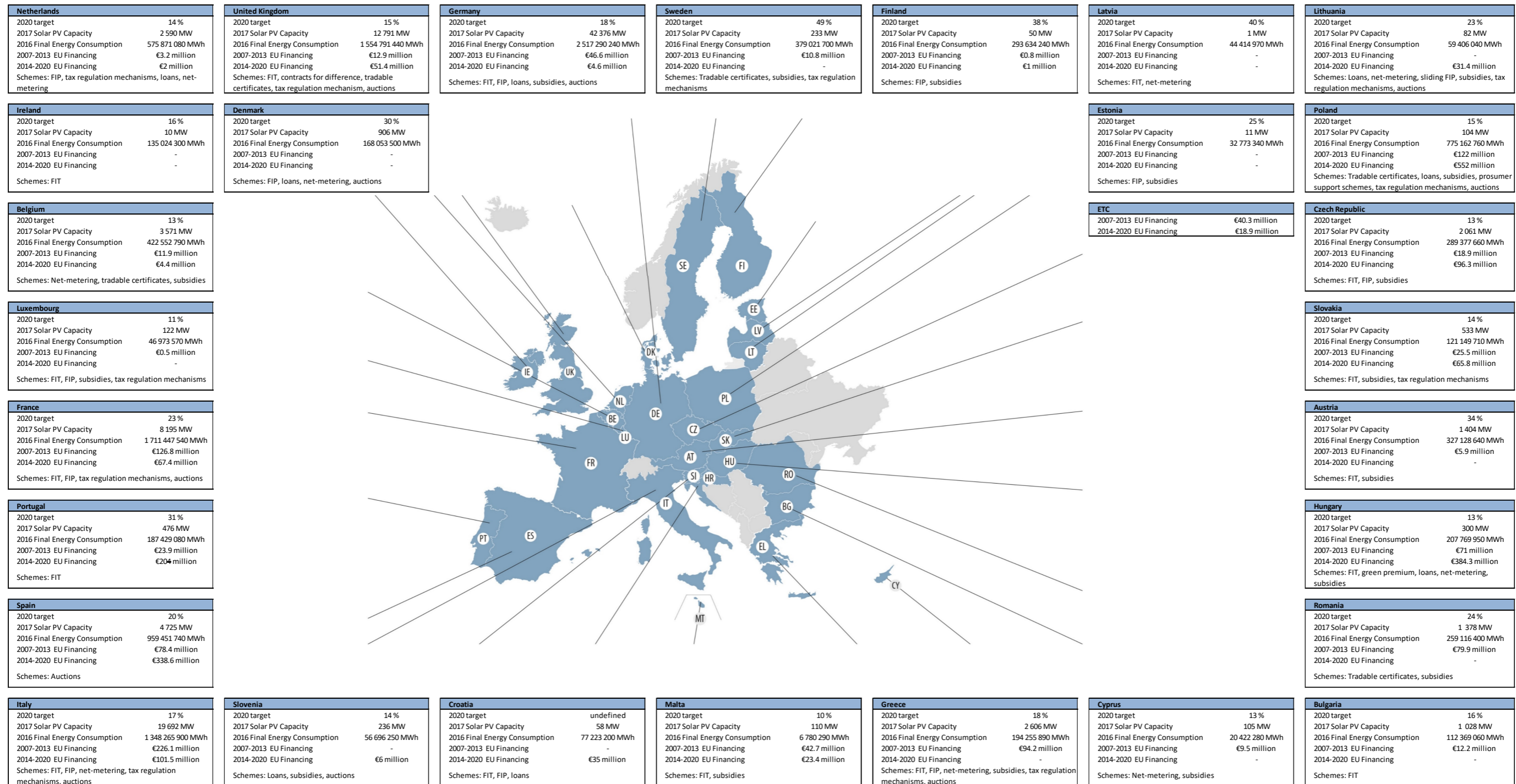
Country	2020 target	2017 Wind Capacity	2016 Final Energy Consumption	2007-2013 EU Financing	2014-2020 EU Financing	Schemes
Netherlands	14 %	4 270 MW	575 871 080 MWh	€4.5 million	€0.6 million	Schemes: FIP, tax regulation mechanisms, loans, net-metering
United Kingdom	15 %	20 488 MW	1 554 791 440 MWh	€14.8 million	€52.4 million	Schemes: FIT, contracts for Difference, tradable certificates, tax regulation mechanisms, auctions
Germany	18 %	55 87 MW	2 517 290 240 MWh	€35.3 million	€0.8 million	Schemes: FIT, FIP, loans, subsidies, auctions
Sweden	49 %	6 631 MW	379 021 700 MWh	€12.4 million	€1.8 million	Schemes: Tradable certificates, subsidies, tax regulation mechanisms
Finland	38 %	1 995 MW	293 634 240 MWh	€0.8 million	€0.8 million	Schemes: FIP, subsidies
Latvia	40 %	66 MW	44 414 970 MWh	€10 million	-	Schemes: FIT, net-metering
Lithuania	23 %	509 MW	59 406 040 MWh	-	€1.2 million	Schemes: Loans, net-metering, sliding FIP, subsidies, tax regulation mechanisms, auctions
Ireland	16 %	3 253 MW	135 024 300 MWh	-	-	Schemes: FIT
Denmark	30 %	5 521 MW	168 053 500 MWh	-	-	Schemes: FIP, loans, net-metering, auctions
Belgium	13 %	2 837 MW	422 552 790 MWh	-	-	Schemes: Net-metering, tradable certificates, subsidies
Luxembourg	11 %	120 MW	46 973 570 MWh	€0.3 million	-	Schemes: FIT, FIP, subsidies, tax regulation mechanisms
France	23 %	13 113 MW	1 711 447 540 MWh	€29.3 million	€20.6 million	Schemes: FIT, FIP, tax regulation mechanisms, auctions
Portugal	31 %	5 123	187 429 080 MWh	€1.2 million	-	Schemes: FIT
Spain	20 %	23 100 MW	959 451 740 MWh	€0.4 million	€179.2 million	Schemes: Auctions
Italy	17 %	9 636 MW	1 348 265 900 MWh	€5.4 million	€7.6 million	Schemes: FIT, FIP, net-metering, tax regulation mechanisms, auctions
Slovenia	14 %	5 MW	56 696 250 MWh	-	€2 million	Schemes: Loans, subsidies, auctions
Croatia	undefined	519 MW	77 223 200 MWh	-	-	Schemes: FIT, FIP, loans
Malta	10 %	0	6 780 290 MWh	€0.1 million	-	Schemes: FIT, subsidies
Greece	18 %	2 624 MW	194 255 890 MWh	€91.3 million	-	Schemes: FIT, FIP, net-metering, subsidies, tax regulation mechanisms, auctions
Cyprus	13 %	158 MW	20 422 280 MWh	-	-	Schemes: Net-metering, subsidies
Bulgaria	16 %	699 MW	112 369 060 MWh	-	-	Schemes: FIT
Estonia	25 %	310 MW	32 773 340 MWh	-	-	Schemes: FIP, subsidies
Poland	15 %	5 849 MW	775 162 760 MWh	€222.6 million	€142.7 million	Schemes: Tradable certificates, loans, subsidies, prosumers support schemes, tax regulation mechanisms,
Czech Republic	13 %	308 MW	289 377 660 MWh	€2 million	€2.7 million	Schemes: FIT, FIP, subsidies
Slovakia	14 %	4 MW	121 149 710 MWh	-	-	Schemes: FIT, subsidies, tax regulation mechanisms
Austria	34 %	2 926 MW	327 128 640 MWh	€0.07 million	-	Schemes: FIT, subsidies
Hungary	13 %	329 MW	207 769 950 MWh	€0.02 million	-	Schemes: FIT, green premium, loans, net-metering, subsidies
Romania	24 %	3 030 MW	259 116 400 MWh	€73.5 million	-	Schemes: Tradable certificates, subsidies
ETC				€37 million	€18.2 million	



Source: ¹Directive 2009/28/EC of 23.04.2009, Annex I; ²IRENA, 'Renewable Capacity Statistics 2018' and Ministries of Energy and/or national Regulatory Authorities (for Germany, Greece, Spain and Poland); ³Eurostat 'EU Energy in figures', Statistical pocketbook 2016, Part 5 (final energy consumption: The total energy consumed by end users, such as households, industry and agriculture, but excluding that used by the energy sector itself); ⁴DG REGIO, extract of 9.4.2019; and ⁵DG ENER, www.res-legal.eu.

Annex II — Data for solar in the EU-28

2020 target¹, 2017 capacity², 2016 final energy consumption³, ERDF/CF financing for 2007-2013 and 2014-2020⁴ and main national schemes⁵



Source: ¹Directive 2009/28/EC of 23.04.2009, Annex I; ²IRENA, 'Renewable Capacity Statistics 2018' and Ministries of Energy and/or national Regulatory Authorities (for Germany, Greece, Spain and Poland); ³Eurostat 'EU Energy in figures', Statistical pocketbook 2016, Part 5 (final energy consumption: The total energy consumed by end users, such as households, industry and agriculture, but excluding that used by the energy sector itself); ⁴DG REGIO, extract of 9.4.2019 (the Commission reports solar PV and solar thermal under the same code); and ⁵DG ENER, www.res-legal.eu.

Annex III — List of projects examined

MS	Project code	Operational programme	Technology	Capacity	Funding source	EU contribution (euro)
DE	801 45 110	OP Brandenburg ERDF 2007-2013	Wind	7.6 MW	ERDF	1 078 125
DE	101000680201	OP Sachsen ERDF 2007-2013	Solar PV	0.1 MW	ERDF	47 896
DE	101000670521	OP Sachsen ERDF 2007-2013	Solar PV	0.1 MW	ERDF	48 219
DE	101000481261	OP Sachsen ERDF 2007-2013	Solar PV	0.1 MW	ERDF	39 999
DE	EFRE 0800572	OP Nordrhein-Westfalen ERDF 2014-2020	Wind (research)	NA	ERDF	210 526
DE	EFRE 0800573	OP Nordrhein-Westfalen ERDF 2014-2020	Wind (research)	NA	ERDF	297 273
EL	350483-1433	OP Competitiveness, Entrepreneurship and Innovation 2007-2013	Wind	38 MW	ERDF	16 504 920
EL	350546-592	OP Competitiveness, Entrepreneurship and Innovation 2007-2013	Wind	23 MW	ERDF	10 851 660
EL	395905-1606	OP Infrastructure for Transportation, Environment and Sustainable Development 2007-2013	Wind	20 MW	CF	8 515 677

EL	296664-960	OP Infrastructure for Transportation, Environment and Sustainable Development 2007-2013	Solar PV	4 MW	CF	7 079 400
EL	395910-2144	OP Infrastructure for Transportation, Environment and Sustainable Development 2007-2013	Solar PV	5 MW	CF	4 999 372
EL	448142-3835	OP Competitiveness, Entrepreneurship and Innovation 2007-2013	Solar PV	2 MW	ERDF	1 610 446
ES	F0704391AVE0000000000520	OP Comunidad Valenciana 2007-2013	Wind	0.02 MW	ERDF	12 920
ES	F07043901AVE00000000003580	OP Comunidad Valenciana 2007-2013	Wind and solar PV	0.06 MW + 0.05 MW	ERDF	36 296
ES	F07044001AVE00000000001019	OP Comunidad Valenciana 2007-2013	Solar PV	0.1 MW	ERDF	63 611
ES	AM30044012005	OP Andalucía 2007-2013	Wind and solar PV	0.06 MW + 0.03 MW	ERDF	18 430
ES	AM300440120008	OP Andalucía 2007-2013	Wind and solar PV	0.02 MW + 0.01 MW	ERDF	1 945
ES	243014	OP Andalucía 2007-2013	Solar PV	0.01 MW	ERDF	5 139
PL	RPPK.02.02.00-18-164/12	ROP Podkarpackie 2007-2013	Solar PV	2 MW	ERDF	1 942 371
PL	RPPK.02.02.00-18-153/12	ROP Podkarpackie 2007-2013	Solar PV	0.5 MW	ERDF	1 482 093
PL	POIS.09.04.00-00-108/09	OP Infrastructure & Environment 2007-2013	Wind	48 MW	CF	9 763 718

PL	POIS.09.04.00-00-093/09	OP Infrastructure & Environment 2007-2013	Wind	20 MW	CF	8 020 263
PL	RPPK.03.04.00-18-0001/17	ROP Podkarpackie 2014-2020	Solar PV	8.3 MW	ERDF	8 536 781
PL	RPPK.03.01.00-18-0450/17	ROP Podkarpackie 2014-2020	Solar PV	0.2 MW	ERDF	234 259

Source: ECA.

Annex IV — Average progress made in the share of renewable energy in gross final energy consumption until 2017 and average progress needed to meet the 2020 targets for all Member States and the EU

Member States	2017			2020 target	Evolution of share		Remaining share		Member States
	2005	...	2017		2005 to 2017	per year on average	until 2020	per year on average	
EU28	9.1 %	...	17.5 %	20 %	8.4 %	0.6 %	-2.5 %	0.8 %	EU28
Belgium	2.3 %	...	9.1 %	13 %	6.7 %	0.5 %	-3.9 %	1.3 %	BE
Bulgaria	9.4 %	...	18.7 %	16 %	9.4 %	0.7 %			BG
Czech Republic	7.1 %	...	14.8 %	13 %	7.7 %	0.6 %			CZ
Denmark	16.0 %	...	35.8 %	30 %	19.8 %	1.5 %			DK
Germany	7.1 %	...	15.5 %	18 %	8.3 %	0.6 %	-2.5 %	0.8 %	DE
Estonia	17.4 %	...	29.2 %	25 %	11.8 %	0.9 %			EE
Ireland	2.8 %	...	10.7 %	16 %	7.8 %	0.6 %	-5.3 %	1.8 %	IE
Greece	7.0 %	...	16.3 %	18 %	9.3 %	0.7 %	-1.7 %	0.6 %	EL
Spain	8.4 %	...	17.5 %	20 %	9.1 %	0.7 %	-2.5 %	0.8 %	ES
France	9.6 %	...	16.3 %	23 %	6.7 %	0.5 %	-6.7 %	2.2 %	FR
Croatia	23.7 %	...	27.3 %	20 %	3.5 %	0.3 %			HR
Italy	7.5 %	...	18.3 %	17 %	10.7 %	0.8 %			IT
Cyprus	3.1 %	...	9.9 %	13 %	6.7 %	0.5 %	-3.1 %	1.0 %	CY
Latvia	32.3 %	...	39.0 %	40 %	6.7 %	0.5 %	-1.0 %	0.3 %	LV
Lithuania	16.8 %	...	25.8 %	23 %	9.1 %	0.7 %			LT
Luxembourg	1.4 %	...	6.4 %	11 %	5.0 %	0.4 %	-4.6 %	1.5 %	LU
Hungary	6.9 %	...	13.3 %	13 %	6.4 %	0.5 %			HU
Malta	0.1 %	...	7.2 %	10 %	7.0 %	0.5 %	-2.8 %	0.9 %	MT
Netherlands	2.5 %	...	6.6 %	14 %	4.1 %	0.3 %	-7.4 %	2.5 %	NL
Austria	23.7 %	...	32.6 %	34 %	8.9 %	0.7 %	-1.4 %	0.5 %	AT
Poland	6.9 %	...	10.9 %	15 %	4.0 %	0.3 %	-4.1 %	1.4 %	PL
Portugal	19.5 %	...	28.1 %	31 %	8.6 %	0.7 %	-2.9 %	1.0 %	PT
Romania	17.2 %	...	24.5 %	24 %	7.2 %	0.6 %			RO
Slovenia	16.0 %	...	21.5 %	25 %	5.5 %	0.4 %	-3.5 %	1.2 %	SI
Slovak Republic	6.4 %	...	11.5 %	14 %	5.1 %	0.4 %	-2.5 %	0.8 %	SK
Finland	28.8 %	...	41.0 %	38 %	12.2 %	0.9 %			FI
Sweden	40.5 %	...	54.5 %	49 %	14.0 %	1.1 %			SE
United Kingdom	1.3 %	...	10.2 %	15 %	8.9 %	0.7 %	-4.8 %	1.6 %	UK

In green:	Member States that have already reached their 2020 target, following Directive 2009/28/EC.
In yellow:	Member States that need less than 2 percentage points increase in the share of renewables in the gross final energy consumption.
In orange:	Member States that need between 2 and 4 percentage points increase in the share of renewables in the gross final energy consumption.
In red:	Member States that need above 4 percentage points increase in the share of renewables in the gross final energy consumption.

Source: ECA, based on Eurostat data.

Annex V — Share and capacity of renewables in EU-28 and the four Member States examined: targets and final values, 2010-2017

Table A – Percentage share of renewable energy in gross final energy consumption in EU-28*, 2010-2017

		2005	2010	2011	2012	2013	2014	2015	2016	2017
EU-28 Renewable share	Final	9.1	13.1	13.4	14.7	15.4	16.2	16.7	17.0	17.5
	Incremental increase			2.0	9.7	4.9	5.1	3.3	1.8	2.9
EU-28 Electricity	Final	14.8	19.7	21.7	23.5	25.4	27.4	28.8	29.6	30.8
	Incremental increase			10.1	8.4	7.8	8.2	5.0	2.6	4.0
EU-28 Heating & cooling	Final	11.1	15.4	16.0	17.1	17.6	18.4	18.8	19.1	19.5
	Incremental increase			4.0	6.6	2.9	4.8	2.2	1.3	2.3
EU-28 Transport	Final	1.8	5.2	4.0	5.3	5.7	6.1	6.6	7.2	7.6
	Incremental increase			-23.9	33.5	7.2	7.1	8.8	9.2	4.9

* There are not available consolidated data at EU-28 level of the NREAPs trajectories of the Member States and of their indicative RED I trajectory for the renewable share in gross final energy consumption and the three sectors that contribute to the share.

Source: ECA, based on Eurostat data.

Table B – Percentage share of renewable energy in gross final energy consumption in the four Member States examined between 2010 and 2017 and trajectories until 2020

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Germany	NREAP national trajectory	10.1	10.8	11.4	12.0	12.8	13.5	14.4	15.7	16.7	17.7	19.6
	Indicative RED I trajectory	-	8.2	8.2	9.5	9.5	11.3	11.3	13.7	13.7	-	18.0
	Final	11.7	12.5	13.6	13.8	14.4	14.9	14.9	15.5	-	-	-
Greece	NREAP national trajectory	8.0	8.8	9.5	9.9	10.5	11.4	12.4	13.7	14.6	16.0	18.0
	Indicative RED I trajectory	-	9.1	9.1	10.2	10.2	11.9	11.9	14.1	14.1	-	18.0
	Final	9.8	10.9	13.5	15.0	15.4	15.4	15.1	16.3	-	-	-
Spain	NREAP national trajectory	13.2	14.4	15.1	15.6	16.1	16.7	17.3	18.1	18.9	19.7	20.8
	Indicative RED I trajectory	-	11.0	11.0	12.1	12.1	13.8	13.8	16.1	16.1	-	20.0
	Final	13.8	13.2	14.3	15.3	16.1	16.2	17.4	17.5	-	-	-
Poland	NREAP national trajectory	9.6	10.2	10.7	11.2	11.6	12.1	12.7	13.4	14.1	14.9	15.9
	Indicative RED I trajectory	-	8.8	8.8	9.5	9.5	10.7	10.7	12.3	12.3	-	15.0
	Final	9.3	10.3	10.9	11.4	11.5	11.7	11.3	10.9	-	-	-

Source: NREAPs and national progress reports on the promotion and use of energy from renewable sources.

Table C – Percentage share of renewable electricity in gross final electricity consumption in the four Member States examined between 2010 and 2017 and trajectories until 2020

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Germany	NREAP national trajectory	17.4	19.3	20.9	22.7	24.7	26.8	28.8	31.0	33.3	35.9	38.6
	Final	18.2	20.9	23.6	25.3	28.1	30.9	32.2	34.4	-	-	-
Greece	NREAP national trajectory	13.3	15.7	18.8	21.8	25.1	27.6	29.7	31.8	33.7	36.7	39.8
	Final	12.3	13.8	16.4	21.2	21.9	22.1	22.7	24.5	-	-	-
Spain	NREAP national trajectory	29.2	31.0	32.0	32.7	33.5	34.1	34.4	35.5	36.4	37.4	39.0
	Final	29.8	31.6	33.5	36.7	37.8	37.0	36.6	36.3	-	-	-
Poland	NREAP national trajectory	7.5	8.9	10.2	11.1	12.2	13.0	13.9	14.7	15.6	16.8	19.1
	Final	6.7	8.2	10.7	10.7	12.4	13.4	13.4	13.1	-	-	-

Source: NREAPs and national progress reports on the promotion and use of energy from renewable sources.

Table D – Evolution of wind capacity in four Member States between 2010 and 2017 and targets until 2020 (in MW)

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Germany	Target	27 676	29 606	31 357	32 973	34 802	36 647	38 470	40 154	41 909	43 751	45 750
	Final	26 903	28 712	30 979	33 477	38 614	44 580	49 587	55 873	-	-	-
Greece	Target	1 327	1 924	2 521	3 119	3 716	4 303	4 906	5 430	6 153	6 776	7 500
	Final	1 298	1 640	1 753	1 809	1 978	2 091	2 370	2 624	-	-	-
Spain	Target	20 744	21 855	23 555	24 988	26 438	27 869	29 330	30 810	32 369	34 049	35 750
	Final	20 693	21 529	22 789	22 958	22 925	22 943	22 990	23 100	-	-	-
Poland	Target	1 100	1 550	2 010	2 520	3 030	3 540	4 060	4 580	5 100	5 620	6 650
	Final	1 180	1 616	2 497	3 389	3 834	4 582	5 807	5 849	-	-	-

Source: NREAPs and national Ministries of Energy and/or national Regulatory Authorities' data.

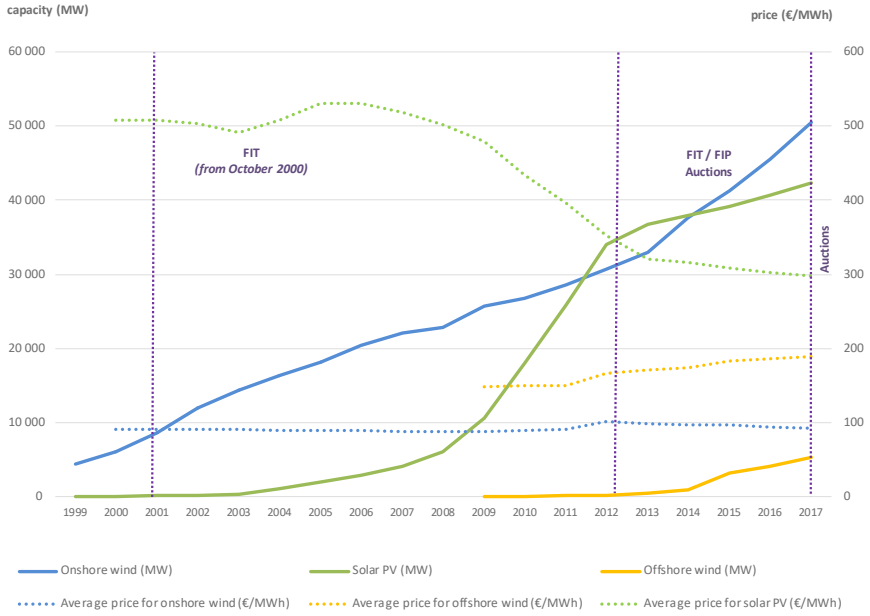
Table E – Evolution of solar PV capacity in four Member States between 2010 and 2017 and targets until 2020 (in MW)

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Germany	Target	15 784	20 284	23 783	27 282	30 781	34 279	37 777	41 274	44 768	48 262	51 753
	Final	18 006	25 916	34 077	36 710	37 900	39 224	40 716	42 376	-	-	-
Greece	Target	184	357	531	778	1 024	1 300	1 566	1 782	1 998	2 234	2 450
	Final	202	612	1 536	2 579	2 596	2 604	2 604	2 606	-	-	-
Spain	Target	3 787	4 265	4 669	4 894	5 143	5 416	5 716	6 047	6 410	6 810	7 250
	Final	3 921	4 352	4 646	4 785	4 854	4 856	4 716	4 725	-	-	-
Poland	Target	1	1	2	2	2	2	2	3	3	3	3
	Final	0	1	1	2	21	71	99	104		-	-

Source: NREAPs and national Ministries of Energy and/or national Regulatory Authorities' data.

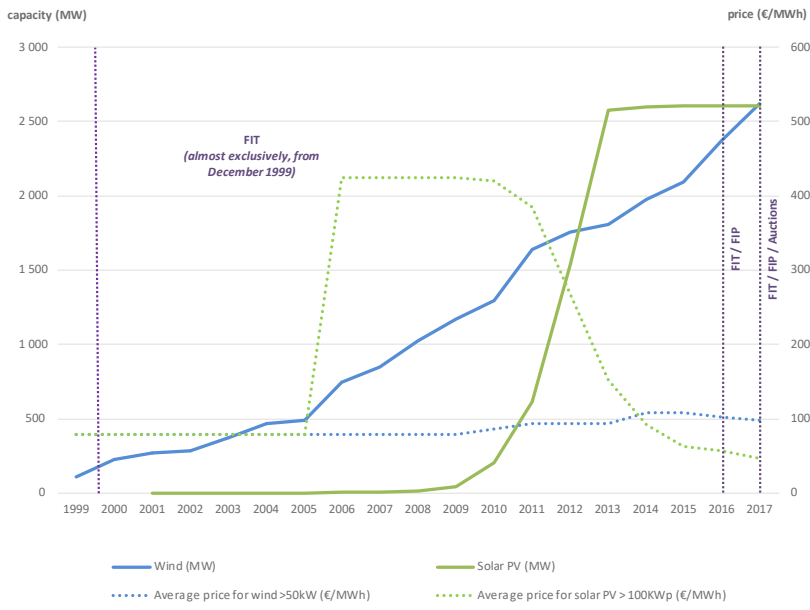
Annex VI — The main support schemes of the four Member States, evolution of wind and solar PV capacity (1999-2017) and tariffs offered to renewables producers for the same period

Germany



Source: ECA, based on data of the Bundesministerium für Wirtschaft und Energie (BMWi).

Greece



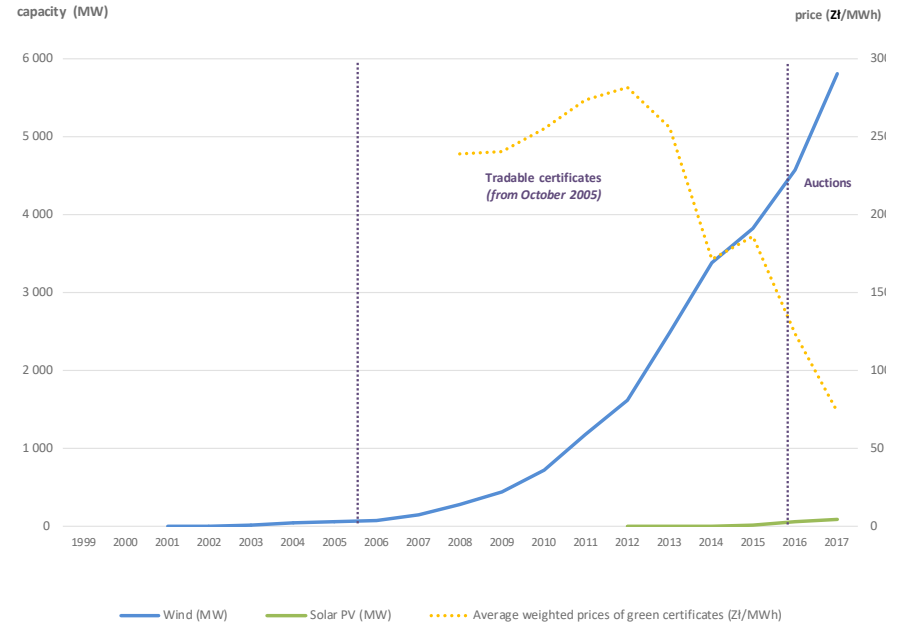
Source: ECA, based on data of the Ministry of Environment and Energy (YPEKA).

Spain



Source: ECA, based on data of the Ministerio para la Transición Ecológica.

Poland



Source: ECA, based on data of PMOZE and PMOZE A indexes of the Polish Power Exchange.

Acronyms and abbreviations

CF: Cohesion Fund

DG COMP: European Commission directorate-general for Competition

DG ENER: European Commission directorate-general for Energy

EEA: European Environment Agency

ERDF: European Regional Development Fund

ESTAT: European Commission directorate-general for Statistics (Eurostat)

ETC: European territorial cooperation

FIP: Feed-in premium

FIT: Feed-in tariff

GDP: Gross domestic product

GHG: Greenhouse gas

IRENA: International Renewable Energy Agency

LCOE: Levelised cost of electricity

MW: Megawatt

MWh: Megawatt-hour

NECP: National energy and climate plan (2021-2030)

NREAP: National renewable energy action plan (2010-2020)

OP: Operational Programme

PV: Photovoltaic

RED: Renewable Energy Directive

TSO: Transmission system operator

TFEU: Treaty on the Functioning of the European Union

Glossary

Biofuel / Bioliqid / Biogas: Liquid or gaseous fuel produced from biomass.

Biomass: Organic matter derived from agriculture, forestry and related industries, including fisheries and aquaculture, as well the biodegradable fraction of industrial and municipal waste, and used in energy production.

Capacity: The maximum power output, in ideal conditions, of an electricity production facility. Generally measured in kilowatts (kW), megawatts (MW) or gigawatts (GW).

Cohesion Fund: An EU fund for reducing economic and social disparities in the EU by funding investments in Member States where the gross national income per inhabitant is less than 90 % of the EU average.

Concentrated solar energy: The conversion of the sun light to heat.

European Regional Development Fund: An EU fund that strengthens economic and social cohesion in the EU by financing investments to reduce imbalances between regions.

Feed-in tariff: A guaranteed fixed price that renewable energy producers receive when selling the electricity to the grid. It usually varies according to the type, size and location of the plant.

Feed-in premium: A guaranteed premium that renewable energy producers receive on top of the price achieved in the market.

Geothermal energy: Energy stored naturally in the form of heat beneath the Earth's surface.

Greenhouse gases: Gases which act as a blanket in the Earth's atmosphere by trapping heat and warming the Earth's surface through the 'greenhouse effect'. The main greenhouse gases are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and fluorinated gases (HFCs, PFCs, SF₆ and NF₃).

Gross final energy consumption: The total energy consumed by end users (such as households, industry and agriculture) and the energy sector itself (for electricity and heat production), including energy losses during transmission and distribution.

Heating and cooling: Thermal energy in the form of steam, hot water or chilled liquids distributed from a central source of production through a network to multiple buildings or sites, to heat or cool the space.

Hydropower: Power generated by the conversion into electrical energy of the kinetic or potential energy in falling and running water.

Solar energy: Radiant light and heat from the sun, harnessed using a range of technologies to produce solar heating or solar photovoltaic and solar thermal electricity.

Solar photovoltaic energy: The conversion of sunlight into electricity using photovoltaic panels.

Solar thermal energy: The sun's heat energy, used for heating and the production of electricity.

Wave, tidal and ocean energy: Technology captures the kinetic power of oceans' waves and tides and converts it into electricity.

Wind energy: The conversion of wind power into electricity using wind turbines.

Waste energy: Electrical and/or heat energy obtained by incinerating waste materials from the domestic, commercial and public services sectors.

REPLIES OF THE COMMISSION TO THE SPECIAL REPORT OF THE EUROPEAN COURT OF AUDITORS

“WIND AND SOLAR POWER FOR ELECTRICITY GENERATION: SIGNIFICANT ACTION NEEDED IF EU TARGETS TO BE MET”

EXECUTIVE SUMMARY

VI.

First indent: The Commission accepts the recommendation.

This is a clear and continuous priority in the Commission’s exchanges with EU Member States at all levels.

Second indent: The Commission accepts the recommendation.

Third indent: The Commission accepts the recommendation to encourage the Member States to proceed in this context and to monitor the progress made. However, the organisation of auctions falls within the remit of the Member States.

Fourth indent: The Commission accepts the recommendation.

The Commission shares the ECA’s view that a simplification of the administrative procedures under national legislation would improve the environment for renewable electricity generation. This simplification effort is at the core of the recast directive adopted on 11 December 2018.

Fifth indent: The Commission partially accepts the recommendation as it considers that grid development falls within the remit of the Member States. The EU is already providing support for investments in grid infrastructure and interconnectors.

Sixth indent: The Commission accepts the recommendation and will implement it in line with the Energy Union Governance Regulation.

INTRODUCTION

15. The Commission has stressed on numerous occasions that the bulk of the investment in renewable energy needs to come from the private sector. Public funding, including EU funding, should not replace but complement and leverage private investment, whenever relevant, in accordance with State aid rules.

Other EU instruments complementing private investment are, *inter alia*, InvestEU, Horizon Europe, the LIFE programme and the Connecting Europe Facility.

The new InvestEU, which is the successor to the Juncker Plan (EFSI), will set aside € 11.5 billion for Sustainable Infrastructure, aiming to stimulate more private sustainable investment through various financial instruments.

Within the scope of the Horizon Europe, the Commission proposed to allocate € 15 billion for Energy, Climate and Mobility, towards developing the next generation technologies that facilitate the energy transition and strengthen the competitiveness of Europe.

The LIFE Environment Programme has a reinforced budget and includes a new line with € 1 billion dedicated specifically to facilitating small-scale renewable energy such as solar and energy efficiency projects.

Finally, under the Connecting Europe Facility, which is the main budgetary instrument to finance connecting infrastructure between Member States, such as interconnections, the Commission has included a new element to specifically promote cooperation between Member States in all sectors of renewables.

OBSERVATIONS

23.

Third indent: The Member States in question still have several avenues to reach the 2020 target, including the use of cooperation mechanisms such as statistical transfers.

The Commission is closely monitoring the progress of all Member States and provides support. Together with the Energy efficiency Task Force launched with EU Member States, efforts are being mobilised at all levels to reach the 2020 targets. Further action to enforce Member States' obligations will be taken, if need be.

27. The Commission notes that national trajectories and targets have provided a useful long-term perspective for investment planning and a point of reference for the Commission for reporting and monitoring.

Common Commission reply to paragraphs 28 and 29:

The Commission has proposed an amendment of the regulation on energy statistics under the regulatory procedure with scrutiny, in interservice consultation in April 2019. This amendment does not address the reporting deadline for annual energy statistics. However, it will speed up the publication of monthly data on electricity and coal (including wind and solar power) by one month (from three to two months).

The Commission has launched a project in 2016 with Member States to speed up the publication of estimates of annual energy statistics, balances and indicators on the share of renewables.

30. The Commission has an ongoing dialogue with the Dutch authorities on this issue. In the energy agreement of 2013 there is a clear political will to mobilise efforts for a target of 14 % of renewables in the Netherlands in 2020 (and 16 % in 2023).

36. The Commission encourages Member States to consider the possibility of using statistical transfers (the possibility to account as own production the surplus of production from another Member State), as foreseen in the Renewables Directive (RED I), either as a way to ensure target achievement when there is a deficit, or to sell their potential surpluses to other Member States. The Commission stands ready to actively support Member States in this regard and facilitate the necessary cooperation.

58. The Commission also recognises that administrative procedures could limit development of renewables projects. RED II aims to address this issue, taking into account that on spatial planning Member States need to carry out an environmental impact assessment and a strategic environmental assessment.

The Commission has adopted a guidance document on wind energy developments and Natura 2000¹, aiming to assist Member States in the procedures they follow in permitting wind energy developments within or outside the Natura 2000 sites. The update of this guidance document is expected to take place by the end of 2019.

63. The integration of the increasing renewables capacities in the grid is a persisting challenge for the majority of the Member States. The barriers mainly arise from high cost of grid connection as well as from the lack of predictability and transparency of the grid connection procedures. The Commission follows the developments tightly on the basis of the Member States' National Energy and Climate Plans and their compliance with the 15 % interconnection target.

¹ http://ec.europa.eu/environment/nature/natura2000/management/docs/Wind_farms.pdf

72. The Commission recognizes the importance of limiting public support to the minimum needed in case of a remaining funding gap for revenue-generating projects. Under the framework for cohesion policy, the Commission is not involved in the selection of projects, except for the approval of major projects. The managing authorities in the Member States, who are responsible for the project selection, need to ensure that public funding does not replace but complements and leverages private investment, whenever relevant, in accordance with State aid rules. The Commission nevertheless recalls that the market conditions for wind and solar PV projects were changing rapidly during the relevant period. In order to comply with the binding renewable energy targets, Member States needed to encourage investments in renewable energy projects, which may not have attracted sufficient private capital without public investment aid, considering the risk profile of such investments in the past when the relevant technologies were still at their early development stages.

77. It is the Commission's view that the new programming and monitoring mechanism under the Governance Regulation will help involvement of Member States in the definition of the respective allocation of effort required towards achieving the at least 32 % renewables target in 2030. The Governance Regulation includes tools to mitigate the risk of Member States being either high-achievers or under-achievers in renewables (*e.g.* recommendations and propose EU wide measures). This is important in order to mitigate the risk of having an emerging gap at EU level when assessing the individual contributions by Member States.

78. The iterative process enshrined in the Governance Regulation will ensure close monitoring of the situation in Member States. Once the Member States' information has been analysed the Commission will react quickly, if necessary.

79. It is the Commission's view that the transposition period is long enough to allow for timely transposition by all Member States.

CONCLUSIONS AND RECOMMENDATIONS

80. According to the 2017 data, a group of Member States indeed needs to step up efforts not only in the electricity sector, but also in the heating and cooling and transport sectors in order to meet their 2020 targets.

81. Overall, with the share of renewables in its final energy consumption reaching 17,5% (2017 data), the EU is on track to meet its 2020 target of 20%.

The Commission is monitoring the progress related to the development of renewables and is in close contact with the Member States. A mobilisation of efforts is on-going.

Recommendation 1 – Focus on closing gaps to meet the 2020 targets

The Commission accepts the recommendation and will step up efforts to actively support Member States in this regard and facilitate the necessary cooperation.

In the renewables 4th progress report of 9 April 2019, the European Commission encourages Member States to continue stepping up efforts to both deploy renewables across the three sectors, while at the same time reducing energy consumption.

The European Commission advises Member States to consider the possibility of using statistical transfers, as foreseen in RED I, either as a way to ensure target achievement when there is a deficit, or to sell their potential surpluses to other Member States.

83. RED I provides for a clear time schedule for the biennial monitoring of the progress of each Member State, which is necessarily linked to the use of statistics on a rolling annual basis.

In relation to energy statistics, the Commission refers to its common reply to paragraphs 28 and 29.

Recommendation 2 – Improve timeliness of statistical data on renewables

The Commission accepts the recommendation.

The Commission will work with Member States to cut down the deadline by two months for annual energy statistics.

The Commission has proposed an amendment of the regulation on energy statistics under the regulatory procedure with scrutiny, in interservice consultation in April 2019. This amendment does not address the reporting deadline for annual energy statistics. However, it will speed up the publication of monthly data on electricity and coal (including wind and solar power) by one month (from three to two months).

The Commission has launched a project in 2016 with Member States to speed up the publication of estimates of annual energy statistics, balances and indicators on the share of renewables.

85. The recast of RED I (2018/2001) contains several initiatives to increase the use of auctions as well as the participation of citizens and energy communities, and to set up a regulatory framework related to consumers.

Recommendation 3– Ensure sufficient auctions are planned to increase renewable capacity for electricity

(a) The Commission accepts the recommendation.

(b) The Commission accepts the recommendation.

The progress made on auctions by all Member States will be monitored and discussed with them in the follow up of their progress reports until the end of the current period.

Recommendation 4 – Simplify procedures to create a more favourable environment for renewable electricity generation

The Commission accepts the recommendation.

Indeed RED II addresses this issue and also proposes further obligations to speed up permit granting and simple notification procedures for grid connections. The Commission will monitor transposition of the Directive in this context and take steps to ensure compliance.

87. The Commission shares the view that grid investment is of the utmost importance to ensure deployment of renewables.

Recommendation 5 – Promote investment in grid infrastructure and interconnectors

(a) The Commission partially accepts the recommendation.

Addressing issues regarding grid developments falls within the remit of the Member States. The Commission will address it in the broader context of the Energy Union Governance, in relation to the National Energy and Climate Plans under the Governance Regulation where infrastructure developments will also be analysed.

(b) The Commission partially accepts the recommendation.

Addressing issues regarding grid developments falls within the remit of the Member States. The Commission will examine it in the broader context of the Energy Union Governance, in relation to the National Energy and Climate Plans under the Governance Regulation where infrastructure developments will also be analysed.

(c) The Commission accepts the recommendation as regards the 2014-2020 operational programmes co-financed by the ERDF and CF and will continue to support implementation, including allocations available for smart grids and interconnectors.

88. The Commission recognizes the importance of limiting public support to the necessary minimum where there is a remaining funding gap for revenue-generating projects. The managing

authorities in the Member States, who are responsible for the project selection, need to ensure that public funding does not replace but complements and leverages private investment, whenever relevant, in accordance with State aid rules. Nevertheless, the Commission recalls that the market conditions for wind and solar PV projects were changing rapidly during the relevant period, and that, in order to comply with the binding renewable energy targets, Member States needed to encourage investments in renewable energy projects, which may not have attracted sufficient private capital without public investment aid, considering the risk profile of such investments in the past when the relevant technologies were still at their early development stages.

89. It is the Commission's view that the new programming and monitoring mechanism under the Governance Regulation will foster the active participation of Member States in the definition of the respective allocation of effort required towards achieving the at least 32 % RES target in 2030. The Governance Regulation includes tools to mitigate the risk of Member States being either high-achievers or under-achievers in renewables (*e.g.* recommendations and EU wide measures). This is important in order to mitigate the risk of having an emerging gap at EU level when assessing the individual contributions by Member States.

Recommendation 6 – Improve monitoring to mitigate the absence of binding national targets

The Commission accepts the recommendation.

The Commission will carry out a close monitoring of the implementation of the Governance Regulation and of the transposition process of RED II (ending on 30 June 2021).

The Commission will report on the progress in the implementation of the 'Clean Energy' package, as provided for under the Governance Regulation.

Audit team

The ECA's special reports set out the results of its audits of EU policies and programmes, or of management-related topics from specific budgetary areas. The ECA selects and designs these audit tasks to be of maximum impact by considering the risks to performance or compliance, the level of income or spending involved, forthcoming developments and political and public interest.

This performance audit was carried out by Audit Chamber II Investment for cohesion, growth and inclusion spending areas, headed by ECA Member Iliana Ivanova. The audit was led by ECA Member George Pufan, supported by Patrick Weldon, Head of Private Office and Mircea Radulescu, Private Office Attaché; Niels-Erik Brokopp, Principal Manager; Chrysoula Latopoulou, Head of Task; Fernando Pascual Gil, Katarzyna Solarek Lutz Venske, Radka Papouskova, Francisco De Assis Carretero Llorente and Pirmin Getzner, Auditors. Thomas Everett, Elli-Anna Tzortzi and Paulina Pruszko provided linguistic support.



From left to right: Pirmin Getzner, Thomas Everett, Chrysoula Latopoulou, Patrick Weldon, Fernando Pascual Gil, George Pufan, Lutz Venske, Radka Papouskova, Niels-Erik Brokopp, Katarzyna Solarek.

Event	Date
Adoption of Audit Planning Memorandum (APM) / Start of audit	8.11.2017
Official sending of draft report to Commission (or other auditee)	7.3.2019
Adoption of the final report after the adversarial procedure	30.4.2019
Commission's (or other auditee's) official replies received in all languages	3.6.2019

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In recent years, electricity generation from wind and solar photovoltaic power has seen impressive growth. Meanwhile, the cost of producing electricity from the wind and sun has become increasingly competitive with the cost of electricity from burning fossil fuels. For this report, we assessed the progress made by the EU and the Member States towards the 2020 renewables targets and examined the effectiveness of their measures to that end. We found that significant progress, beginning in 2005, was followed by a deceleration in both sectors after 2014. For half of the EU Member States, meeting the 2020 targets will be a significant challenge. We address a number of recommendations to the Commission to help Member States support further deployment — by organising auctions, promoting citizen participation and improving the conditions for deployment, including resolving grid insufficiencies.



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