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REPORT FROM THE COMMISSION

**TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN
ECONOMIC AND SOCIAL COMMITTEE, THE COMMITTEE OF THE REGIONS
AND THE EUROPEAN INVESTMENT BANK**

Fourth report on the State of the Energy Union

I. INTRODUCTION

The Juncker Commission’s Energy Union project¹ set out to give EU consumers secure, sustainable, competitive and affordable energy by overhauling Europe’s energy and climate policies. It also committed to making the EU the world leader on renewable energy, to placing energy efficiency first and to continuing to lead global efforts to fight climate change. Four years on, the Energy Union is a reality. With strong support from the European Parliament, Member States and stakeholders, the Energy Union has made Europe more resilient and thoroughly modernised European policy on energy and climate in a number of essential ways.

First, it has resulted in a comprehensive and legally binding framework for reaching the Paris Agreement goals, while simultaneously helping to modernise the European economy and its industry. The Energy Union includes a **governance framework**, which will allow Member States and the European Commission to work together to develop the policies and measures necessary to deliver on our climate and energy goals. It is also firmly embedded in the broader framework of EU priorities. The Energy Union helps to meet the Sustainable Development Goals and implement the circular-economy and air-quality agendas. It is closely linked to policies for the Capitals Market Union, the Digital Single Market, the New Skills Agenda for Europe, the Investment Plan for Europe, and the Security Union.

Secondly, this comprehensive approach to the Energy Union has enabled the EU to put in place clear and ambitious targets for 2030 in renewable energy and energy efficiency. It has enabled the EU to set up equally ambitious policies on clean mobility including emissions for new cars, vans and lorries. It has also provided a solid basis for work towards a modern and prosperous climate-neutral economy by 2050. The European Commission’s 2050 vision² has laid out a framework for future climate and energy policy that will put Europe on a path towards climate neutrality, while providing significant benefits for the economy and for the quality of life of its people³.

Thirdly, the Energy Union provides a combination of a fully up-to-date regulatory framework and a vision for the policies that are required between now and 2050. This provides the certainty necessary for high-quality, innovative investment to modernise the EU economy and create local jobs. There are more than 4 million ‘green jobs’ in the EU today, and the energy transition provides clear opportunities to create more. More green jobs will be created by EU investment through cohesion policy funds; research and innovation funds; the Juncker Plan; and the European Commission’s recent initiatives on sustainable finance. The Energy Union supports the competitiveness of European industry by fostering innovation that creates a global ‘first mover’ advantage. The Energy Union is also promoting the creation of European value chains in critical and emerging sectors such as batteries and hydrogen.

Fourthly, the Energy Union has at its core the deepening of the internal energy market, which is key to providing all citizens with a supply of secure, sustainable, competitive

¹ A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy (COM(2015) 080 final), 25 February 2015.

² A Clean Planet for all — A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy (COM(2018) 773 final), 28 November 2018.

³ See also: 10 trends reshaping climate and energy, European Political Strategy Centre, 3 December 2018. https://ec.europa.eu/epsc/sites/epsc/files/epsc_-_10_trends_transforming_climate_and_energy.pdf.

and affordable energy. Investments in smart infrastructure, including cross-border interconnections, and common arrangements to prevent and manage possible disruptions, have increased the security of energy supply and improved the overall resilience of the EU's energy system to external energy shocks. These investments have also prepared the EU's grid for the changing energy system. In parallel, recent changes to the design of the electricity market will make access to this market more competitive, ensure the cost-efficient integration of renewables, and deliver better value for consumers, who will be able to offer their production and flexibility to the market.

Fifthly, in parallel to the regulatory framework, the European Commission has put in place an enabling framework of supporting measures to address social, industrial, and other issues. These measures seek to empower citizens, businesses, cities, and innovators to play an active role in the energy transition. New approaches that the European Commission has pioneered are proving to be effective, notably in helping to create a European battery industry, supporting coal regions in transition, or giving cities the means and motivation to scale up their climate and energy action. The enabling framework will be critical to mobilise the investment that is necessary to take full advantage of the energy transition, and to ensure that the transition is fair and socially acceptable for all. The social implications of these changes must be a part of the policy process from the outset, and not simply be an afterthought.

Finally, the Energy Union has allowed the EU to speak with one voice on the international stage. The EU has been able to exercise effective climate leadership by being a key player in the Paris Agreement, ensuring that the Agreement entered into force in record-time, and implementing the Agreement through the Katowice Rulebook adopted in December 2018. In this process, the EU's credibility is underpinned by concrete action and the adoption of the full legislative package needed to reach its 2030 commitment under the Paris Agreement. In line with its firm commitment to multilateralism, the EU's unity and determination has been key to maintaining international confidence in the climate regime, faced with the vacuum of leadership following the post-2017 withdrawal of the United States from this regime. Europe has continued close international cooperation on climate and energy policies. For example, it worked with China on kicking off a nationwide emissions trading system in 2017.

With this modern governance framework for climate and energy policy firmly established on the European level, Member States are now working to integrate and upgrade their national policies. The Energy Union ensures that all Member States move forward together, as they agreed to finalise their National Energy and Climate Plans by the end of 2019. These plans will be based on national public consultations and feedback from the European Commission on initial drafts, which all Member States have now officially submitted. The common framework promotes mutual learning and maximises the opportunities for regional cooperation. It also kicks off a learning-by-doing exercise, as the Energy Union plans regular 'checkpoints' to review and collaboratively improve policies. The management of this iterative dialogue will be a key challenge for 2019 and an essential element in ensuring that the Energy Union collectively delivers all its benefits.

Beyond energy and climate policy, the Energy Union is about a structural modernisation of the European economy. It promotes structural reform of energy and resource use in all key sectors: energy, with its central role; buildings; transport; industry; agriculture; and land use more generally. The Energy Union is also an investment strategy, which has positive impacts on the economy and employment, and takes into consideration its impact on vulnerable regions and people. Through its focus on efficiency and domestic energy resources, it will strengthen the EU's position in global markets.

II. TRENDS AND POLICY OBSERVATIONS

Greenhouse gas emissions and energy consumption are increasingly decoupled from economic growth. The transition to a modern, low-carbon and energy-efficient economy is well underway, and Europe is on a credible pathway to meeting its Paris Agreement commitments. The EU is well on track to achieve its 2020 target for reductions in greenhouse gas emissions (i.e. a reduction in emissions of 20 % by 2020 compared to 1990 levels). Between 1990 and 2017, the EU economy grew by 58 %, while emissions decreased by 22%, according to preliminary data submitted by the Member States⁴ (Figure 1).

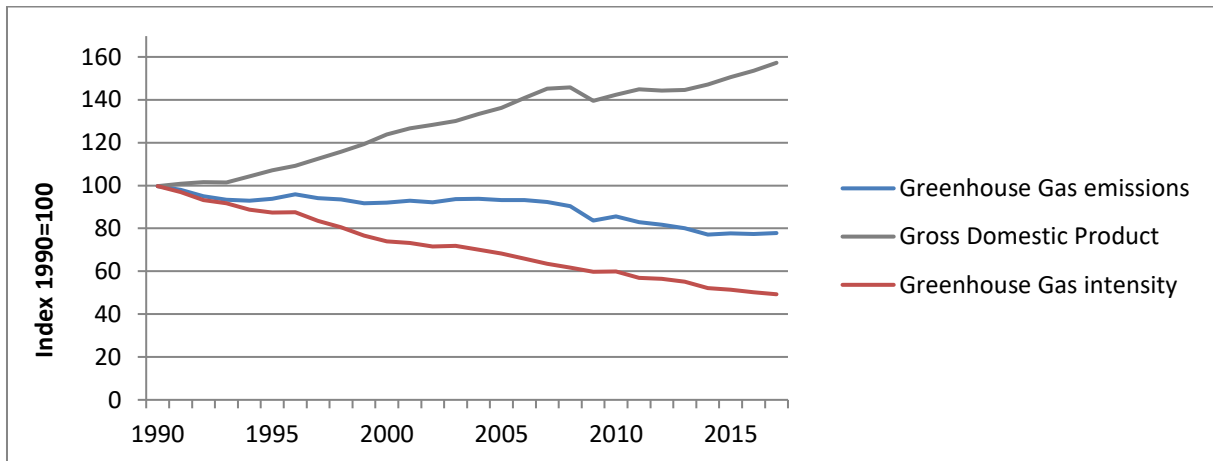


Figure 1: Changes in EU Gross Domestic Product (in real terms), EU greenhouse gas (GHG) emissions, and GHG-emissions intensity of the EU economy

Since 1990, emissions have decreased in all economic sectors except transport. The most marked fall has been in emissions from energy supply (Figure 2). Economic growth is less dependent on energy consumption (Figure 3). Both energy productivity and the greenhouse gas intensity of energy consumption have continuously improved in the EU, thanks primarily to energy efficiency measures in Member States.

⁴ Annual European Union greenhouse gas inventory 1990–2016 (European Environment Agency), approximated EU greenhouse gas inventory 2017 (European Environment Agency), Gross Domestic Product from the Annual Macro-Economic Database of the European Commission’s Directorate General for Economic and Financial Affairs.

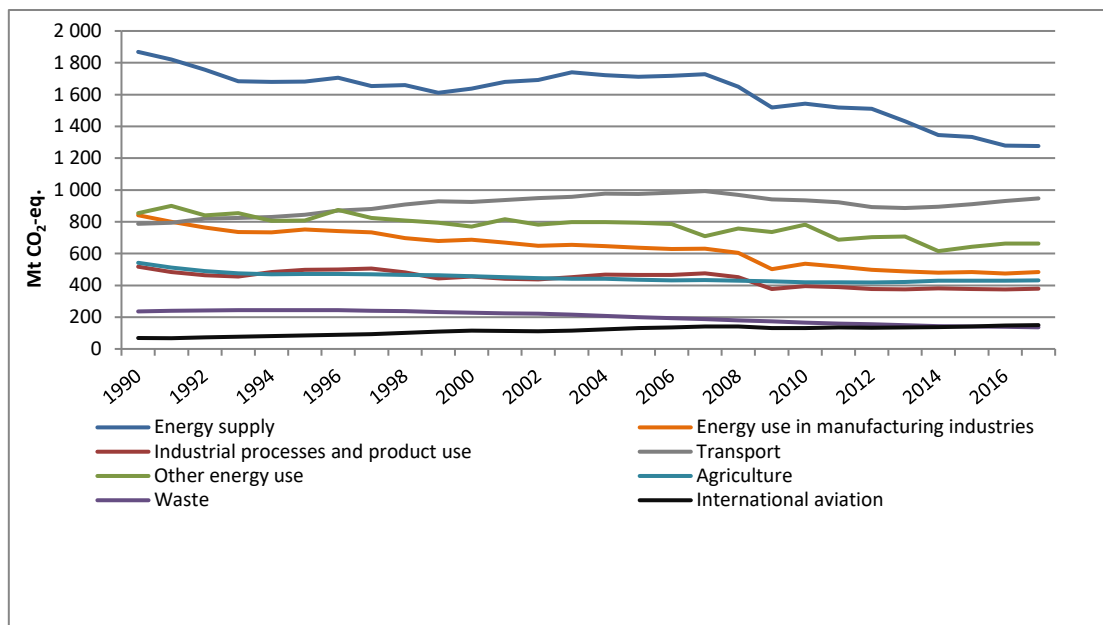


Figure 2: EU greenhouse gas emissions by sector 1990-2016

However, there is a need to further intensify efforts to reach the 2020 energy efficiency target. The most recent analysis⁵ shows that following a gradual decrease between 2007 and 2014, energy consumption has started to increase in recent years, and is now slightly above the linear trajectory for the 2020 targets. This is due to weather variations, notably colder years 2015 and 2016, but also increased economic activity and low oil prices. Energy intensity in industry has continued to improve by as much as 22 % between 2005 and 2017 and energy savings have indeed helped offset parts of the impact of these increases. But they have been insufficient to maintain total consumption on a downward trend. While the 2020 energy efficiency target is still within reach, continued increase in energy consumption could put it at risk. This is why the European Commission has established a Task Force with Member States to mobilise efforts and fully exploit energy efficiency potentials.

In the transport sector, energy consumption and emissions decreased between 2007 and 2013, but are now roughly back at 2005 levels. The positive impact of efficiency policies (and, in a more limited manner, the positive impact of a modal shift in transport) has been outweighed by increased transport activity, and low capacity utilisation in road- freight transport.

⁵ See report from the Commission to the European Parliament and the Council – 2018 assessment of the progress made by Member States towards the national energy efficiency targets for 2020 and towards the implementation of the Energy Efficiency Directive as required by Article 24(3) of the Energy Efficiency Directive 2012/27/EU (COM(2019) 224 final), 9 April 2019.

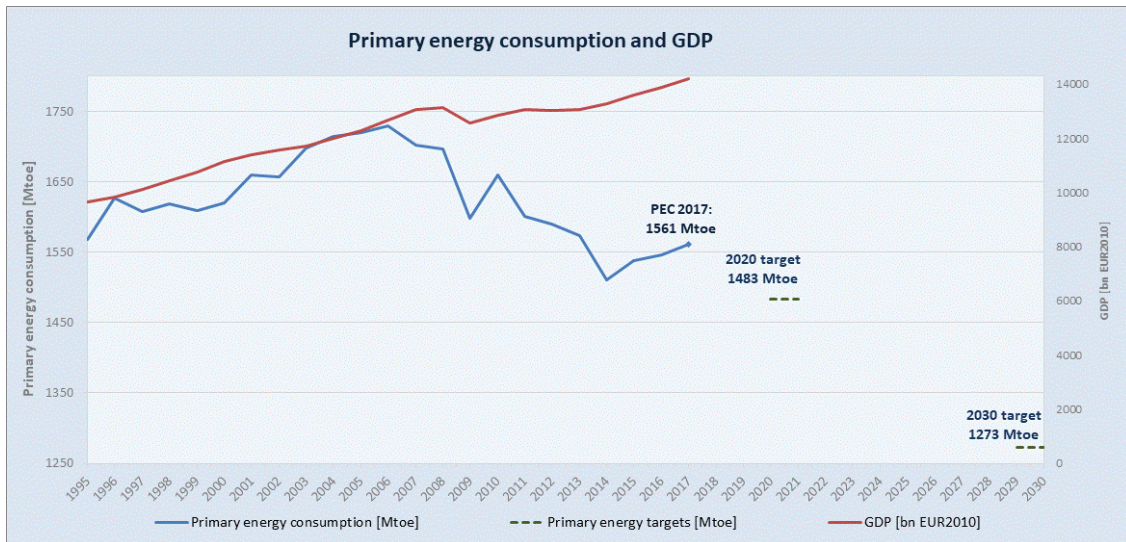


Figure 3: Changes in EU GDP and primary energy consumption

Strong growth continued in the renewable sector but with an unequal deployment. Since 2014, the share of renewable energy in the EU energy mix has significantly increased, reaching 17.5 % in 2017⁶. Investments in renewable energy are increasingly driven by market decisions and Member States increasingly grant support for renewable energy through competitive tenders and ensure that renewable energy installations are integrated in the electricity market, as required by State aid rules⁷. This has significantly decreased the costs of renewable deployment⁸. However, the penetration of renewable energy varies across sectors, with renewable energy reaching 30.8 % in the electricity sector, but only 19.5 % in the heating and cooling sector, and 7.6 % in the transport sector. The pace of increase in the share of renewable energy has also slowed since 2014. While the EU is on track to meet its 2020 targets for renewable energy, efforts should be stepped up to ensure that 2030 targets are met (Figure 4).

⁶ See report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – Renewable Energy Progress Report (COM(2019) 225 final), 9 April 2019.

⁷ Guidelines on State aid for environment and energy 2014-2020, OJ C 200, 28.6.2014, p.1.

⁸ For example, in Germany support levels for solar photovoltaic plants were set administratively at around 9 ctEUR/kWh in 2015. Competitive tenders helped to reduce costs to below 5 ctEUR/kWh in 2018.

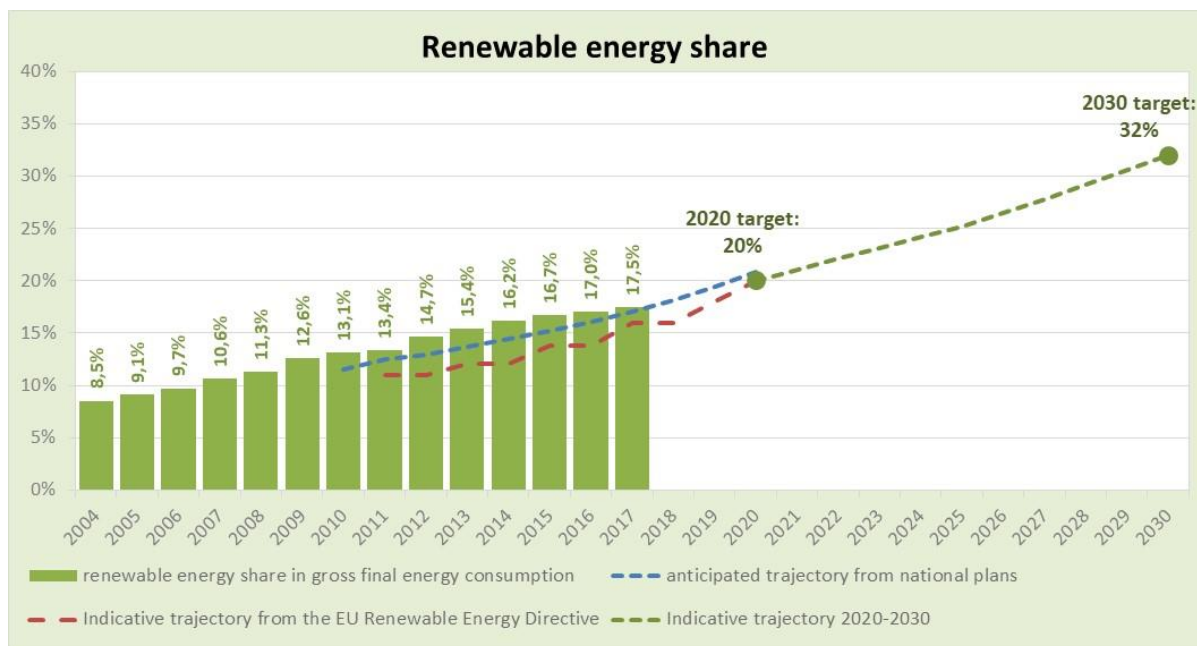


Figure 4: Renewable energy shares in EU gross final energy consumption vs Renewable Energy Directive and National Renewable Energy Action Plan trajectories⁹

In 2017, 11 Member States¹⁰ already had a renewable energy share above their 2020 targets. In addition, 21 Member States¹¹ met or exceeded their average indicative trajectory from the Renewable Energy Directive¹² for the two-year period 2017-2018. The remaining 7 Member States¹³ needed to step up efforts to comply with the average 2017-2018 trajectory towards 2020.

However, for 11 Member States¹⁴, the policies currently being planned or implemented to promote renewable energy appear insufficient to meet their indicative trajectory if only domestic supply, without cooperation mechanisms, is considered¹⁵. Moreover, for 7 Member States¹⁶, there is some uncertainty on whether they will achieve the 2020 renewable targets.

To meet the 2020 renewable energy targets and sustain these levels as a baseline from 2021 onwards, Member States should continue to increase their efforts to both deploy renewables and reduce energy consumption. In addition, all Member States should consider the possibility of using statistical transfers, as provided for in the Renewable Energy Directive¹⁷, either to ensure that they achieve the target when there is a deficit or to sell their potential

⁹ National Renewable Energy Action Plans are detailed reports submitted by Member States outlining their commitments and initiatives to develop renewable energy in accordance with Article 24 of the Renewable Energy Directive 2009/28/EC.

¹⁰ Bulgaria, Czechia, Denmark, Estonia, Croatia, Italy, Lithuania, Hungary, Romania, Finland and Sweden.

¹¹ Bulgaria, Czechia, Denmark, Germany, Estonia, Greece, Spain, Croatia, Italy, Cyprus, Latvia, Lithuania, Hungary, Malta, Austria, Portugal, Romania, Slovakia, Finland, Sweden and the United Kingdom.

¹² 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, OJ L 140, pp. 16-62.

¹³ Belgium, France, Ireland, Luxembourg, Netherlands, Poland and Slovenia.

¹⁴ Belgium, Ireland, Greece, France, Cyprus, Luxembourg, Malta, the Netherlands, Poland, Portugal and the United Kingdom.

¹⁵ See Member States' progress report towards their indicative renewable energy targets for 2020.

¹⁶ Austria, Germany, Spain, Latvia, Romania, Slovenia and Slovakia.

¹⁷ 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. 16-62..

surpluses to other Member States. The Commission stands ready to support Member States in this.

In this context, a number of actions are underway across the EU. These are taking place through the task force on energy efficiency, which the Commission launched, the new renewable energy auctions announced by several Member States, including France, the Netherlands, Portugal, and the wider use of corporate power purchase agreements through which European companies bought a record amount of wind power capacity in 2018.

Good progress has been made towards a more integrated European energy market. Energy is now traded more freely (although still not sufficiently freely) across borders¹⁸, building on the Electricity and Gas Market Directives¹⁹ as well as antitrust enforcement²⁰. Antitrust decisions have notably given customers in Central and Eastern Europe an effective tool to make sure they have access to more competitive gas prices. As concerns electricity, the measurable decrease in wholesale electricity prices by 6.4 % between 2010 and 2017 contributed to a decrease in the costs of energy for households and industry by 6 % and 30 %, respectively. However, the increase in network charges as well as taxes and levies led to an average increase in final consumer prices of 19.3 % for households and 8.7 % for industrial consumers across the EU over the same period (see Figure 5). Energy-related taxes and levies represent up to 40% of the retail energy prices for households.

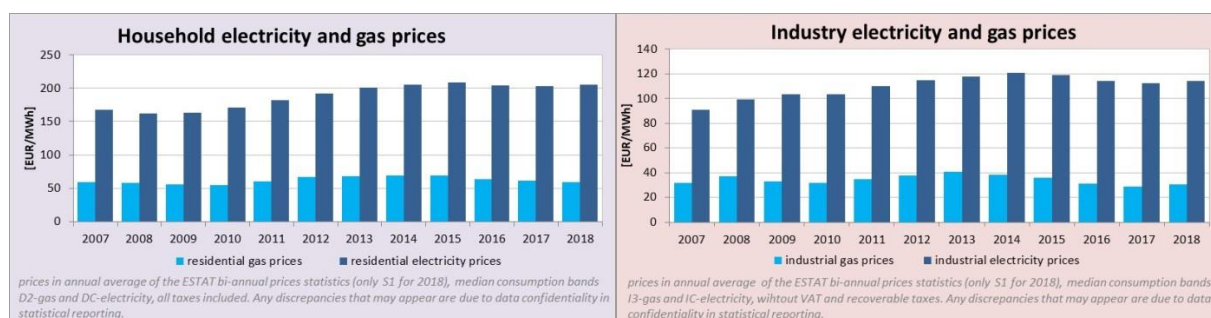


Figure 5: Changes in energy prices for households and industry (source: Eurostat)

Air quality has progressed, but further improvements remain necessary. Thanks to joint efforts by the EU and Member States, emissions of air pollutants have decreased in the EU in recent decades, with the exception of ammonia (Figure 6). This trend has contributed to better air quality. It has also led to a decrease in the number of air quality zones exceeding EU limit values for particulate matter, and a decrease in the estimated number of premature deaths due to air pollution, to around 400 000 in the latest estimates²¹. Emissions of air pollutants in the EU are projected to continue decreasing, as Member States implement measures to fulfil their

¹⁸ See Agency for the Cooperation of Energy Regulators/Council of European Energy Regulators (ACER/CEER) Annual reports on the results of monitoring the internal electricity and natural gas markets in 2017, September 2018: https://acer.europa.eu/Official_documents/Publications/Pages/Publication.aspx.

¹⁹ Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity, OJL 211, 14.8.2009, pp. 55-93 and Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning the common rules for the internal market in natural gas, OJL 211, 14.8.2009, pp. 94-136.

²⁰ The Commission has adopted numerous antitrust decisions, which contributed to unrestricted flow of energy in the internal market in both gas and electricity markets, most recently in the following decisions: [AT.39816 Gazprom commitment decision](#), [AT.40461 DE-DK Interconnectors commitment decision](#), [AT.39849 BEH Gas prohibition decision](#).

²¹ See: <https://www.eea.europa.eu/publications/air-quality-in-europe-2018>.

national commitments on reductions in emissions of pollutants for 2020 and 2030 onwards²². The implementation of several Energy Union policies makes these emissions reductions easier and less costly to achieve – for example, reductions in the use of coal, energy efficiency measures to replace inefficient heating equipment, and the development of more sustainable means of transport²³.

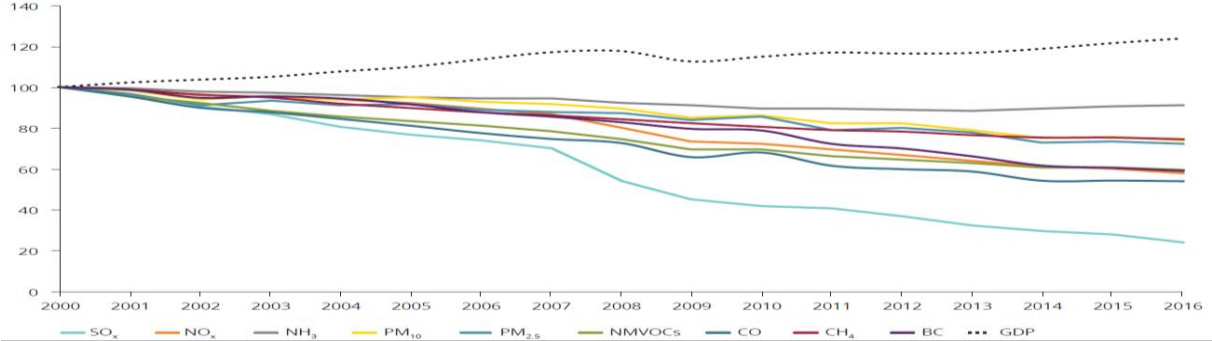


Figure 6: Changes in EU emissions of air pollutants²⁴, as a percentage of 2000 levels

The EU’s Emissions Trading System is more robust. The start of operation of the Market Stability Reserve in January 2019, and the adoption of the reform of the post-2020 Emissions Trading System in early 2018, significantly strengthened the carbon price (Figure 7). The Market Stability Reserve will address the current surplus of 1.65 billion emissions allowances and improve the system’s resilience to major shocks in the future by adjusting the supply of allowances to be auctioned. The stronger carbon price signal is already boosting confidence in greater development and deployment of low-carbon technologies. According to market analysts, the Market Stability Reserve will maintain its effect on the carbon market in the following decade with carbon prices at a similar or higher level. This is combined with concrete measures to avoid carbon leakage, protecting the competitiveness of European industry.

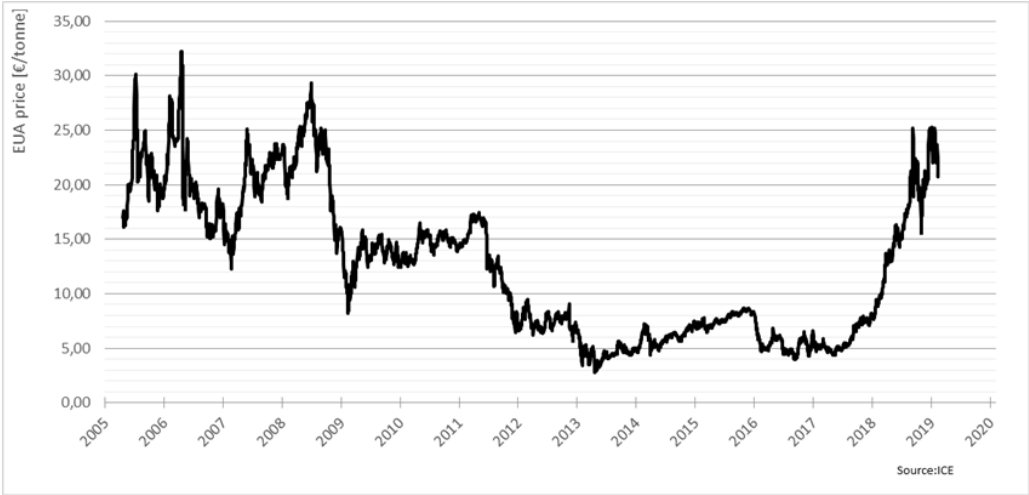


Figure 7: Changes in the carbon price on the European carbon market 2005-2018 (source: ICE)

²² Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, OJL 344, 17.12.2016, pp.1-31.

²³ Report on the First Clean Air Outlook (COM(2018) 446 final), 7 June 2018.

²⁴ This graph represents relative changes from one year to the other and takes into account the changes in the number of EU Member States over the years.

Public investment (national and EU) in the Energy Union’s research and innovation priorities was relatively stable throughout 2014-2017. Public investment in these priorities during this period averaged around EUR 5.3 billion a year (Figure 8)²⁵. With national funding of EUR 4.1 billion on average per year²⁶, the EU’s Horizon 2020 research programme and cohesion policy funds were essential in keeping research and innovation investment steady over the last 4 years. The European Commission is on track to invest almost EUR 2 billion in 2020 in clean energy research and innovation, meeting its commitment to double its public research and innovation investment in this area since 2015 as part of its membership of Mission Innovation. However, the private sector remains the main provider of such investment, consistently accounting for more than 75% of EU investments in clean energy research and innovation, having increased annual spending from about EUR 10 billion to over EUR 16 billion within a decade. Public funding will continue to play a key role in coordinating research and steering private investment to priorities compatible with our long-term strategic vision, also through smart specialisation. This will help bridge the gap from research to commercial deployment and attract new private investments by de-risking technologies. Strong policies and predictable price signals are necessary conditions for promoting innovation in the clean-energy ecosystem, which will ultimately boost research investment in clean energy technologies.

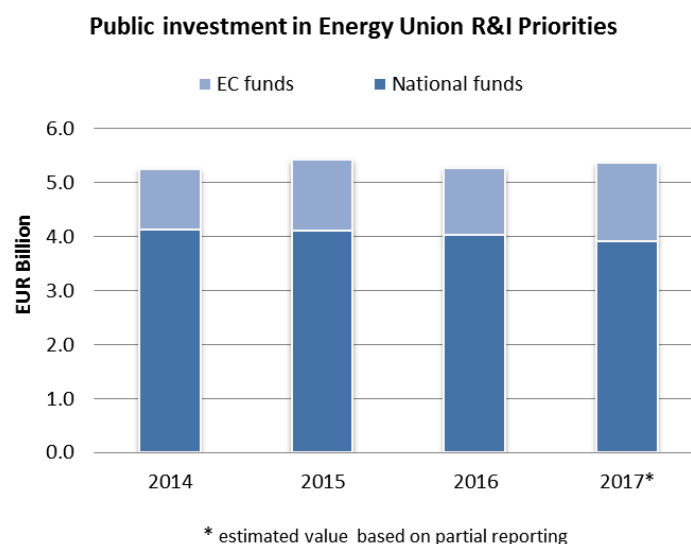


Figure 8: Public investment in Energy Union research and investment priorities 2014-2017 (source: Joint Research Centre)

III. AN AMBITIOUS AND MODERN LEGISLATIVE FRAMEWORK

Under this European Commission, the EU has successfully adopted a completely new legislative framework for energy and climate policies²⁷. The European Parliament and Council agreed on a revision of the EU’s climate legislation, including the Emissions Trading

²⁵ Pasimeni, F.; Fiorini, A.; Georgakaki, A.; Marmier, A.; Jimenez Navarro, J.P.; Asensio Bermejo, J. M. (2018): SETIS Research & Innovation country dashboards. European Commission, Joint Research Centre (JRC).

²⁶ Idem.

²⁷ In parallel, the Commission adopted along with the present report a communication on the institutional framework “A more efficient and democratic decision making in EU energy and climate policy” (COM (2019) 177 final, 9 April 2019).

System Directive²⁸, both for stationary installations and for aviation, the Effort Sharing Regulation²⁹, and the Regulation on Land use, Land use change and Forestry³⁰. They also agreed on the eight legislative proposals in the ‘Clean Energy for All Europeans’ package³¹, and on the ten mobility proposals following the ‘Low-Emission Mobility Strategy’³².

This comprehensive legislative framework forms a robust basis for the EU to deliver on its climate and energy policies for 2030 and beyond. This framework will allow us to deal with future challenges such as digitisation, the integration of renewables into the market, and an energy policy that is more consumer oriented. The legislation addresses both cross-cutting elements to promote climate and energy action, and specific provisions for sectoral action where needed. The EU has also sent a strong message to other countries around the world that it intends to continue to lead by example. It is doing this by taking concrete and ambitious steps to deliver on its commitments and adaptation goals under the Paris Agreement. The EU’s agreed framework also contains built-in review clauses and provisions to guarantee that these commitments will be met. This framework puts the EU on a good trajectory to a climate-neutral economy by 2050.

The updated legislative framework sets out quantified objectives and a clear ‘direction of travel’ to 2030 providing a stable, predictable environment for planning and investment. In particular, the EU has considerably raised its ambition by setting new targets for 2030, namely: to reduce greenhouse gas emissions domestically by at least 40 % compared to 1990 levels; to reach a share of at least 32 % in renewable energy³³; and to increase energy efficiency by at least 32.5 %³⁴. The electricity interconnections target was set to improve security of supply by stepping up to 15 % in each Member State by 2030. Binding targets for 2030 were also set to reduce carbon emissions from cars by 37.5 % compared to 2021 levels³⁵; from vans by 31 % compared to 2021 levels³⁶; and from lorries by 30 % compared to 2019 levels.

²⁸ Directive (EU) 2018/410 of the European Parliament and of the Council of 14 March 2018 to enhance cost-effective emission reductions and low-carbon investments, OJL 76, 19.3.2018, pp. 3-27.

²⁹ Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement, OJL 156, 19.6.2018, pp. 26-42.

³⁰ Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, OJL 156, 19.6.2018, p. 1-25.

³¹ Clean Energy for All Europeans (COM(2016) 860 final), 30 November 2016.

³² A European Strategy for Low-Emission Mobility (COM(2016) 501 final), 20 July 2016.

³³ 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, OJL 328, 21.12.2018, pp. 82-209.

³⁴ Directive (EU) 2018/2002 of the European Parliament and of the Council of 11 December 2018 on energy efficiency, OJL 328, 21.12.2018, pp. 210-230.

³⁵ EU legislation already provided that by 2021, phased in from 2020, the fleet average to be achieved by all new cars is 95 grams of CO₂ per kilometre.

³⁶ EU legislation already provided a 2020 target of 147 grams of CO₂ per kilometre for vans.

2030 FRAMEWORK FOR CLIMATE AND ENERGY — AGREED TARGETS

	GREENHOUSE GAS EMISSIONS	RENEWABLE ENERGY	ENERGY EFFICIENCY	INTER-CONNECTION	CLIMATE IN EU-FUNDED PROGRAMMES	CO2 FROM:
2020	-20%	20%	20%	10%	2014-2020 20%	
2030	≤ -40%	≤ 32%	≤ 32.5%	15%	2021-2027 25%	CARS -37.5% Vans -31% Lorries -30%

Upwards revision clause by 2030

The EU has strengthened its energy security. New rules³⁷ on security of gas supply and electricity risk preparedness have been adopted to organise operational cross-border regional cooperation to prevent and manage risk of gas disruptions, electricity shortage or black-out.

Significant progress has also been made in improving the design of electricity markets. There is now a more integrated set of rules on the design of the electricity market³⁸. These rules are improving the efficiency of the electricity market through increased price convergence and cross-border exchanges. They also set a common framework for capacity mechanisms to ensure that these are compatible both with the internal market as well as with the EU's decarbonisation objectives. There has been a thorough State aid sector enquiry on capacity mechanisms,³⁹ and State-aid control and antitrust rules⁴⁰ help ensure that our ambitious energy and climate targets are achieved at the lowest cost, and without undue distortions of competition. Overall, the European Commission's efforts allow electricity to move more freely to where it is most needed, and facilitate the integration of renewable energy, demand response, and storage facilities to the market at least cost. It will also enhance digitisation across the sector and foster stronger consumer empowerment.

Progress has also been made in the gas market, notably with the agreement on the revision of the Gas Directive⁴¹, according to which gas pipelines entering or leaving the European internal gas market will now need to comply with EU rules. In addition, the European Commission can now ensure that Member States' agreements with countries outside the EU

³⁷ Regulation (EU) 2017/1938 of the European Parliament and of the Council of 25 October 2017 concerning measures to safeguard the security of gas supply and repealing Regulation (EU) No 994/2010, OJ L 280, 28.10.2017, p. 1–56 and Proposal for a Regulation of the European Parliament and of the Council on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC, COM/2016/0862 final - 2016/0377 (COD)

³⁸ See: <https://ec.europa.eu/energy/en/topics/markets-and-consumers>.

³⁹ The first of its kind under State aid rules, this inquiry concluded in November 2016. See http://ec.europa.eu/competition/sectors/energy/state_aid_to_secure_electricity_supply_en.html.

⁴⁰ The Commission has now adopted 19 State aid decisions on 13 different capacity mechanisms under the 2014 State aid guidelines, ensuring the participation of foreign capacity and technology neutral competitive allocation processes. The Commission's case practice in this area is available here: http://ec.europa.eu/competition/sectors/energy/state_aid_to_secure_electricity_supply_en.html.

The Commission also adopted a DE-DK Interconnectors antitrust decision in late 2018 requiring German network operator TenneT to enable imports of electricity from Denmark into Germany and in any event to guarantee 75% of the Danish-German electricity interconnectors' capacity for trade.

⁴¹ See: <https://ec.europa.eu/energy/en/topics/markets-and-consumers/market-legislation>.

comply with EU law⁴² before they are concluded. These achievements will help increase the predictability of the single market for investors.

The regulatory framework for specific sectors has also been brought up to date. This was done to make buildings ‘smarter’ and more energy efficient⁴³; to set limits to carbon emissions from cars, vans⁴⁴ and lorries⁴⁵; to update rules on land use, land-use change and forestry⁴⁶; and to update rules on the eco-design of energy-related products⁴⁷. This will ensure that all sectors contribute to the energy and climate transition, taking into account their specific needs.

The new governance framework will help to implement and further develop the Energy Union⁴⁸. Member States’ integrated National Energy and Climate Plans will include national contributions to the collective EU targets (and the necessary policies and measures to achieve these contributions) for ten-year periods. Member States will develop their plans through a continuous, iterative dialogue with the European Commission. They will also ensure public participation and consult with other Member States in a spirit of regional cooperation. This will increase opportunities for cooperation between Member States, and provide greater regulatory certainty for stakeholders. The National Energy and Climate Plans will make it easier to identify areas of interest for future investments, and opportunities for economic development, job creation and social cohesion.

All Member States have now submitted their first draft National Energy and Climate Plans (covering the period 2021-2030). The European Commission is assessing these draft plans with a view to issuing potential recommendations to Member States by June 2019, to help Member States further improve their plans, and ensure that the EU can collectively deliver on its commitments. One key question of the assessment will be whether the Member States’ national contributions to the renewable energy and energy efficiency targets are sufficient to meet the EU’s collective level of ambition as a whole. Building on this process, Member States will continue to develop, and ultimately adopt, their national energy and climate plans in the second half of 2019.

Box: towards an EU long-term strategy for a prosperous, modern, competitive and climate-neutral economy by 2050

In November 2018, the European Commission published a strategic long-term vision⁴⁹ for a prosperous, modern, competitive and climate-neutral economy by 2050. This

⁴² Decision (EU) 2017/684 of the European Parliament and of the Council of 5 April 2017 on establishing an information exchange mechanism with regard to intergovernmental agreements and non-binding instruments between Member States and third countries in the field of energy, OJL 99, 12.4.2017, pp. 1-9.

⁴³ Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018 on the energy performance of buildings, OJL 156, 19.6.2018, pp. 75-91.

⁴⁴ See: https://ec.europa.eu/clima/policies/transport/vehicles/proposal_en#tab-0-1.

⁴⁵ See: https://ec.europa.eu/clima/policies/transport/vehicles/heavy_en.

⁴⁶ Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, OJL 156, 19.6.2018, pp. 1-25.

⁴⁷ As part of the implementation of the Ecodesign Working Plan 2016-2019, a set of revised Ecodesign and Energy labelling measures will be adopted in the first half of 2019.

⁴⁸ Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action, OJL 328, 21.12.2018, pp. 1-77. The new regulation also requires Member States to develop long terms strategies, and integrates and streamlines energy and climate reporting.

⁴⁹ A Clean Planet for all — A European strategic long-term vision for a prosperous, modern, competitive and climate-neutral economy (COM(2018) 773 final), 28 November 2018.

document (drafted following requests from the European Council⁵⁰ and the European Parliament⁵¹ and as called for as part of the agreed governance framework⁵²) was the Commission's contribution to the EU's long-term low greenhouse gas emission development strategy, which should be adopted and communicated by 2020 to the United Nations Framework Convention on Climate Change, in accordance with the Paris Agreement. In parallel, each Member State will also need to prepare its national long-term strategy.

The European Commission presented a vision not only to keep the global increase in temperature well below 2 °C compared to pre-industrial levels, but also to pursue efforts to limit this increase to 1.5 °C by achieving net-zero greenhouse gas emissions by 2050.

The strategy demonstrates how Europe can lead the way to climate neutrality by investing in realistic technological solutions, empowering citizens, and aligning action in key areas such as industrial policy, finance, or research – while simultaneously ensuring social fairness for a just transition and not leaving behind any region nor any population group.

The European Commission's strategy shows that transforming the economy in this way is both possible and beneficial. It is an investment in the modernisation of the EU's economy to better face forthcoming challenges. To achieve this transition, the EU will need to make progress on seven strategic building blocks⁵³. These building blocks build on the five dimensions of the Energy Union. They also set the direction of travel for EU climate and energy policy to achieve the temperature objectives in the Paris Agreement.

IV. AN ENABLING FRAMEWORK SUPPORTING THE ENERGY TRANSITION

Over the past five years, in addition to strengthening the legislative system, the European Commission has delivered a framework of actions to support the energy and climate transition. This framework is about creating the conditions for Member States, and all stakeholders, to deliver on the EU's objectives.

1. A future-proof infrastructure ensuring the EU's security of supply and enabling the green transition

Europe enjoys one of the world's most comprehensive and reliable networks for electricity and gas. The prime objective of the European Commission has been to strengthen this network where necessary to address remaining security of supply issues, connect energy islands, and address challenges resulting from the ongoing transition to a low-carbon economy.

A key priority of the Energy Union has been to end the energy isolation of disconnected regions. Significant progress has been achieved in the Baltic states. While these states were once an energy 'island' in the EU, they are now well interconnected with the rest of the EU, with 23.7 % cross-border interconnection. This has been made possible by new interconnectors with Sweden, Finland and Poland. Work is now concentrating on synchronising the Baltic states' power system with the continental European network by 2025

⁵⁰ European Council conclusions, 22 March 2018.

⁵¹ European Parliament resolution of 4 October 2017 on the 2017 UN Climate Change Conference in Bonn, Germany (COP23).

⁵² Article 15 of Regulation (EU) 2018/1999 of 11 December 2018 on the Governance of the Energy Union and Climate Action.

⁵³ Energy efficiency; the deployment of renewables and increased electrification; clean, safe, and connected mobility; competitive industry and circular economy; infrastructure and inter-connections; bio-economy and natural carbon sinks; and tackling remaining emissions with carbon capture and storage.

at the latest⁵⁴. Greater integration of the Iberian peninsula is also being promoted by the support by the European Commission for the INELFE⁵⁵ project and for a power line crossing the Bay of Biscay. These efforts will double the exchange capacity between France and Spain by 2025, bringing Spain closer to the 10 % interconnection target, and progressively integrating the whole Iberian peninsula into the internal electricity market. The European Commission also supports further efforts to integrate the gas market of the Iberian Peninsula and the rest of Europe. These efforts, which show the value of European solidarity and regional unity, have been discussed in regular summit level meetings between France, Portugal and Spain with the European Commission⁵⁶.

The efforts of the European Commission to ensure diversification of gas supply are also delivering concrete results. These efforts are ending dependency on a single supplier in certain Member States, increasing the resilience of the Member States' energy systems, enhancing competition, and decreasing prices. As a result, all Member States but one have access to two independent sources of gas, and if all ongoing projects are implemented on schedule, all Member States except for Malta and Cyprus will have access to three sources of gas by 2022, and 23 Member States will have access to the global liquefied natural gas market. Ongoing diversification initiatives based on liquefied natural gas and the Southern Gas Corridor are of particular importance to the eastern Baltic sea region and central south-eastern Europe. These areas were historically dependent on a single gas supplier. If the necessary commitment is maintained, and there are no delays in implementing key projects, Europe should achieve a well-interconnected and fully shock-resilient gas grid by 2020 or shortly thereafter.

The European Commission has been also supporting projects to improve the EU's electricity grid and to allow for greater uptake of renewable generation. Despite the progress, investments on a much larger scale are needed in electricity grids (both transmission and distribution). The level of investment needed for electricity transmission is estimated at more than EUR 150 billion for the period 2021-2030⁵⁷. These new investments should be bundled with further digitisation and 'smartening' of the grids, as well as the deployment of new storage facilities.

The EU's trans-European networks (TEN-E) policy has been instrumental in upgrading the EU's infrastructure. The TEN-E policy promoted a focused approach to identify and implement the Projects of Common Interest (PCIs) critical to building well-connected networks across Europe. So far, over 30 PCIs have been implemented, and some 75 PCIs should be in place by 2022. The creation of four high-level regional groups⁵⁸ under the leadership of the European Commission has helped to accelerate the implementation of the PCIs. PCIs have also benefited from EU financial support, which has leveraged private investment. Since 2014, 91 PCIs have received EUR 3.2 billion in support from the Connecting Europe Facility (CEF) programme and EUR 1.3 billion in support from the European Fund for Strategic Investment (EFSI). This has leveraged total investments of

⁵⁴ Political Roadmap on the synchronisation of the Baltic States' electricity networks with the Continental European Network via Poland, 8 June 2018.

⁵⁵ 'Interconexión Eléctrica Francia-España'.

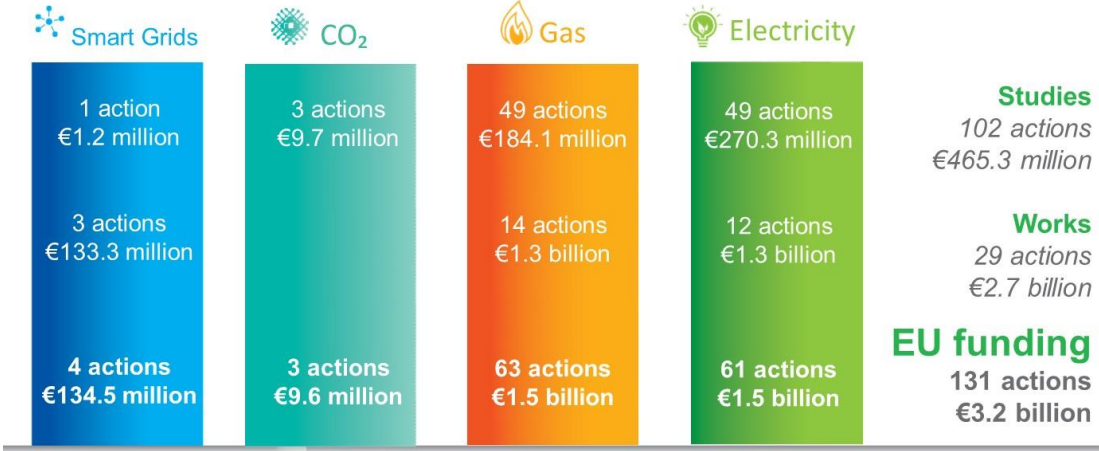
⁵⁶ http://europa.eu/rapid/press-release_IP-18-4621_en.htm.

⁵⁷ Investment needs in trans-European energy infrastructure up to 2030 and beyond, Ecofys, July 2017.

⁵⁸ The four high-level groups in the area of energy infrastructure are Central and South Eastern European Energy Connectivity (CESEC), North Seas Energy Cooperation, South-West Europe, and the Baltic Energy Market Interconnection Plan (BEMIP).

around EUR 50 billion. Additionally, EU cohesion policy has contributed with EUR 2.8 billion in natural gas and electricity infrastructure projects that were selected by end 2018.

Level of funding per sector under the Connecting Europe Facility (CEF)



Stronger and better-interconnected grids in the Member States have allowed for more effective application of the internal energy market’s rules. This has resulted in greater competitiveness, reduced costs and better security. So far, 26 countries — accounting for over 90 % of European electricity consumption and more than 400 million people — have coupled their day-ahead electricity markets. Over the past 7 years, day-ahead market coupling alone has rendered a benefit of approximately EUR 1 billion per year to European consumers⁵⁹. There have also been significant welfare gains from the integration of intraday markets and the balancing of cross-border markets, which has led to several billion euro in savings per year. Market coupling has also promoted price convergence in various regions in recent years (e.g. by 80 % and 41 % price convergence in the Baltic and central-western Europe regions respectively). In addition, the European Commission has supported the establishment of regional cooperation centres to help the integration of cross-border power flows and variable power flows across the European power system. The digitisation of power infrastructure will require increased attention on improving cybersecurity and protecting critical infrastructure.

Investments have been made to enable sector integration. However, more needs to be done to bring together the power generation and end-use sectors. This is necessary to integrate the rising share of variable renewable energy; heating and cooling; and electric vehicles in the energy system. Since the end of 2016, close to EUR 400 million in Connecting Europe Facility (CEF) grants have been made available to over 50 projects to deploy alternative fuels, mobilising total investments exceeding EUR 3 billion. The aim is to make available an additional EUR 350 million through the CEF blending facility in 2019. This will be a key area of attention for the future. Future demand for electrical vehicles will vary across EU regions, and be dependent on a number of factors, including the development of alternative fuels infrastructure. Furthermore, EU cohesion policy remains an important source of EU co-funding for the deployment of clean transport, e.g. with about EUR 12 billion planned for sustainable urban mobility.

⁵⁹ See Agency for the Cooperation of Energy Regulators/Council of European Energy Regulators (ACER/CEER) Annual reports on the results of monitoring the internal electricity and natural gas markets in 2017, September 2018: https://acer.europa.eu/Official_documents/Publications/Pages/Publication.aspx.

2. *Piloting ways to ensure social fairness of the transition*

The energy and climate transition is already benefiting the economy and fostering job creation, and it has the potential to do more. Between 2000 and 2014, employment in the environmental sectors of the economy grew considerably faster (+49 %) than employment in the economy as a whole (+6 %) ⁶⁰. Today, there are 4 million ‘green jobs’ in the EU. This includes around 1.4 million jobs in the energy sector related to renewable technologies ⁶¹ and 900 000 jobs related to energy efficiency activities ⁶². These figures are expected to increase with further energy and climate action, as investments in Europe replace imports of fossil fuels, European industries gain competitiveness from the early-mover advantage, and adaptation to climate change protects jobs and job opportunities.

While this transition benefits the vast majority of people and regions, it also brings social challenges in some cases. For example, regulatory or fiscal measures can have unintended regressive effects which can exacerbate energy poverty. The benefits of the transition also risk to be unevenly distributed. Most sectors, regions and population groups will enjoy significant growth as a result of this transition, while others may need support to deal with the adjustment. Also as regards energy poverty, although decreasing to pre-crisis levels, important differences ⁶³ among Member States remain. There are many policies to address these challenges on the national level, particularly education and training as well as social and fiscal policies. Important and sustained human capital investments are essential to equip future generations with the skills required by a changing economy. ⁶⁴

The initiative for coal and carbon-intensive regions in transition helps mitigate the social consequences of the low-carbon transition. There are currently 41 coal regions across 12 Member States that still provide around 185 000 jobs in coal extraction. The European Commission is helping these regions to draw up low-carbon transition strategies that address the potentially negative socioeconomic impacts in two ways, outlined below.

1. Firstly, the European Commission has created an open platform that brings together all affected stakeholders (national, regional and local governments; businesses; civil society organisations; etc.) to exchange best practices, foster peer learning, and receive information on EU support instruments that are available.
2. Secondly, the European Commission provides tailored support, either in the form of operational country teams or bilateral discussions with Commission experts. This support can help national and regional authorities to identify ways to start and lead the transition. This support is accompanied by existing EU funds, financing tools, and programmes. 18 regions in 8 Member States ⁶⁵ are currently benefiting from this support. Early experience shows that regional transition needs to be planned with the broad support of all

⁶⁰ <https://ec.europa.eu/eurostat/web/products-eurostat-news/-/EDN-20170529-1?inheritRedirect=true>

⁶¹ https://irena.org/-/media/Files/IRENA/Agency/Publication/2018/May/IRENA_RE_Jobs_Annual_Review_2018.pdf.

⁶² https://ec.europa.eu/energy/sites/ener/files/documents/CE_EE_Jobs_main%2018Nov2015.pdf.

⁶³ Energy poor are considered those with arrears on utility bills and/or unable to keep their homes adequately warm.

⁶⁴ For a presentation and discussion of the expected impacts on skills, wages and tasks, see in particular the recent publication by Eurofound on “Employment Implications of the Paris Climate Agreement”: <http://www.eurofound.europa.eu/publications/report/2019/energy-scenario-employment-implications-of-the-paris-climate-agreement>.

⁶⁵ These regions include Trenčín (SK), Silesia, Lower Silesia and Greater Poland (PL), Western Macedonia (EL), the Jiu Valley (RO), Moravskoslezský, Karlovarský and Ústecký (CZ), Aragón, Asturias and Castilla y León (ES), Savinja and Zasavje (SI) Saxony, Saxony-Anhalt, Brandenburg, NordRhein Westphalen (DE)

stakeholders. Early experience also shows that engagement from the European level is effective in mobilising stakeholders and identifying avenues for investment which might otherwise not be considered.

The initiative on clean energy for EU islands aims to accelerate the clean energy transition in Europe's over 1 000 inhabited islands. It aims to help these islands tap into locally available renewable energy sources, energy efficiency potential and innovative storage and transport technologies and become self-sufficient in energy, thus reducing costs, environmental pollution and reliance on heavy fuel oil to generate power, while creating growth and local jobs.

More must be done to address energy poverty, which still affects nearly 50 million people across the EU. A key way of doing this is to promote investments in energy efficiency for households. This improves living conditions and reduces energy bills. Almost EUR 5 billion from the European Structural and Investment Funds 2014-2020 have been allocated to help renovate the homes of around 840 000 households. In addition, as part of their national energy and climate plans, Member States will now assess the number of energy-poor households. If this number is significant, Member States will outline policies and measures to alleviate this energy poverty. To support these processes, the European Commission launched the European Energy Poverty Observatory⁶⁶ whose mission is to collect data, provide guidance, and disseminate best practices.

In 2016, the European Commission launched the European Solidarity Corps which creates opportunities for young people to volunteer, do a traineeship or work on a variety of projects, including climate and energy projects that benefit communities around Europe. So far, around 120 000 young people have registered for the Corps, and over 13 000 have completed — or are currently engaged in — their solidarity activities.

On the global level, the European Commission has supported elevating the social issue of the need for a ‘just transition of the workforce’, that creates decent work and quality jobs, as one of the key challenges facing the world in the fight against climate change⁶⁷.

3. Empowering cities and local communities

Cities are home to 70 % of Europeans. They can be powerful supporters of Energy Union objectives, but they also face specific challenges. Cities have a key role to play in a variety of issues such as: building standards; urban mobility; adaptation to climate change impacts; heating and cooling; and renewable energy. Local authorities recognise the opportunities, but often face constraints in their ability to design policies and mobilise investments.

To help mobilise local-level action, the European Commission has played a key role in developing the EU Covenant of Mayors for Climate and Energy. The Covenant is a bottom-up initiative through which local and regional authorities showcase their actions for a low-carbon economy, receive support, exchange good practices, and share resources. The EU Covenant of Mayors is now the world’s widest-ranging network of local authorities, with over 8 800 cities representing more than 230 million Europeans. These cities, who contribute for nearly a third of the EU’s 2020 commitment for emissions reductions, have already cut their

⁶⁶ <https://www.energypoverty.eu/>.

⁶⁷ At the United Nations COP24 conference in Katowice in December 2018, the EU, alongside 54 countries, adopted the ‘Solidarity and Just Transition Silesia Declaration’, which calls for a just transition for the workforce and the creation of decent work and quality jobs as an important enabler for the implementation of the Paris Agreement.

emissions by 23 % from their baseline year inventory⁶⁸. By the end of last year, over 1 500 cities had committed to work towards the more ambitious target of a 40 % reduction in carbon emissions by 2030, and implement additional adaptation actions. The Covenant is open to any European city willing to take on climate and energy commitments in support of EU objectives. It has inspired also similar European Commission-funded initiatives in other regions of the world, all coming together under the umbrella of the Global Covenant of Mayors alliance to accelerate energy transition towards the Paris climate agreement objectives.

The Urban Agenda for the EU is also advancing well. Several of its ongoing 14 Partnerships, involving local authorities, Member States and EU institutions in an innovative governance approach, address issues related to the Energy Union⁶⁹. **Urban Innovative Actions** continue to test **innovative solutions** that could be **transferred to other EU cities**. In addition to the ongoing projects on Energy Transition, new projects are being supported on Climate Adaptation on Air Quality⁷⁰. **URBIS is a new dedicated urban investment advisory platform** within the European Investment Advisory Hub which helps cities to facilitate, accelerate and unlock urban investment. URBIS has already begun handling 36 requests from all over Europe covering a broad range of urban subsectors. The European Commission will continue working with the European Investment Bank to develop URBIS.

Finally, the Energy Union legislative framework acknowledges the role played by local and regional actors, notably in the Governance Regulation and calls for actions, for instance on low-carbon mobility and energy-efficient buildings⁷¹.

4. New ways to support research and innovation

Research and innovation are key to the objectives of the Energy Union. The Communication on Accelerating Clean Energy Innovation⁷² outlined a strategy for promoting clean energy research and innovation and for bringing results to the market quickly. This strategy sets priorities by committing through the Horizon 2020 research and innovation programme around EUR 2.5 billion for the period 2018-2020 to decarbonise the EU's building stock; strengthen EU leadership in renewables; develop energy-storage solutions and electro-mobility; and encourage a more integrated urban transport system. In support, the Strategic Energy Technology Plan (SET Plan) has brought together detailed Implementation Plans⁷³ for public and private investments in all these priorities to place Europe at the forefront of the energy transition. The Horizon Europe programme, starting in 2021, will include a mission oriented approach that will have concrete targets and will be time-bound, to achieve societal objectives. A mission area on Climate Neutral and Smart Cities is included in the proposal.

The European Commission is promoting new ways to bring the results of research projects to market. It is preparing to launch a co-investment fund with Breakthrough

⁶⁸ http://publications.jrc.ec.europa.eu/repository/bitstream/JRC103316/jrc103316_com%20achievements%20and%20projections_online.pdf.

⁶⁹ e.g. the partnerships on Energy Transition, on Climate Adaptation, on Urban Mobility, on Air Quality and on Housing <https://ec.europa.eu/futurium/en/urban-agenda>

⁷⁰ <https://www.uia-initiative.eu/en>

⁷¹ Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018 on the energy performance of buildings, OJL 156, 19.6.2018, pp. 75-91.

⁷² Accelerating Clean Energy Innovation (COM(2016) 763 final), 30 November 2016.

⁷³ <https://setis.ec.europa.eu/actions-towards-implementing-integrated-set-plan/implementation-plans>.

Energy⁷⁴ (a coalition that includes private investors, global corporations, and financial institutions) to support innovative European companies developing radically new clean-energy technologies and bringing them to market. In addition, the European Innovation Council pilot provides support to breakthrough innovations, including in clean energy technologies, to develop innovations and bring them to the market by combining grants and equity investments. Further evidence of the progress made by EU-funded projects can be seen in more than 100 cases on energy and resource efficiency, shortlisted to be part of the World Alliance for Efficient Solutions portfolio⁷⁵. The InnovFin instrument for energy demonstration projects⁷⁶ is proving highly successful, having mobilised more than EUR 140 million in 2018, compared to only EUR 25 million during its pilot phase from 2015 to 2017. This brings the total EU support until now to almost EUR 170 million, for total project costs of more than EUR 350 million. In view of the important demand for supporting demonstration of large-scale innovative technologies, undisbursed funds were reallocated from the NER 300 Programme⁷⁷ to the InnovFin Energy Demonstration Projects and Connecting Europe Facility Debt Instruments. Cohesion policy funds also support low-carbon research and innovation, based on smart specialisation, with at least EUR 2.5 billion of EU funding available, out of which about EUR 1.2 billion have already been allocated to selected projects at end 2018⁷⁸. The European Commission also established the **Innovation Fund** and aims to invest around EUR 10 billion in innovative clean technologies.

The EU is supporting the creation of a European network of academics and innovators in clean-energy technologies. The European Institute of Innovation and Technology supports start-ups through its Knowledge and Innovation Communities (KICs) network. Over the period 2018-2020, around EUR 150 million has been allocated from the KICs to develop solutions that promote clean-energy innovation.

New areas of interest are emerging in space and hydrogen technologies. As proposed in the European Space Programme Regulation⁷⁹, the European Commission is fostering the adoption of EU space technologies. The European Space Programmes Copernicus and Galileo are important enablers for innovative solutions relevant to the whole economy, including the energy sector and the fight against climate change. Positioning services result in higher efficiency in weather forecast and EU earth monitoring capabilities will provide accurate identification of CO₂ and methane⁸⁰ emissions so to design better energy and climate policies. Hydrogen can also play an important role in both addressing the needs for large-scale/inter-seasonable energy storage and optimising the overall energy system through sector coupling. Hydrogen can support the decarbonisation of gas infrastructure, transport, and energy-intensive industries. Over the past 10 years, over EUR 1 billion was invested in hydrogen technologies through the Fuel Cells and Hydrogen Joint Undertaking.

⁷⁴ <http://www.b-t.energy/>.

⁷⁵ <https://solarimpulse.com/network/EUFunded>.

⁷⁶ http://www.eib.org/attachments/thematic/innovfin_energy_demo_projects_en.pdf.

⁷⁷ The NER 300 programme took its name from the sale of 300 million emission allowances from the New Entrants' Reserve (NER) set up for the third phase of the EU emissions trading system.

⁷⁸ <http://s3platform.jrc.ec.europa.eu/esif-energy>.

⁷⁹ Proposal for a Regulation establishing the space programme of the Union and the European Union Agency for the Space Programme, COM/2018/447 final of 6 June 2018.

⁸⁰ The European Commission is launching a study on methane emissions in the energy sector.

Europe is taking a leading role in developing fusion as a promising low-carbon energy source for the future. The EU's investment in ITER⁸¹, along with US, Japan, China, Russia, South Korea and India, has already produced tangible benefits for EU's economy and society in terms of innovation and growth. European companies and research centres are developing the technologies that will make fusion energy possible in the future and have already found various applications beyond the energy sector.

5. Sustaining and strengthening Europe's industrial competitiveness

To foster discussions between industry players across value chains, and as part of an effort to enhance the links between research and industry, the European Commission launched three 'industry-led initiatives' in 2017 on batteries, renewable energy, and construction. The European Commission also established the Clean Energy Industrial Forum, organised as an integral part of the annual EU Industry Days (22-23 February 2018, 5-6 February 2019 as well as separately on renewable energy on 18 March 2019), to foster exchanges among industry representatives, academia, local authorities and policy-makers.

A Strategic Forum on Important Projects of Common European Interest (IPCEI) was set up in May 2018. This covers key strategic value chains such as batteries.

Batteries will indeed be of particular strategic importance in decarbonising the European economy, strengthening the EU's strategic autonomy in energy supply, and boosting the EU's industrial competitiveness. Batteries will be important for the management of the electricity grid to distribute and store power from renewable energy sources. They will also help to promote low-emission and zero-emission mobility. Building on the European Battery Alliance⁸², the European Commission report on the implementation of the strategic Action Plan on Batteries, 'Building a Strategic Battery Value Chain in Europe' (adopted⁸³ together with the present report), underlines the importance of this strategic value chain. It highlights the broad nature of the challenges facing the battery sector in Europe and reports on the progress made in the European Commission's strategic Action Plan on Batteries⁸⁴.

The full implementation of the Circular Economy approach is also critical for decarbonising the European economy, notably energy intensive sectors such as steel, cement or glass, while keeping or increasing its competitiveness. Re-use and recycling of raw material lead to lower emissions – and reduces Europe's dependency on raw materials supply⁸⁵. In December 2018, the European Commission launched the Circular Plastic Alliance of key industry stakeholders covering the full plastics value chain as part of its persisting efforts to reduce plastics littering, increase the share of recycled plastics and stimulate market innovation.

6. Investments in sustainability and in the energy transition

The investment gap in Europe following the financial crisis is now nearly closed. However, delivering high-quality investment will remain essential for a prosperous

⁸¹ The EU is part of an international consortium building an experimental facility called ITER ("the way" in Latin) in the South of France. This will be the largest fusion device to produce energy and is one of the most ambitious energy projects in the world today.

⁸² https://ec.europa.eu/growth/industry/policy/european-battery-alliance_en.

⁸³ Report on the implementation of the strategic action plan of batteries: building a strategic battery value chain in Europe (COM(2019) 176 final), 9 April 2019.

⁸⁴ Annex to Europe on the move — Sustainable Mobility for Europe: safe, connected and clean (COM(2018) 293 final), 17 May 2018.

⁸⁵ <https://www.sitra.fi/en/publications/circular-economy-powerful-force-climate-mitigation/>

future⁸⁶, and the Energy Union is a key investment opportunity. Achieving the benefits of the 2030 climate and energy framework will require an estimated EUR 180 billion in additional annual investment between 2020 and 2030.⁸⁷ Reaching climate-neutrality will require additional investments in the range of EUR 142-199 billion a year between 2030 and 2050⁸⁸ (compared to a baseline with existing measures⁸⁹ requiring already close to EUR 400 billion investment each year⁹⁰). Public resources can provide leverage or steer investments in the right direction, but the vast majority of this investment will have to come from private sources. This is why the Energy Union and the EU's industrial policy have both focused on reducing the risks of investments in clean energy. Member States will continue to play a central role in securing revenues for new projects in the form of support schemes. But long-term offtake arrangements in the form of corporate power-purchase agreements will increasingly play a complementary role in hedging the revenues of renewable energy providers.

The Investment Plan for Europe (also known as the 'Juncker plan') mobilises investments in renewable energy, energy efficiency and energy infrastructure. From a total of EUR 390 billion investments mobilised by European Fund for Strategic Investment (EFSI), close to EUR 70 billion was invested in the energy sector. For example, the EFSI has contributed to finance renewable energy access to 7.4 million households in the EU. A number of national and regional scale energy efficiency investment programs in residential buildings in France, Spain, Italy, Germany, Finland, Poland, Czech Republic and other Member States have benefited from EFSI support. EFSI also contributed to the financing of electricity interconnector between Italy and France, and major gas infrastructure projects, such as Transadriatic pipeline and Black Sea Gas Connection.

EU cohesion policy also provides substantial support, including significant funding of EUR 69 billion – or around EUR 92 billion with national public and private co-financing – under 2014-2020 programmes for all five Energy Union dimensions. Implementation is progressing well, with 71% of the total funding allocated to projects by end 2018. Around EUR 2.5 billion for low-carbon economy investments is deployed via financial instruments.

In addition, **the 'Smart Finance for Smart Buildings' initiative is boosting investment in energy efficiency renovations of households and SMEs.** It is achieving this by enabling public funds to be used more effectively through (i) the use of financial instruments (e.g. guaranteed loans) and energy performance contracting; (ii) improving aggregation and assistance for project development; and (iii) reducing the risks of investments.

In May 2018, the European Commission proposed to further strengthen climate mitigation and adaptation in the next Multiannual Financial Framework 2021-2027⁹¹. It proposed to increase the current targets for EU budget expenditure on climate objectives from

⁸⁶ Annual Growth Survey 2019: For a stronger Europe in the face of global uncertainty (COM(2018) 770 final), 21 November 2018.

⁸⁷ Compared to 2016 Reference scenario

⁸⁸ If including transport: EUR 176 to 290 billion annually - see "In-depth analysis in support of the Commission Communication (2018) 773", Table 10.

⁸⁹ Baseline assumed to respect the 2030 objectives for energy efficiency (32.5%) and renewables (32% of gross final energy demand) and to prolong the 2030 policies without strengthening them or adding new ones.

⁹⁰ If including transport: EUR 1 200 billion annually - see "In-depth analysis in support of the Commission Communication (2018) 773", Table 10.

⁹¹ "A Modern Budget for a Union that Protects, Empowers and Defends The Multiannual Financial Framework for 2021-2027" COM/2018/321 final of 2 May 2018.

20 %⁹² to 25 %. It also proposed to increase Horizon Europe expenditure on climate objectives to 35 %⁹³. Projects will have to be resilient to current and future climate changes. This will be complemented by instruments to facilitate a just transition to a low-carbon economy in carbon-dependent regions, such as the Modernisation Fund under the EU's Emission Trading System – a fund that will support decarbonisation and modernisation of energy systems in 10 beneficiary Member States as of 2021.

To boost sustainable investment, in May 2018, the European Commission proposed a series of measures to create a unified classification system (taxonomy) of what can be considered an environmentally sustainable economic activity. On 25 February 2019, co-legislators agreed on this new generation of low-carbon benchmarks, which will regulate disclosure obligations for how institutional investors and asset managers can integrate environmental, social and governance factors in their risk processes. These measures will also develop a new category of low-carbon and positive-carbon-impact benchmarks, which will provide investors with better information on the carbon footprint of their investments.

A phase-out of environmentally harmful fossil fuel subsidies is necessary to achieve an efficient and effective Energy Union, as recognised by EU commitments in the G20 framework. Between 2008 and 2016, fossil fuel subsidies did not decrease. These subsidies are estimated to be worth EUR 55 billion in 2016, implying that EU and national policies are not yet sufficient to phase them out⁹⁴.

7. A strong external dimension to the Energy Union

As a global player, the EU has been among the first to recognise the challenge of climate change and the opportunities of the clean-energy transition. Thanks to close coordination with EU Member States, the EU is successfully engaging in energy and climate diplomacy by mobilising its diplomatic networks and cooperation agencies to push for ambitious global climate action. This includes outreach to partner countries and the scaling-up of climate finance and technical assistance to help countries implement their Nationally Determined Contributions to the Paris Agreement. The EU has organised ministerial meetings with China and Canada on climate action that have helped to maintain confidence in global climate action. The EU also works closely with G7 and G20 presidencies and partners to promote the global climate agenda, underlining the need for high-emitting economies to demonstrate leadership and progress. Additionally, the Mission Innovation initiative is providing an important intergovernmental forum for new research and development activities. Annual Mission Innovation organised back-to-back with the Clean Energy Ministerial⁹⁵ provide major opportunities for accelerating investments into clean energy innovation.

The EU's global leadership on clean energy and climate is embedded in its other international objectives. Climate change acts as a 'threat multiplier', contributing to global instability and large-scale migration flows. Conversely, clean-energy investments in partner countries create opportunities for pioneering European low-carbon industries, which EU action seeks to maximise.

The EU is seeking new ways to align trade and climate objectives. For example, the EU-Japan Economic Partnership Agreement is the first in the world to include a specific

⁹² The figure shows that the total contribution to climate mainstreaming is expected reach 19.3 % in 2018. The figure is revised every year.

⁹³ https://ec.europa.eu/commission/sites/beta-political/files/communication-modern-budget-may_2018_en.pdf.

⁹⁴ <https://ec.europa.eu/energy/en/data-analysis/energy-prices-and-costs>.

⁹⁵ <http://www.cleanenergyministerial.org/>

commitment to the Paris Agreement. In the area of bilateral trade and energy, the EU also agreed in 2018 on an ‘energy and raw materials’ chapter with Mexico and continues to insist on such chapters in ongoing free trade agreements negotiations with important energy and raw materials countries, such as Australia, Azerbaijan and Chile.

Addressing emissions from international aviation and maritime transport remains a challenge considering the projected emissions growth linked to traffic increase. In October 2016, the International Civil Aviation Organisation agreed on the development of a global market-based measure, CORSIA⁹⁶, as an initial step aimed at offsetting emissions beyond 2020 levels from 2021. In the maritime sector, the International Maritime Organisation adopted an initial strategy⁹⁷ in April 2018, on reducing greenhouse-gas emissions from ships by at least 50 % by 2050 compared to 2008 levels. For both sectors, these essential steps towards decarbonisation will need to be secured.

The EU’s international engagement has contributed to the Energy Union objective of diversifying Europe’s sources of energy and ensuring energy security. The EU maintains a regular energy dialogue with key energy suppliers and partners — both bilaterally (Norway, the U.S., Iran, Algeria, Egypt and Turkey) and through multilateral platforms (e.g. OPEC, the Union for the Mediterranean, the G7 and the G20).

On gas supply, the European Commission has facilitated several rounds of trilateral talks between Ukraine and the Russian Federation aimed at ensuring the uninterrupted transit of natural gas from Russia via Ukraine. The first deliveries of natural gas via the Southern Gas Corridor are expected to start next year, as a result of the EU’s consistent engagement with all the relevant partners and project stakeholders. The European Commission has also supported the efforts of eastern Mediterranean countries to explore common solutions to bring their significant gas resources to the market. The European Commission also remains committed to supporting the region’s development into a natural gas hub and a future provider of natural gas to the EU. It will continue its policy aiming at further diversification of supply sources and transport routes as well as strict implementation of the energy acquis throughout the territory of the Union.

The European Commission has followed up on its strategy of 2016⁹⁸ to ensure that the EU becomes an even more attractive destination for global liquefied natural gas (LNG) supply, helping it to play a crucial part in our diversification efforts. The EU is pursuing close exchanges on all energy policy issues with our major partners, and in particular the United States; both the United States and the EU have taken concrete steps to increase imports of competitively priced United States LNG to the EU. Since the meeting between President Juncker and President Trump of July 2018⁹⁹, the LNG trade relation has intensified, with a total of almost 9 billion cubic metres as of end of March 2019¹⁰⁰ imported. A high-level

⁹⁶ Carbon Offsetting and Reduction Scheme for International Aviation. The agreement sets out (i) the objective to stabilise emissions at 2020 levels by requiring airlines to offset the growth of their emissions, (ii) key design elements of the global scheme, and (iii) a roadmap for the completion of the work on implementing modalities — see https://ec.europa.eu/clima/policies/transport/aviation_en.

⁹⁷ [http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Documents/Resolution%20MEPC.304\(72\)_E.pdf](http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Documents/Resolution%20MEPC.304(72)_E.pdf).

⁹⁸ EU strategy for liquefied natural gas and gas storage, COM(2016) 49 final, 16 February 2016.

⁹⁹ European Commission Press Release: EU-U.S. Joint Statement of 25 July: European Union imports of U.S. Liquefied Natural Gas (LNG) are on the rise. Brussels, 9 August 2018. URL: http://europa.eu/rapid/press-release_IP-18-4920_en.htm.

¹⁰⁰ http://europa.eu/rapid/press-release_IP-19-1531_en.htm.

conference on LNG under the EU-U.S. Energy Council will be held on 2 May 2019 to further enhance business-to-business contacts.

The EU has continued to help countries in its neighbourhood to modernise their energy sector. Through the Energy Community, the EU has continued to assist the contracting parties to adopt the key elements of the EU's energy and climate *acquis*. An update of the Energy Community Treaty is ongoing.

Ensuring nuclear safety beyond the borders of the European Union has also been a key area of attention for the European Commission. Stress tests have been organised in the EU's neighbourhood, as the ones carried out on all EU reactors, and will continue to be pursued. The stress test carried out by Belarus was peer-reviewed by EU experts.

On civil nuclear cooperation, the EU has successfully continued to advance its cooperation with Iran, in line with the Joint Comprehensive Plan of Action. In this context, the EU aims to foster cooperation — to understand better Iran's civil nuclear needs and to gradually increase confidence in Iran's nuclear programme — and broader long-term reengagement with Iran. The EU has launched several actions to support this process, particularly in nuclear safety and in support of Iran's Nuclear Regulatory Authority. The EU also recently organised the third EU-Iran high-level seminar on international nuclear cooperation and nuclear governance.

The EU has further expanded its international cooperation with international partners on carbon markets, working closely with China to support the start and development of their nation-wide system, but also with New Zealand and California. The first Emission Trading System linking Agreement was signed and concluded between the EU and Switzerland.

The EU recognises the importance of sustainable and clean energy for development and global stability. For this reason, the EU is continuously building up its support for access to sustainable and affordable energy. In the current Multiannual Financial Framework 2014-2020, EUR 3.7 billion has been earmarked for sustainable energy. Two challenges of tremendous significance must be faced simultaneously: the challenge of access to energy and the challenge of climate change mitigation and adaptation. Given the significance of these challenges, the EU is also focusing its efforts on supporting the governance of the energy sector and on providing innovative financial mechanisms to leverage private investments in sustainable energy. These innovative financial mechanisms include the European External Investment Plan. Under the new Africa-Europe Alliance announced in September 2018, a joint Africa-Europe high-level platform for sustainable energy investments was launched in November 2018. This high-level platform will be contributing to the African led 'Africa Renewable Energy Initiative'.

As action by governments alone is insufficient to reach global climate targets, the EU engages with global civil society, the private sector and local and regional governments to help them mobilise for climate action. For example, the European Commission has supported the development of the Global Covenant of Mayors for Climate and Energy since its creation in 2017. So far, 9 296 cities, representing more than 808 million people worldwide and 10.59% of the total global population, have committed to the Global Covenant. Such actions not only mobilise commitments by cities, they also facilitate investment in urban climate and energy plans by replicating on the global level solutions that have been pioneered in the EU.

Box: further strengthening the euro's global role in the energy sector

The EU is the world's largest energy importer with an annual energy-import bill averaging EUR 300 billion over the last 5 years. It therefore has a strategic interest in promoting the use

of the euro in the energy sector. This would reduce the exposure of European companies to currency and political risks. It would also reduce costs and risks for European businesses, and reduce interest rates paid by households.

This can only happen if there is a joint effort from the EU, Member States, market participants and other players. For this reason, in December 2018, the European Commission adopted a recommendation¹⁰¹ to promote the wider use of the euro in international energy agreements and transactions. The European Commission has also launched a series of consultations with stakeholders on the market potential for a broader use of euro-denominated transactions, including those related to crude oil, gas or refined products.

V. CONCLUSIONS

Creating the Energy Union has required close cooperation between the EU institutions, Member States and all segments of society. It has made a significant contribution to strengthening Europe's energy security. This was achieved through interconnecting national markets, further diversifying energy sources, deploying indigenous renewables, implementing energy efficiency measures and promoting an enabling environment for investment. These efforts need to be maintained to ensure Europe's energy security and competitive energy prices.

To deliver on its economic potential and promote climate neutrality, the Energy Union must now be firmly rooted on the ground. The implementation of the new legal framework and the enabling actions are attracting investments that will develop Europe's entire economy and create jobs and promoting inclusive growth. These efforts must now be redoubled to reap further benefits. The transition must be fair and socially acceptable. Social implications of the process must be at the centre of policies from the outset.

Between now and 2030, the ongoing iterative dialogue between Member States and the European Commission over National Energy and Climate Plans will be critically important. This dialogue will help to find collective solutions, foster mutual support among Member States, and involve all stakeholders. This will ensure that the EU jointly delivers on its commitments. Following the assessment of the draft National Energy and Climate Plans submitted by Member States, and the recommendations issued by the European Commission by 30 June 2019, Member States will adopt their final plans before 31 December 2019. The next 'State of the Energy Union' report will be published before October 2020. By then, this report will be in a position to emphasise progress delivered through the implementation of the agreed legislative framework, and new developments on enabling actions. Reviewing progress and adapting dynamically to new developments will remain important.

Integrating and innovating in all economic sectors, and promoting consistency between a wide range of related policies and various scales of action, will be more essential than ever. This approach — including energy; climate mitigation and adaptation; air quality; digital technologies; industry; transport; land; agriculture; social issues; security; and many other issues — needs to be fostered at European, national, regional, and local level. It will equip the EU to deal with future challenges, such as digitisation, consumer empowerment, and the development of flexible electricity markets that can cope with high shares of variable renewables.

¹⁰¹ Commission recommendation of 5 December 2018 on the international role of the euro in the field of energy (C(2018) 8111 final), 5.12.2018.

The European Commission needs to continue to engage citizens, local authorities and industry to foster cooperation, create complete industrial value chains and strengthening urban innovation and investment. In particular, securing the necessary funding will be key — the financial sector in the EU has the potential to deliver the yearly investment needs of almost EUR 180 billion to achieve the EU’s climate and energy targets by 2030. It will be essential to secure stable, long-term funding over many years and to ensure that this funding meets the needs of the Energy Union.

The EU needs to maintain and step up its leadership role in global climate and energy action, while providing energy and climate security to all its citizens. It will therefore be of the utmost importance to continue strengthening the enabling framework, facilitate the energy transition, and create the right conditions for a climate-neutral economy.

The EU’s strategic long-term vision for a prosperous, modern, competitive and climate-neutral economy by 2050 will be essential to give a clear direction to the further development of the Energy Union. The proposal put forward by the European Commission shows the direction of travel towards a climate-neutral and modern economy. It underlines once again the importance of the EU’s wide-ranging enabling framework to attain climate-neutral status by mid-century. This framework promotes favourable conditions on finance and investment through internalising externalities, a consistent research and innovation agenda, a just transition for regions, economic sectors, and the general public, and a full use of relevant policies, including the EU’s budget, employment and cohesion policies.