

1. Executive summary

Over the past five years, the European Union (EU) has made significant progress in completing the internal market for electricity and gas, promoting energy efficiency action, renewable energy deployment, greenhouse gas (GHG) emissions reductions and a stronger carbon price signal. In 2019, the EU proposed the European Green Deal (EGD), a set of 50 actions for the coming five years across all sectors to prepare the EU economy for climate neutrality by 2050.

This in-depth review of the EU energy and climate policies by the International Energy Agency (IEA) assesses progress made over the past five years and reviews opportunities for boosting energy-sector action in the context of the EU economic recovery and the climate neutrality.

Together with the European recovery plan and the EU budget, the EGD is an excellent framework for the the EU to leverage short- and long-term actions for a clean, resilient and just recovery of the EU economy. The EGD has the potential to fast-forward investments and technology progress needed for the longer term decarbonisation during the coming five years to smoothen the mitigation efforts over time. Last but not least, the EGD is an opportunity for greater consistency of EU policies, to enable cost-effective, secure and guided transitions across the EU and across sectors beyond 2030 towards 2040 and 2050, within a common framework to promote industrial transformation, technology, and innovation leadership and a “just transition”.

Covid-19 tests the EU’s resilience and clean energy transitions

In 2020, the EU is facing a 7-10% economic downturn as a result of the Covid-19 health crisis. The longer the crisis lasts, the higher the impacts will be felt in the economy, including in the energy sector. Maintaining energy security is critical, as the energy sector is vital for the health of the citizens and the economy and needs to continue functioning. The physical resilience of the EU energy sector has been strong however, its financial resilience is under severe stress.

The EU energy sector witnessed a fall in energy demand and supply, and lower levels of CO₂ emissions and air pollution, amid the sharp reduction of air and road transport and industrial activity. During the first quarter of 2020, EU coal demand declined by 20% and the share of renewables reached an all-time high, with lower generation from coal, gas and nuclear. For the year 2020 as a whole, EU energy demand is expected to be 10% below the 2019 levels, which would be twice the decline experienced during the 2008-09 financial crisis. Energy-related CO₂ emissions in the EU declined by 8% during the first quarter of 2020 compared with the same period in 2019.

While these trends could enable the EU to meet its 2020 targets for renewable and energy efficiency, it should not lead to complacency. Investment in renewable energy is set to decline by one-third in 2020, compared to 2019, which would be a historic decline for the

EU, notably the 50% decline in solar PV. The rebound in emissions and energy use is expected to be high, supported by very low global commodity prices. As the energy sector – production and use – accounts for 75% of the EU's greenhouse gas emissions, efforts are required to mitigate such a rebound across the economy, including in buildings/heat, industry and transport.

Europe's energy transitions progressed fast in electricity

In 2018, total EU GHG emissions have fallen by 17% since 2005 and by 23% since 1990. Energy efficiency, renewables and fuel switching were essential drivers of the GHG reductions in the power sector.

In electricity, wind power is becoming the largest renewable source. In 2018, the EU share of renewables reached 32% in electricity. The EU has seen substantial investments in renewable electricity thanks to robust renewable energy policies, such as the Renewable Energy Directives (RED I and II), ambitious targets and relevant national policies and incentives, including recent auctions and long-term power purchase contracts. Thanks to low natural gas prices, significant coal-to-gas switching took place in the power sector, which also relied on nuclear for 25% of its generation in 2018.

Other policy drivers are the plans of 16 member states to phase out coal use in the next decades (coal still accounted for 20% of the EU electricity mix in 2018) and the successful reform of the EU Emissions Trading System (EU ETS) with a market stability reserve (MSR), which adapts to the economic development. In 2019, the EU saw a price for allowances of EUR 28, up from only EUR 8 in 2014. In 2020, the EU ETS withstood the oversupply from the Covid-19 crisis thanks to the MSR.

By international comparison, the EU has a significantly lower emissions intensity of power generation than other large economies. The carbon intensity was 270 grammes of CO₂ per kilowatt-hour (gCO₂/kWh) in 2018, compared with over 400 gCO₂/kWh in the United States, over 500 gCO₂/kWh in Japan, around 600 gCO₂/kWh in the People's Republic of China and over 700 gCO₂/kWh in India and Australia. In 2019, the EU power generation carbon intensity reached 235 gCO₂/kWh.

Progress was slower in buildings and transport by end of 2019

Outside the electricity sector, energy transitions have only just begun with varied results for energy efficiency and renewable deployment in sectors such as transport, buildings and industry.

Renewables reached 18% in the EU's gross final consumption in 2018; results in transport and heating and cooling are, however, below expectations. Energy efficiency has enabled the decoupling of the EU's GHG emissions and energy use. Emissions and energy use would have been higher without EU-wide energy efficiency improvements during 2010-19. However, the rate of energy efficiency improvements has slowed down, and the EU as a whole is not on track towards its energy efficiency target for 2020. Growing energy consumption in road and air transport had been the most important drivers for the shortfall in the EU's energy efficiency target for 2020. Covid-19 has changed some of these dynamics and will impact on the 2020 trends.

The transport (notably aviation) and buildings sectors had seen a rebound in emissions until the end of 2019. Emissions from intra-EU aviation (not from third countries) and

electricity used in rail and road transport are covered under the EU ETS. Road transport and buildings are subject to national emissions reductions targets stipulated under the EU Effort Sharing rules, and are subject to national energy taxation, regulations and incentives. Efforts in these sectors will result in the EU being able to meet the 2020 target of 10% below 2005, but seem not to be on track for a 30% cut in emissions by 2030 (from the 2005 baseline).

The transport sector has been a key focus and the EC will address the shortfall in emission reductions in the forthcoming EU Sustainable Transport and Smart Mobility Strategy. The European Green Deal seeks a 90% reduction of greenhouse gas (GHG) emissions from transport by 2050. To support the transition in transport, a substantial part of the 75% of inland freight carried today by road should shift onto rail and inland waterways. By 2025, the Commission expects 1 million public recharging and refuelling stations (and 3 million by 2030) will be needed for the 13 million zero- and low-emission vehicles on the road.

Fuel switching is also promoted by the Directive on the deployment of alternative fuels infrastructure, which requires that member states provide a minimum infrastructure for alternative fuels such as electricity, hydrogen and natural gas. A revision of the Directive is planned for 2021 to achieve greater harmonisation of efforts and a level playing field across fuels.

Transport sector demand and emissions have seen major trend changes in 2020 in the context of the Covid-19 pandemic. Faced with lockdowns around the world, global aviation activity almost fully collapsed and EU aviation activity, too. Covid-19 and the related lockdown measures across the EU and the globe may have medium-term impacts on public, air and road transport, as behavioural changes and stimulus measures from governments for electric vehicles might show longer-lasting impacts on the sector and fast-forward the transition. Europe's sales of electric vehicles have been very robust. It will be critical for the Commission to assess these trends when preparing the strategy.

Renewables play a minor role in gross final consumption in transport (8%). The share of renewables in heating and cooling was 20% in 2018. Despite the doubling of bioenergy use in the heat sector, the sector remains a large consumer of fossil fuels – natural gas was the largest fuel in district heating with 37% of total heat production in 2017, followed by coal with 25%. Buildings account for 40% of the total final consumption in the EU and offer large opportunities for renewables penetration.

Enhanced efficiency gains have been most apparent in the buildings and industry sectors, where several policies have driven efficiency gains. These include minimum energy performance standards for electrical equipment and appliances and the building envelope, more stringent building codes, and other policies (i.e. Energy Performance Certificates and financial measures to support renovations), utility obligations and energy audits. Energy consumption has started to increase in transport and buildings, after a period of decrease in energy use from 2007 to 2014, which was partly due to the global financial crisis.

Fuel switching is promoted through renewable targets under RED II. With the RED II, the EU introduced a target of 14% renewable energy in transport by 2030 (with a 3.5% target for advanced biofuels), an ambitious increase from 8% in 2018. Overall, the transport target for renewables will be increasingly met through the promotion of electric vehicles (EVs). Rail is providing the highest contribution to the target in terms of renewable

electricity. Advanced biofuels and biomethane are expected to play a significant role in a number of transport sectors, notably aviation and maritime.

The EU has the world's most stringent CO₂ emissions standards for light- and heavy-duty vehicles. To reach the EU fleet-wide target of 95 grammes of CO₂ per kilometre (gCO₂ per km) in 2020-21 for newly registered cars, companies can deploy a number of different technologies. This includes technologies for the electrification of the fleet. While electrification increases energy efficiency, the increase in sales of SUVs resulted in a slowdown in energy efficiency improvements. Today, the EU fleet is made up of conventional cars, and they will dominate new sales at least for the coming years. If new car sales will be largely composed of SUVs, the EU could see a further slowdown in energy efficiency improvements, if no fuel economy standards are adopted. It is therefore welcome that the European Green Deal announced a revision of the CO₂ standards to ensure a clear pathway from 2025 onwards towards zero-emission mobility.

The industry sector is covered under the EU ETS with free allowances for those industries that are at risk of carbon leakage. Industry does not have any specific target for energy efficiency or renewables, and its inclusion under the EU ETS has not yielded substantial reductions in emissions. From 2013 to 2018, CO₂ emissions from industrial installations decreased by only 0.3%. The EU should assess the allocation of allowances, investigate life-cycle approaches and review carbon leakage implications. The amount of carbon leakage may be lower than expected, including in electricity imports from third countries (which are very low in volume). The new Industrial Strategy for Europe, along with the Circular Economy Action Plan and the SME Strategy set a clear direction for a globally competitive, climate-neutral and digital industry. It has the potential of promoting the transformation of Europe's industrial sector and small and medium-sized enterprises (SMEs).

Energy sector action is central to the European Green Deal

Under the European Green Deal (EGD), the European Commission announced a review of its energy and climate legislation to scale up emissions reductions, boost the deployment of renewables and energy efficiency, and review the Energy Taxation Directive. In the field of state aid, the European Commission started the review of its 2014 Environmental Protection and Energy Aid Guidelines.

The EU is not yet on track towards the targeted increase of the renewables share to 32% (which was at 18% in 2018), nor energy efficiency savings of 32.5% by 2030. Today's 2030 targets will require a significant system transformation, even more so with the announced enhanced targets under the EGD. The EU should therefore accelerate the implementation of the current policies and regulations (Clean Energy Package [CEP] adopted in 2018-19) while considering the need for new EU policies, notably in energy system integration, to decarbonise the heat and transport sectors, and in innovation and technology deployment, in areas of underperformance.

Progress will require both EU actions and higher efforts from national measures under the National Energy and Climate Plans (NECPs). The NECPs are at the heart of today's energy sector governance: each member state had to submit its plan to the European Commission (deadline was 31 December 2019; almost all countries have submitted the final NECPs by end of May 2020). Taken together, the NECPs should ensure the EU meets

its energy and climate targets set under the landmark CEP. The implementation of the NECPs and the CEP has just started in 2020. While member states are in the driver's seat to meet collective EU-wide targets for 2030, the EU can also adjust policies in the medium term. The European Commission will assess all final NECPs in the course of 2020 and discuss the possible medium-term reviews of energy sector legislation during 2020-21. This will provide a sense of direction and progress, and opportunities for strengthening policies and/or initiating new action under the EGD.

The EU's competition and internal market rules should continue to focus on preserving the integrity of the EU single market in energy, i.e. avoid undue fragmentation of energy markets (along national lines), leading to cost inflation and undue distortions to competition and trade. Covid-19 crisis measures and public economic rescue spending may exacerbate this challenge.

Whether the EU will increase its 2030 targets for emission reductions will be subject to a major impact assessment and political debate conducted in 2020. Analysis by the European Environment Agency outlined that national measures implemented by 2019 will not be enough to meet the 2030 targets of a reduction by 40% from 1990 levels, let alone enhanced targets. The European Commission therefore considers that the implementation of the final NECPs will be critical to deliver on the 40% target.

This IEA review has assessed EU policies and identified opportunities to strengthen policies. There are a number of opportunities to scale up ambitions and improve policies on the way to 2030, having in mind the long-term decarbonisation towards 2050.

Boosting EU economic recovery under the Green Deal

For Europe's recovery, the EGD presents a real opportunity to boost investments in clean energy transitions. The EC presented on 27 May 2020 proposals for an increased long-term EU budget of EUR 1.1 trillion (2021-27) and the creation of a new short-term recovery instrument of EUR 750 billion (2021-24), with financing raised on the financial markets. The EU should swiftly agree on an economic recovery programme that can leverage private investments by both designing adequate public sector funding instruments and by implementing the right policies to lift barriers to investments.

First, stimulus investments in efficiency should be a prime target, as they can boost job creation in critical manufacturing, construction, and small and medium-sized businesses, save consumers money, and reduce GHGs. The European Commission is developing a new Renovation Wave initiative announced by the EGD in order to stimulate the renovation of the existing building stock at a faster and deeper pace, by addressing the main barriers to building renovation and reinforcing the pull factors for faster and deeper renovation focusing on areas such as social housing, public buildings, schools and hospitals and their related energy distribution, lighting and heating infrastructure (upgrade to solar rooftop photovoltaic [PV], renewable heat).

Equally, national fiscal stimulus programmes for home owners and builders can create a market for higher-efficiency products and services. State aid or EU funding (including EIB loans) should support high energy efficiency and/or CO₂ emissions requirements and be conditional upon scaling up existing standards, codes or ratings. Campaigns to replace old, inefficient technologies and products with new, efficient ones (to fast-forward

implementation of the EU eco-design requirements), also referred to as “cash for clunkers” programmes can target cars, refrigerators, or other appliances and motors in industry, and need to include recycling and end-of-life aspects.

Second, the period of low fuel prices represents an opportunity to undertake a number of measures that will be difficult to do as prices rise again, including phasing out fossil fuel subsidies, reforming energy prices and taxation to favour low-carbon energy, abolishing high taxation of electricity, and reforming fixed network charges.

Third, investment in energy sector resilience, notably infrastructure and smart energy systems, has multiple cross-sector spillovers for the digital industrial revolution. Smart energy systems also enable an efficient and secure decarbonisation of the entire energy system.

Fourth, the EU should act to avoid the scaling back of private investment in the clean energy industry. EU funding instruments are available across the entire innovation value chain, with programmes for energy research, development and demonstration (RD&D). Horizon Europe, the Innovation Fund, the Modernisation Fund, InvestEU and others take research to development and demonstration. The EIB is expected to play a major role in stimulating private-sector investment. The greater involvement of the EIB in earlier-stage and riskier energy projects compared with five years ago is a very positive sign. This will also be critical for the economic recovery – the EIB has a critical role in supporting energy efficiency investment and more risky innovative projects, including by equity funding. The EU needs to better evaluate the impact of EU energy RD&D funding, notably in the context of the EU economic recovery, ensure the alignment of EU and national priorities (under the Strategic Energy Technology Plan) in the NECPs, and boost private capital and innovation.

Besides, EU rules for state aid and sustainable finance will be critical. The new EU taxonomy for sustainable finance is going to guide public and private finance flows in energy transitions. Its implementation will need to cater for a wide range of technologies, including technologies that are critical enablers of energy transitions and the EU recovery. The EU should ensure a level playing field for investors and technologies, including natural gas and nuclear, for those countries and sectors that rely on it. When reviewing the state aid guidelines for environment and energy for the period after 2020, the European Commission will also need to account for the EU recovery and opportunities for EU industrial leadership and large-scale investment opportunities in technology and innovation, including in offshore wind, in electrolysers for hydrogen, and lithium-ion batteries and related infrastructure. EU rules need to facilitate state aid for public and private renovation (for instance by energy service companies), large-scale infrastructure and technology replacement.

Scaling up long-term actions on the road to net-zero

There are many different national policy approaches on energy transitions for the period 2030 to 2050. Several EU member states have already adopted 2050 objectives for climate neutrality (or earlier) and very ambitious targets in non-ETS sectors (transport, buildings) alongside policies to phase out fossil fuels. At their EU Council meeting of December 2019, EU member states agreed to the climate neutrality goal by 2050. This allowed the European Council as a whole to endorse the 2050 climate neutrality goal. In

March 2020, the EU formally submitted its long-term strategy to the United Nations Framework Convention on Climate Change (UNFCCC), based on several scenarios for a 2050 vision.

Under the Paris Agreement, the EU is invited to submit an updated nationally determined contribution (NDC) that reflects increased ambitions for 2030 by the 26th Conference of the Parties (COP26). This would require EU leaders to agree on an increased 2030 target by COP26, which has been postponed to 2021. As the EU accounts for 8% of the global GHG emissions, global action is a critical part of the EGD.

The European Commission presented a proposal for a first EU Climate Law in March 2020, which aims at creating a new governance framework for emissions reductions during 2030-50 based on five-year reviews of progress and the NECPs.

The road to net-zero will require further action. First, the EU needs to fully implement its “energy efficiency first” principle for the achievement of its 2030 targets and the long-term pathways towards net-zero emissions by 2050. The EU should unlock the potential for energy efficiency in transport, industry and buildings and operationalise the principle at various levels and sectors. Measures to scale up energy efficiency include raising standards, strengthening market-based instruments, and boosting opportunities from digitalisation and electrification. For instance, a more efficient organisation of the entire mobility system based on EU wide digitalisation, data sharing and interoperable standards could help make mobility cleaner. Such an efficient organisation should include smart traffic management and increasingly automated mobility in all modes and result in reducing congestion and increasing occupancy rates. All this requires the better tracking of progress through measurement, reporting and monitoring of impacts of national measures, as well as the strengthening of EU-wide standards for buildings, appliances and vehicles.

Efficiency gains across all sectors will continue to be vital for EU member states seeking to meet their 2030 renewable energy targets (as less energy consumption automatically increases the share of existing renewable energy consumption), especially as renewable energy deployment in several EU countries has not been sufficient to meet their renewable goals.

Second, the EU power system is going to be characterised by higher shares of variable renewables. Wind is expected to become the largest power source in the coming years, mostly driven by investment in offshore parks, where the EU has taken global leadership. The need for power system flexibility will rise fast in the coming decade, but the development of flexibility sources, such as interconnections and grids, demand response, and energy storage is slower than renewable development. The growing deployment of digital technologies will unlock new opportunities in this area.

The implementation of the CEP will upgrade the EU electricity market design to more active demand participation and enhance system operation for higher shares of variable renewables. The CEP rules should enable efficient cross-border capacity utilisation, and trading across shorter time frames in day-ahead, intra-day and balancing markets. However, the scale of investment needed and the transformation of the system required is significant. This is not just an issue of infrastructure assets but enhanced market and regulatory frameworks will also be needed.

The EU identified critical transmission interconnections, marked as projects of common interest as part of the ten-year network development plans by the European Network of

Transmission System Operators for Electricity (ENTSO-E). However, progress is slow in building such new large-scale power transmission, as public acceptance in most member states remains the limiting factor. The CEP focuses on increasing the utilisation of existing power lines and requires that 70% of cross-border electricity capacity is allocated to the market. Transmission and distribution system operators and energy markets will also need to facilitate the operation of system flexibility by unlocking demand response, smart grids and smart meters, with help of increased digitalisation.

The EU should assess the techno-economic potential of storage – in all its forms – as another important source of system flexibility, and work on policies and incentives needed to unlock such potential. This includes pumped hydro, batteries, both at large scale and distributed level and thermal (heat and cold) storage. Several projects exist across the EU for the development of electrolyzers to convert and store wind power and other renewable electricity into hydrogen, to be transported by the gas grid, which can boost the flexibility of the EU power system.

Third, system integration will become the EU's regulatory priority. As the electrification of end-use sectors increases, opportunities for energy system integration will multiply efforts from renewables and energy efficiency. This IEA review finds the EU can reap the full benefits of flexibility, reliability and decarbonisation by adopting an energy system-wide approach. This includes reducing barriers from separate sector policies, improving system operation, use and planning for a range of low carbon fuels, while prioritising efficient end use, fuel switching and the development of innovation and technologies and digitalisation. The planned EU energy system integration strategy should support the alignment of policies and reduction of barriers. One example is the elimination of EU-wide barriers for the production, transportation and use of clean hydrogen (produced either from fossil fuels with carbon capture, utilisation and storage or from renewable electricity) which is being developed by France, Germany, the Netherlands, Portugal and others. These barriers include the cost of low-carbon hydrogen, the availability of transportation infrastructure and regulatory stability. The EU should facilitate regional industrial clusters by lifting regulatory barriers, supporting the enabling infrastructure and industrial alliances.

The EU ETS system has been and can be a strong enabler of fuel switching. The European Commission should examine the opportunity of strengthening the carbon price signal under the non-ETS and the EU ETS to incentivise innovation in low-carbon industrial development. As part of the EGD, the European Commission is exploring options of including transport and buildings in the ETS. The European Commission should assess the costs and benefits of different policy options, and prioritise their alignment across sectors. The review of the EU Energy Taxation Directive is important in this context. National taxation should be more reflective of climate objectives. The European Commission should work with the member states to improve green budgeting and fiscal reforms, as revenues from fuel taxation have come under pressure, while aligning EU-wide energy taxation rules to carbon content and air quality standards.

The EGD is expected to bolster the EU ETS price, creating concerns that industrial production could relocate to countries with lower environmental standards. Industry concerns regarding carbon leakage risks will need to continue to be addressed. The electricity sector has seen some carbon leakage related to electricity imports into countries at the border of the EU, which have doubled with the rising EU ETS price. However, the amount of total electricity imports to the EU and the related leakage risk is very small today.

The European Commission is contemplating the adoption of a border adjustment mechanism for certain sectors by 2021, should differences in levels of climate ambition persist among EU trade partners worldwide, to reduce the risk of carbon leakage to countries with lower-cost and more carbon-intensive products. Taking a life-cycle approach in accounting for emissions is an important policy enabler to avoid leakage across end-use sectors. This would also reflect upstream and downstream emissions and end-of-use, including addressing waste management in a circular economy. However, today, global emission accounting and reduction strategies are country-based and reflect the national determined contributions made under the Paris Agreement.

Strengthening the EU's energy security and resilience

Maintaining and further reducing the carbon intensity of power generation is central to the EU's decarbonisation strategy, given that many EU member states envisage boosting the electrification of end-uses, notably in transport and buildings. This includes the phasing out of coal use in power generation, switching to natural gas and further to low-carbon and renewable gases (biomethane, hydrogen), and boosting all other low-carbon sources in power generation, such as wind and solar, sustainable biomass and new nuclear plants and extending the lifetime of existing ones that can operate in a safe manner. Electrification entails a range of security aspects that need to be addressed.

The EU cannot take energy security during the transition for granted, notably as members states' energy transitions are national in scope and do not regularly account for cross-border impacts. Electricity security is a key priority, as countries phase out coal and retire nuclear baseload and see domestic gas production falling in the coming years, while increasing generation from variable renewables like wind and solar PV. Several EU countries rely on their neighbours for baseload capacity. As a next step, the EU needs to fully implement and guarantee the envisaged regional approach by building on regional security co-ordination of system operators and regional and European adequacy assessments. This can critically help electricity systems to have appropriate operating flexibility and ramping ability in the context of a rapid shift from dispatchable to variable renewable generation.

Gas security is increasingly linked to electricity security, as the reliance on flexible natural gas-fired power generation is set to increase across the EU with the coal-phase-out and some countries' decision to end the use of nuclear energy. Natural gas can boost coal to gas switching (in particular in Central and Eastern European countries) and support the transition to cleaner fuels, including for hydrogen. As domestic gas production is declining, imports will increase even further. The EU is well placed to benefit from the rapid expanding global market for liquefied natural gas (LNG). In 2019 LNG imports to the EU hit the 100 billion cubic metre (bcm) mark, accounting for 115 bcm and 25% of total imports. Lead by the TTF, EU gas hubs have seen record low prices. But not all countries are yet able to access LNG supplies at competitive terms. The completion of gas market integration in Eastern Europe has been the focus of EU efforts in recent years to ensure the free flow of gas at competitive prices to improve security of supply.

At the same time, the use of gas in the EU is changing. The EU needs to study further the role of gas in its pathway to decarbonisation and the contribution of gas infrastructure. For instance, the natural gas infrastructure creates prospects to accommodate the uptake of low-carbon gases in the EU. The upcoming EU hydrogen strategy and system integration strategy are an opportunity to reduce barriers and promote a European hydrogen market.

The European Commission's long-term vision expects nuclear to contribute to 15% of electricity production in 2050. Europe's nuclear reactor fleet is ageing, with many nuclear plants being taken out of service and only a few reactors under construction and several planned. IEA analysis finds that without new policy action at the national level, nuclear power capacity in the EU could fall to 5% by 2040. This may have implications not only for the cost of electricity but also the security of supply at a regional level, if not properly studied and addressed. To keep the nuclear energy option open for 2030 and beyond, the EU needs to maintain a level playing field for the financing of nuclear, to support lifetime extensions and new plants in countries where nuclear is accepted, and foster safety and waste disposal for the decommissioning of existing plants.

The EU has strengthened oil and gas emergency preparedness and security, notably by increasing the co-ordination among member states (in dedicated co-ordination groups) and by implementing a regional approach under the Energy Union. The EU has maintained a robust oil security system, and managed well the largest oil disruptions in the EU during this century, the Druzhba oil contamination in 2019 and the Covid-19 crisis. However, the refinery outlook for the EU is bleak, as refining margins have turned negative in North West Europe in April 2020. Equally, robust gas security measures have been put in place and critical gas interconnections and reverse flows have been implemented. The EU is also bolstering measures to address cybersecurity, including in the energy sector, with a dedicated network code. This marks strong progress in terms of preparedness, but much of the implementation work lies ahead.

Across the EU energy infrastructure, impacts of extreme weather have been on the rise, be it the impacts of lower water levels of the Rhine or an increased number of storms, droughts or heat waves. Steady temperature increase can put stress on energy infrastructure, whether through higher demand for cooling in buildings or reduced ability to use water from rivers to cool thermal power plants or transport energy commodities. The EU is promoting adaptation and has a framework in place for critical infrastructure, but has yet to evaluate measures that can boost the resilience of its energy infrastructure against climate change impacts. Integrating resilience into the NECPs and energy security policies will allow governments to improve prevention and preparedness.

Key Recommendations

The European Union should¹:

- Boost energy sector action for Europe's short-term recovery with large-scale programmes for renovation, and by lifting barriers for investment in energy projects and promoting the clean energy industries and infrastructure of the future.

¹ Please note that the recommendations are addressed to the European Union, taking the institutional and decision-making structure of the EU as given. This IEA report does not reflect the impact of the withdrawal of the United Kingdom from the EU as it covers policy analysis and data until 2018-19.

- Implement the 2030 framework based on the NECPs in a cost-effective manner and review policies to scale up energy action towards climate neutrality while ensuring competitiveness, security of supply, sustainability and affordability.
- Fully operationalise the energy efficiency first principle and strengthen standards across end uses. Foster the integration of policies across end-use sectors, including for energy efficiency, renewables, the internal energy market, and carbon pricing by reducing regulatory and pricing barriers and enabling digitalisation and electrification.
- Strengthen carbon price signals in the EU ETS/non-ETS sectors and EU energy taxation in line with climate and air pollution objectives.
- Ensure the functioning of the internal energy market and the level playing field for energy technology development, investment and sustainable financing in the EU to keep all technology options open for achieving net-zero emissions.
- Keep under regular review the EU's energy security position based on foresight and long-term energy modelling at regional and EU levels, in line with European energy system adequacy assessments.