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Support to Sino-German Cooperation on NDC Implementation:

Sectoral Best Practice

Summary of EU policies and measures targeting industrial decarbonisation

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Executive summary

Germany supports relevant programmes and projects in China through bilateral dialogue in the “Sino-German Working Group on Environment and Climate Change”. One focus of this cooperation is accelerating implementation of the NDC, including providing support on "low-carbon transition" for the Chinese economy and "capacity development on climate change related matters" for climate change authorities at provincial and municipal levels.

Industry accounts for the largest percentage of China’s energy use so the sector is a key focus for realisation of the national actions. Over the past 15 years there have been significant actions in Europe at national and Union levels to drive forward industrial decarbonisation. There is an opportunity to draw on this experience in Europe to identify best practices for industrial decarbonisation policies and technical measures. This report compiles a summary of policies and measures adopted in the EU targeted at enabling a transition to low carbon industry.

This report describes the over-arching EU strategy for decarbonising industry before providing a summary of key aspects of the main relevant policies, including the Emissions Trading System, Energy Efficiency Directive and Renewable Energy Directive. The energy union Governance requirements for reporting National Energy and Climate Plans (NECPs) and Long-Term Strategies (LTS) are described. In parallel to legislative drivers, there are a number of financing mechanisms in the EU available to support research, demonstration and roll out of low carbon techniques. A summary is included of the most relevant funds for industry: Horizon Europe, Innovation Fund and Modernisation Fund as well as the more general SET Plan.

The anticipated changes that are required to achieve the committed levels of decarbonisation could have significant implications for the socio-economic situation in regions highly dependant on high emitting industries. To minimise the negative impacts a just transition is sought, and key elements are described.

A summary is presented of the governance systems of EU legislation. This describes the main instruments, processes and entities. Examples are given of national policies in order to demonstrate the need for coherence between local and national legislation and priorities.

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1 Introduction

1.1 Context

Nationally Determined Contributions (NDCs) are a central part of the Paris Agreement (PA). China submitted as its first NDC in 2016 the 2015 INDC document, which is aligned with national policies and measures in its 13th Five Year Plan (FYP). This includes actions to: achieve peak carbon dioxide emissions around 2030; lower carbon dioxide emissions per unit of GDP by 60% to 65% from the 2005 level; and to increase the share of non-fossil fuels in primary energy consumption to around 20%.

Germany supports relevant programmes and projects in China through bilateral dialogue in the “Sino-German Working Group on Environment and Climate Change”. Currently, one focus of this cooperation is accelerating implementation of the NDC, including providing support on "low-carbon transition" for the Chinese economy and "capacity development on climate change related matters" for climate change authorities at provincial and municipal levels.

Industry accounts for the largest percentage of China’s energy use (62% in 2017, BP 2019), so the sector is a key focus for realisation of the national actions. Indirect impacts can also be significant, for example due to energy sector emissions associated with industrial electricity consumption. There could potentially be a variety of opportunities, such as retrofitting technologies or fuel switching.

Over the past 15 years there have been significant actions in Europe at national and Union levels to drive forward industrial decarbonisation. This includes, for the high emitting sectors, the introduction of the EU emissions trading system (ETS) and free allocation mechanism based on benchmarks for best performance of CO_2 emissions intensity, functioning alongside energy efficiency and renewable energy commitments, for example via the Energy Efficiency Directive (2012/27/EU and 2018/2002/EU) and Renewable Energy Directive (2009/28/EC and 2018/2001/EU). There have additionally been national and sectoral initiatives, roadmaps, policies and measures to identify and implement industrial decarbonisation.

There is an opportunity to draw on this experience in Europe to identify best practices, as well as the associated economic, political and social dimensions, for industrial decarbonisation policies and technical measures.

1.2 Objective

The objective of this study is to prepare capacity building materials and engage with relevant partners to support the question of: **“How to organize the low carbon transition in selected heavy emitting industries in China and what technical best practices exist?"**.

The aim is to provide an overview of the EU situation, which will be used to identify and share examples of good practice for consideration in China. Providing an understanding of the spectrum of options in Europe can be used to inform suggestions for options for (packages of) measures at national and provincial level in China as a mechanism for industry transition to accelerate realisation of the NDC commitments.

This report compiles a summary of policies and measures adopted in the EU targeted at enabling a transition to low carbon industry. This information will feed into capacity building material for GIZ to support cooperation with Chinese climate change authorities.

2 Background

As part of the European Green Deal, the European Commission has set the ambition for Europe to become the first climate-neutral continent by 2050 (European Commission, 2019a). Decarbonisation of European industry will be essential if this aim is to be achieved. This will, however, be a challenging task, given the CO_2- and energy-intensive nature of many industrial processes and because most low-hanging fruits for decarbonisation have already been taken. Furthermore, the Commission has also highlighted the importance of a "just transition", in which emissions reductions do not come at the expense of negative social impacts, such as increased unemployment.

In March 2020, the European Commission also published "A New Industrial Strategy for Europe", a framing document that links together different industrial policies and initiatives that the Commission plans to implement in the coming years (European Commission, 2020a). The strategy is underpinned by seven "fundamentals", including supporting industries towards climate neutrality. This is by no means the only objective of the strategy, however, with clear emphasis also placed on the need for a digital transition and the need to ensure that the competitiveness of the EU economy on the world stage is maintained.

To put the Green Deal and New Industrial Strategy in context, it is important to first understand the frameworks that have already been put in place to encourage industrial decarbonisation, both at EU and national levels. The industrial policy of the European Commission can simplistically be viewed as an attempt to strike a balance between three main drivers (European Parliament, 2017):

- Regulatory frameworks:
    - Implementing regulations to drive industrial manufacturing towards certain areas considered of importance
    - Balancing industrial actors
    - Foreseeing future developments
- Financial incentives:
    - Limited direct financial support, investments (private or public) in industry according to predefined targets
- Member States' own industrial targets, strategies and policies.

Achieving consistency between these drivers requires effective governance and ensuring synergy between complex sets of interacting policies, regulations and financing schemes.

At European level, a combination of legislation enforcing or encouraging emissions reductions and financing programmes aimed at incentivising decarbonisation projects have been implemented to encourage decarbonisation. Relevant EU-wide policies and financing mechanisms will be outlined in Section 3 and 4 of this report respectively. Aspects related to governance of European industrial policy will then be discussed in Section 5, with notable examples of national policies and discussing how they interact with EU-wide directives, highlighting both synergies and incompatibilities.

3 European policies, targets and strategies

3.1 Overview

Whereas steps have been taken for European energy policy to be drawn together through the creation of the 'Energy Union', with integrated policy objectives and a clear governance structure (European Commission, 2018a), there is currently no such 'Industry Union'. This has led to a less well-defined industrial policy landscape with less cohesion between the industrial policies of Member States (European Parliament, 2017).

However, while Member States have been free to develop their own industrial policies to some extent, the environmental impact of industry has been the focus of EU level action. Certain emissions targets and regulations must be adhered to, by Member States' governments and by industrial emitters across Europe. Greenhouse gas emissions arising from most industrial processes are covered under the EU Emissions Trading System (Section 2.2.1) while further controls on emissions are applied through other sectoral policies and measures such as the Industrial Emissions Directive.

The EU 2030 climate and energy framework includes EU-wide targets for 2030, of:

- 40% reduction in GHG emissions from 1990 levels
- 32% share of renewable energy in total final energy consumed (i.e. fuels, heat and electricity).
- 32.5% improvement in energy efficiency.

Binding targets for each Member State have been agreed for non-ETS sectors via the Effort Sharing Regulation.

The introduction of an over-arching framework for climate and energy targets seeks to coordinate Member States' efforts and the setting of objectives for a 15-year (from agreement towards the end of 2014) time period provides clarify to investors. It aims to drive low-carbon transition, while maintaining available and affordable energy alongside creating opportunities for growth, jobs, and wider environmental and health benefits through reduced pollution.

Under the Green Deal, more ambitious targets are currently under assessment by the European Commission and in discussion with Member States; including a potential increase of the GHG reduction commitment to a 55% reduction by 2030.

3.2 Key existing policies

3.2.1 Emissions Trading System (ETS)

Emissions trading is intended to provide a degree of flexibility to decarbonisation, encouraging emissions to be reduced in the most cost-effective way and to promote investment in low-carbon technologies. Starting in 2005, the EU ETS was the world's first international emissions trading system (European Commission, 2004a) and remains the EU's flagship climate policy for industrial sectors and accounts for around half of the EU's overall greenhouse gas (GHG) emissions.

The ETS covers carbon dioxide (CO_2) emissions from power and heat generation, commercial aviation and emissions-intensive industry sectors, as well as nitrous oxide (N_2O) from production of nitric, adipic and glyoxylic acids and perfluorocarbons (PFCs) from aluminium production. Participation in the EU ETS is mandatory for companies in these sectors, with some exceptions, for example plants below a certain size (European Commission, 2008a) and covers over 11,500 stationary installations.

The EU ETS works on the 'cap and trade' principle; a cap is set on the total amount of certain greenhouse gases that can be emitted by installations covered by the system. The cap is reduced each year so that total emissions fall. Companies receive a free allocation or buy emission allowances (EUAs) through auctions or from other companies in the carbon market. They can also buy limited amounts of international credits from emission-saving projects around the world (see Section 6.2.3). After each year, a company must surrender allowances to cover all its emissions from that year,

otherwise heavy fines are imposed. If a company reduces its emissions, it can keep any spare allowances to cover its future needs or sell them to another company that is short of allowances.

Box 1. EU ETS cap

Since the beginning of Phase 3 of the EU ETS (2013-2020), an EU-wide cap on emissions has been set centrally. During this phase, the cap decreased each year by a linear reduction factor of 1.74% whereas in the forthcoming Phase 4 (2021-2030), the cap on emissions will be subject to an annual linear reduction factor of 2.2%. As the EU tightens its overall GHG reduction commitments for 2030 it is probable that this 2.2% LRF will be increased as the ETS cap is reduced in line with the increased ambition in the Green Deal.

The allowances available under the cap are apportioned between free allocation, auction (distributed by Member State based on contribution to emissions, with a weighting towards least wealthy countries), a New Entrants' Reserve and Market Stability Reserve.

As well as encouraging industry directly to invest in low carbon technologies to reduce emissions, by putting a price on GHG emissions, revenues generated by ETS auctions can also be used to support the achievement of climate and energy activities (European Commission, 2017). Member States report to the European Commission annually on the revenues generated and their use: around 80% of revenues were used for such purpose. In 2019, over €14.6 billion was raised (European Commission, 2020b).

The implementation of an ETS can potentially create a barrier to activity and growth in processes which emit GHG emissions due to the introduction of a price associated with those emissions. This is particularly the case in carbon intensive sectors producing products which are traded at an international level. This can potentially enable the price of imports to undercut domestic produce, leading to a shift of production to those jurisdictions and relocation of emissions, known as "carbon leakage". The partial free allocation of allowances is intended to reduce the risk of carbon leakage in order to protect EU industry from price increases that would make them uncompetitive against trade with regions where there is no carbon price incorporated in product prices. The amount of free allocation has been decreasing over time but continues for those sectors deemed at greatest risk to carbon leakage.

Box 2. Free allocation of allowances

In Phases 1 and 2 of the ETS, almost all emission allowances were provided for free via grandfathering (i.e. based on historic emissions). Since 2013, electricity generators have had to buy all their allowances at auction or on the market, with exceptions to allow for modernisation of the electricity sector in lower income Member States which joined the EU since 2004[1]. In sectors other than power generation, the transition to auctioning is taking place progressively and the amount of free allocation provided is determined based on the risk of carbon leakage to the sector.

Free allocation is calculated as a function of historic activity level multiplied by a benchmark and a carbon leakage risk factor. Finally, a cross sectoral correction factor is applied to ensure the amount of free allowances calculated bottom up does not exceed the allowances available for free allocation under the cap. The benchmarks represent GHG intensity (tCO_2e per unit of production or heat or fuel consumption) and represent the best performing (lowest CO_2 intensity) installations (average of the best 10% of installations). The carbon leakage risk factor is 100% for sectors deemed to be at risk of carbon leakage considering the emissions intensity and trade intensity, or for products deemed not

[1] Bulgaria, Cyprus, Czechia, Estonia, Hungary, Lithuania, Poland and Romania (Latvia and Malta were eligible but chose not to) provided a decreasing number of free allowances to existing power plants on condition that the value of the free allocation was invested in modernisation of the electricity sector. Only Bulgaria, Hungary and Romania have decided to continue such free allocation into Phase 4.

to be at risk was 80% in 2013, decreasing gradually year-on-year, down to 30% in 2020, with further reduction to 0% by 2030 under Phase 4.

The Green Deal introduced the potential for adoption of a Border Carbon Adjustment Mechanism (BACM). This would add a carbon price tariff onto certain goods imported from outside the EU, from countries with no or lower carbon pricing than faced by manufacturers within the EU. The objective of this BCAM is to reduce the risk of carbon leakage, which is also the reason for the free allocation of allowances under the EU ETS. Therefore, it is possible that products for which there is a BCAM will no longer be eligible for free allocation under EU ETS once BCAM is introduced. *The design of the BCAM is at an early stage of development at the time of preparation of this report and therefore specific details have yet to be established.*

Since its adoption in 2005, the EU ETS is estimated to have led to greenhouse gas mitigation of 21% in the sectors covered and is believed to have been partly responsible for driving low-carbon innovations, without affecting economic performance (European Commission, 2019b). However, questions have been raised over the effectiveness of the ETS across all covered sectors. For instance, while the emission intensity of ETS sectors reduced by 3.35% on average in Phase 2 (2008-2012), intensity dropped only 0.45% in the industrial (non-power) sectors. Emissions from the industrial sectors have remained reasonably steady over Phase III (2013-2020) while emissions from the power sector continued to decline (European Environment Agency, 2020). This limited impact on industry sectors can be explained by low carbon prices and high proportion of free allocation (Court of Auditors, 2020).

In Phase 3 and the forthcoming Phase 4 (2021-2030), the free allocation is calculated based on GHG intensity benchmarks. The benchmarks provide a signal to operators regarding performance levels for an activity. For installations with higher intensity, the shortfall in allowances between the free allocation and their actual emissions needs to be purchased. This therefore provides an incentive to reduce emissions, although the strength of that incentive depends on the carbon price, or forecast future carbon price, being higher than the cost of investment to reduce emissions.

Operators are able to bank allowances between years, meaning that many accumulated a surplus in allowances from periods of over-allocation. This occurred primarily as a result of the 2008 economic crisis leading to several years of reduced activity (and therefore emissions) below historic levels on which free allocation was calculated. This led to low prices in the carbon market, for many years (Figure 1). This has meant the incentive to invest in low carbon techniques has been low. Other issues have also been encountered, including price volatility, and problems related to governance and emissions monitoring (Borghesi and Montini, 2016). The ETS has been revised with modifications intended to address some of these issues (European Commission, 2018b). For example, the Market Stability Reserve (MSR) has been introduced in response to the surplus of emission allowances that has built up and to support intended functioning of the carbon market (see Box 1). This, along with the declining cap and tightening of free allocation for Phase 4, has led to a recovery in carbon prices (Figure 1, S&P Global Platts, 2018).

Box 3.Market intervention in the EU ETS

As a short-term measure the Commission postponed (“backloaded”) the auctioning of a total of 900 million allowances from 2014 (400 million), 2015 (300 million) and 2016 (200 million) until 2019-2020. These were subsequently transferred into the MSR.

As a long-term solution, a Market Stability Reserve was introduced from January 2019. The reserve addresses the current surplus of allowances and improves the system's resilience to major shocks by allowing for future adjustment to the supply of allowances to be auctioned. Pre-defined rules have been set so there is no discretion in its implementation, in order to provide transparency to the market.

Figure 1. Change in EU allowance carbon prices under the EU ETS over time *(Source: S&P Global Platts, 2018)*

Under the 2030 climate and energy package, the EU ETS cap reduces by 43% compared to 2005 emissions. The EU ETS is not yet aligned with a net zero objective although this is expected to change. Under the European Green Deal, the Commission will present an impact-assessed plan to increase the EU's greenhouse gas emission reduction target, which is set to include changes to the ETS cap (European Commission, 2019a). A reduction target of at least 55% by 2030 has been proposed by the Commission, subject to confirmation by Parliament and Council before being reflected in the EU NDC and climate law. Legislative proposals for implementing this increased ambition are to be presented by June 2021 (European Commission, 2020c) and analysis by the Commission on the policy options is on-going in addition to consultation with stakeholders. This may include revisions to aspects of the ETS rules, such as reducing the cap (and therefore increasing the annual linear reduction factor), changes to free allocation to better target the sectors at highest risk of carbon leakage, and a possible extension of the ETS to new sectors such as maritime and road transport (European Commission , 2019a).

In terms of the targets of the EU ETS, the effect of other targets and policies, such as contributing to energy efficiency and renewable fuels targets, has in principle been considered in the setting of the EU-wide cap.

3.2.2 Energy Efficiency Directive (EED)

Entering into force in 2012, the Energy Efficiency Directive (EED) was intended to establish a common framework to promote energy efficiency within the EU in order to achieve the target of increasing efficiency by 20% by 2020 (European Commission, 2012). The EED introduced a series of wide-ranging policies to ensure that all EU countries use energy more efficiently at all stages of the energy chain, from generation and transmission through to distribution and end-use consumption.

Following implementation of the EED, Member States are required to set efficiency targets, outline national strategies and provide yearly updates on progress in the area of energy efficiency. The EED also contains measures aimed at a few key sectors. For example, in response to high energy usage by heating and cooling in buildings and industry, EU countries are requested to carry out and notify to the Commission a comprehensive assessment on efficient heating and cooling. Financial barriers are furthermore addressed in the Directive, with measures included that encourage the mobilisation of financial institutions and promotion of financial mechanisms, such as energy service markets, by Member States.

While the EED is intended to reduce final energy consumption across residential, tertiary, industrial and transport sectors, the impact is unlikely to be evenly spread across these sectors. In the impact assessment of proposed amendments to the EED carried out in 2016, energy efficiency improvements were projected to be lower for industry and transport than residential and tertiary sectors for all scenarios (European Commission, 2016). Generally, the impact of the EED on industry is expected to be limited as many Member States have also chosen to make the ETS sector exempt from energy efficiency measures, as they are entitled to do under the Directive. This flexibility was permitted given the view in some quarters that mandating energy efficiency actions would distort the market-based approach of ETS, which is intended to encourage take up of the most cost-effective options as the carbon price increases. Furthermore, requiring energy efficiency actions in ETS sectors would result in a reduction in emissions which could lead to a surplus in allowances in the system unless the associated emissions reductions are correctly accounted for in the setting of the cap.

Following the partial review in 2016 (European Commission, 2016), the EED was amended in 2018 (European Commission, 2018c). Amendments included an increased headline efficiency target of 32.5% by 2030, reflected the new emphasis placed on energy efficiency by the Commission. However, as previously mentioned, the Commission has recently announced its intention to further reduce 2030 emissions targets and achieve a carbon neutral European economy by 2050. In light of this increased ambition, a full assessment of the effectiveness and impact of the EED to date is forthcoming, with a view to further revisions in the future (European Commission, 2020d).

3.2.3 Renewable Energy Directive (RED)

The original Renewable Energy Directive (RED) established an overall policy for the production and promotion of energy from renewable sources in the EU (European Commission, 2009). It stipulated that the EU must obtain at least 20% of its total energy needs from renewable sources by 2020. Under the RED, all EU Member States also had to ensure that at least 10% of their transport fuels came from renewable sources by 2020. These renewable energy targets were translated into targets at the Member State level and achieved through individual policy instruments implemented by Member State governments. The specifics of such national policies ultimately determine which stakeholders are affected by this directive.

In general, the RED is likely to have contributed to industrial decarbonisation either by encouraging the use of biomass for industrial processes, or indirectly by a higher share of renewable electricity on the grid being used in industry. However, the use of heat pumps, solar and geothermal energy in industrial processes remains low, despite increasing market maturity (European Commission, 2016b), suggesting further incentivising measures may be required to drive the uptake of renewables in industry.

In December 2018, the revised RED entered into force, aimed at helping the EU to meet its emissions reduction commitments under the Paris Agreement (European Commission, 2018d). The new directive includes a revised binding renewable energy target for the EU for 2030 of at least 32%, with a clause for a possible upwards revision by 2023.

3.2.4 Industrial Emissions Directive (IED)

The Industrial Emissions Directive (IED) is the main EU instrument regulating emissions of pollutants from industrial installations (European Commission, 2010). The IED aims to reduce environmental impacts of industrial activities through an integrated approach.

Under the IED, around 50,000 installations undertaking industrial activities are required to operate in accordance with a permit granted by authorities in the Member States. Permits set conditions for performance in relation to emissions to air, water and land, generation of waste, use of raw materials, energy efficiency, noise, prevention of accidents, and restoration of the site upon closure.

The approach of the IED is different to the market-based approach of the EU ETS. For emissions to air, IED is based on ensuring compliance with emission limit values (ELVs), for individual processes

based on what is achievable by so-called Best Available Techniques (BAT). BAT is defined via Technical Working Groups with representatives from the European Commission, EU Member States, European industry and environmental NGOs.

Although a single installation may be covered by both legislations, the scope of the IED does not cover GHG emissions that are covered by the EU ETS. Under IED there is an option to set energy efficiency standards and guidance is provided in the EU Best Available Techniques reference documents (BREF) for Energy Efficiency (JRC, 2019), but this is not mandatory and CO_2 limits are not included so effects on emissions are indirect. For certain activities not covered by ETS there are BAT Conclusions which affect GHG emissions, such as substituting refrigerants to reduce F-gas emissions or achievable emissions limits for methane from certain combustion plants. The recent IED evaluation estimated that around 10% of GHG emissions of IED plants are not covered by the ETS, representing around 4% of total EU GHG emissions. However, GHG emissions are not routinely covered in BREFs and BAT Conclusions even for activities not covered by the ETS and so little attention has been given to this in installations permits. Therefore, the impact to date on industry GHG emissions is small. Furthermore, no information was available on the impacts on industrial energy efficiency savings caused by IED (European Commission, 2020e).

Air pollutant levels have dropped since 2014, which can be attributed in large part to the stricter emission limit values imposed by the IED (EEA, 2019). There is also evidence to suggest the IED regulatory process has been effective in controlling industrial emissions to water (EEA, 2018). However, questions have been raised over the level of compliance with the directive in some Member States (Conti *et al*, 2015).

Under the European Green Deal, a possible revision for the Directive is being considered (European Commission, 2020f). A number of options for potential changes are under consideration for possible inclusion in a revised IED, including interaction with industry decarbonisation efforts and contribution to the circular economy. Any options for extending scope to cover GHGs will be assessed for coherence with EU ETS and whether mandating BAT-based, installation GHG emissions standards is compatible with the market based approach.

3.2.5 National Energy and Climate Plans (NECPs) and Long-Term Strategies (LTS)

The energy union and climate action governance system requires action by Member States to support meeting the EU's 2030 climate and energy targets. This includes obligations on EU countries to report to the Commission, to allow transparency and to support EU cooperation.

Under the governance system, Member States are required to adopt integrated national energy and climate plans (NECPs) covering ten-year periods starting from 2021 to 2030. These plans are at the interface of European governance and national governance in that they are used by the EU to check that nationally set ambitions are in line with targets set by the Commission. The NECPs are furthermore used to assess the adequacy of planned energy and climate policies, as well as the level of cooperation between Member States. Member States had to submit their final plans for the first ten-year period by the end of 2019 and are currently under review by the Commission.

Within these NECPs, all Member States are required to carry out impact assessments for national policies and measures and are encouraged to address country-specific issues to ensure that decarbonisation does not negatively impact Member States. For instance, following the Commission's assessment of draft NECPs, coal-reliant Member States have been asked to specifically consider how mining regions can undergo a 'just transition' away from coal without employment levels and social welfare being affected.

Following this recommendation:

- Slovakia has adopted the Action Plan for the Transition of the Coal Region Upper Nitra in July 2019
- Poland has stated that it intends to carry out a comprehensive analysis of the impact of its plan on mining areas (including society, employment and skills) as part of a restructuring plan for coal and lignite mining areas to be drawn up in 2020.

- The Bulgarian National Assembly decided to join the “Coal Regions in Transition” platform, which promotes knowledge sharing and exchanges of experiences between EU coal regions (see Section 5).

However, NGO analysis of the draft NECPs highlights that Czechia, Greece, Poland, Romania, Slovakia and Slovenia show little decrease in coal capacity by 2030, despite being eligible for support via the Coal Regions in Transition platform and Modernisation Fund (see Section 4.4) (CAN Europe, 2019).

Under the governance system, Member States are also required to develop national long-term strategies (LTSs) and ensure consistency between the LTS and NECP. These are to forecast GHG emission reductions, in individual sectors, and decarbonisation measures along with their socio-economic impacts to the extent feasible, with a perspective of at least 30 years.

The Commission supports Member States when preparing their long-term strategies by providing information on underlying scientific knowledge as well as opportunities for sharing information and best practices. Around half of Member States have submitted an LTS during 2020 and these are currently under review by the Commission to assess whether these are adequate to support achieving the EU targets. This is in the context of the Paris Agreement which invites Parties to communicate their strategies. The EU submitted its LTS to the UNFCCC in March 2020 presenting the strategic vision for a climate neutral EU by 2050.

3.2.6 F-gas Regulation

To control emissions from fluorinated greenhouse gases (F-gases), including hydrofluorocarbons (HFCs), the EU has adopted the ‘F-gas Regulation’ which covers key applications in which F-gases are used (EEA, 2014), such as in refrigerants used in industrial processes. After 13 years of continually increasing F-gas emissions, emissions declined in 2015, 2016 and 2017 compared to the previous years (European Commission, 2019b), suggesting that the policy has been effective.

4 Financing Mechanisms

4.1 Overview

Financing mechanisms play an important role in ensuring cohesion between the objectives of the European Commission, EU Member States, the private sector, foundations and other stakeholders. European funding programmes are generally designed and developed to complement the legislation described in Section 2. For example, as part of the next phase of the ETS, several low-carbon funding mechanisms will be set up to help energy-intensive industrial sectors and the power sector meet the innovation and investment challenges of the transition to a low-carbon economy.

The main funding schemes are usually intended to fund one of three stages of industrial undertakings: research, demonstration or roll-out of infrastructure.

Figure 2. Examples of forthcoming EU funding programmes and the stages of industrial activity they are intended to support

This section presents the pertinent funding programmes shown in Figure 1. The aims and scope of these programmes is introduced with particular emphasis on how these are designed to support industrial transitions, for instance through specific eligibility criteria.

These three are the most relevant EU funding mechanisms. There are various other financing initiatives at EU and EU Member State level. The Strategic Energy Technology Plan has been established to coordinate research efforts among EU countries, companies and research institutions, and match projects to investment.

4.2 Horizon Europe

The Horizon Europe programme (2021-2027) is a €100 billion research and innovation programme with the aim of addressing global challenges and industrial modernisation through concerted research and innovation efforts.

The Horizon Europe programme succeeds Horizon 2020, the previous EU Framework Programme for Research and Innovation (2014-2020). This was similarly implemented with the intention of stimulating economic growth and creating jobs by coupling research and innovation, promoting science and industrial leadership, and tackling societal challenges. An evaluation into the effectiveness of the Horizon 2020 programme has informed development of the new programme (European Commission, 2018e) although Horizon Europe is a gentle evolution from the existing programme.

Eligibility for obtaining funding from Horizon Europe will vary depending on the specific grant scheme within the programme although “Low-carbon and clean industry” has been outlined as an Area of Intervention within the “Digital, Industry and Space” cluster. An example of a completed Horizon 2020 project is the ‘STEam And Management Under Pressure’ (STEAM-UP) project, which was targeted at large, energy-intensive industry across Europe. The project achieved energy savings within steam and electric motor systems through auditing and knowledge sharing.

4.3 Innovation Fund

Following the research and innovation stage, significant challenges are also encountered by low-carbon industrial technologies approaching the market. Funding programmes are therefore also required to support the demonstration phase of eligible projects that have received funding from Horizon Europe or other programmes.

The forthcoming Innovation Fund is intended to fulfil this role, complementing research and innovation funded by Horizon Europe and supporting the demonstration of breakthrough innovations in European industry. Following on from the NER300 programme, the Innovation Fund has a notably expanded remit. Whereas the NER300 programme was intended solely to support the demonstration of CCS and renewable energy technologies, the Innovation Fund is open to applications from a broader range of projects across energy-intensive industries . The maximum funding rate has also been increased, with the Innovation Fund supporting up to 60% of additional capital and operational costs linked to innovation. This is aimed at creating upfront risk-sharing between project promoters and the innovation fund, whereas the NER300 failed to cover these risks for promoters as funds were only provided for successful projects (European Commission, 2019c).

Proposed projects are assessed based on the following criteria:

- Greenhouse gas emissions avoidance
- Degree of innovation
- Project maturity
- Scalability
- Cost efficiency

When it comes into force, the fund will be one of the world's largest financing programmes for the demonstration of innovative low-carbon technologies. The first call for proposals is planned for 2020 and will be followed by regular calls until 2030. According to the Impact Assessment carried out in 2019, the Innovation Fund is expected to result in reductions in industrial greenhouse gas emissions of around 8.3 Mt CO_2 eq. annually, almost 1% of current industrial emissions under the EU ETS (European Commission, 2019c).

4.4 Modernisation Fund

The Modernisation Fund is another new fund to be established as part of the post-2020 reform of the EU ETS (European Commission, 2018b). The Fund is intended for progressing emerging decarbonisation technologies in lower income Member States and financed through the auction of up to 2% of the total EU ETS allowances; a total of between €6.2 billion and €9.3 billion (CEPS, 2019).

The Fund will support projects focusing on energy efficiency, modernisation of energy systems and the "just transition" of carbon-intensive regions in 10 Member States with a GDP per capita below 60% of the EU average in 2013 (Bulgaria, Czechia, Estonia, Croatia, Latvia, Lithuania, Hungary, Poland, Romania and Slovakia). Projects are to be proposed by Member States before being assessed by the European Investment Bank (EIB) and finally, a disbursement decision is made by the Commission. The implementation of the Fund will then be the responsibility of beneficiary Member States, who must report back to the Commission on the progress of selected projects.

Unlike the Innovation Fund, which is intended for energy-intensive industries, the Modernisation Fund is aimed at modernising the power sector and wider energy systems. Depending on national priorities and design, the Fund can be used by companies, citizens or project promoters although the Commission has provided a clear list of priority projects which are to be the main beneficiaries of the Fund. These include:

- Renewable energy
- Energy efficiency
- Energy storage
- Modernisation of energy networks
- Just transition in carbon dependent regions

Projects which do not fall under this list of priority projects, may still be considered for funding as 'non-priority projects'. However, these projects must still be in line with the EU 2030 Climate and Energy Policy Framework and with the long-term objectives expressed in the Paris Agreement (European Commission, 2018b).

During its development, alignment of the Modernisation Fund with the Innovation Fund and, more widely, the ETS has been ensured. Joint auctions for these Funds and regular auction volumes have been proposed to ensure the same annual average price for allowances, with the added expected benefits of limiting undesirable market impacts and reducing price risks (European Commission, 2019c). As with the Innovation Fund, the first call for proposals for the Modernisation Fund is planned for 2020, with regular calls in the following years until 2030.

4.5 European Strategic Energy Technology Plan (SET Plan)

The objective of the SET Plan is to support cooperation in order to accelerate transition to a low-carbon system in a cost-competitive way. Of the ten actions identified for research and innovation, those relevant for industry include: energy efficiency, renewable fuels and bio-energy, carbon capture and storage and a cross cutting theme of reducing costs of technologies.

The SET Plan governance structure consists of:

- a Steering Group of national representatives: seeking alignment of R&I programmes at EU and national level to maximise the impact of public investment.
- European Technology and Innovation Platforms (ETIPs) for nine technology areas: providing a network of researchers to connect skills and research facilities, and funding.
- SET Plan Information System (SETIS): a platform to provide information on technologies, policies, costs and benefits.

5 Industrial Decarbonisation and the "Just Transition"

Ensuring a "just transition" to a decarbonised economy is an important element of the EU's programme of industrial decarbonisation. While the notion of a just transition is typically associated with the energy sector—and the shift from a fossil-based energy system to a decentralised renewables-based system—the concept has begun to underpin all aspects of European industrial policymaking.

As well as this broad recognition of the challenges that may be faced, a focused initiative, the Coal Regions in Transition platform, has been established to coordinate efforts and share good practice.

Box 4. Coal Regions in Transition Platform

Established in 2017, the platform assists coal regions in efforts to transition their economies and prepare for structural and technological transition away from reliance on coal. It provides a forum for discussion between the stakeholder community and promotes knowledge exchange between regions. Technical assistance , toolkits and guidance are available, including support in identifying funding sources[2].

20 regions participate in the platform, from 9 Member States: Czechia, Germany, Greece, Ireland, Poland, Romania, Slovakia, Slovenia and Spain.

Specific financing mechanisms and programmes have also been introduced aimed at smoothing the transition to a low carbon economy for potentially vulnerable countries and regions. For example:

- Just Transition Mechanism (JTM): As part of the European Green Deal, financial and technical support will be available to all Member States, focused on the most carbon-intensive regions and regions with many people working in fossil fuels.
- A Just Transition Fund of €100bn for 2021-2027 to support initiatives such as reskilling people, providing cleaner transport and energy efficient homes in regions at risk of socio-economic difficulties as a consequence of the closure of fossil fuel-related mining and quarrying as well as sectors requiring major transformation, such as the steel, cement, chemicals and car manufacturing sectors.
- Modernisation Fund: financing programme available to 10 lower-income Member States primarily aimed at the power sector, with the aim of smoothing the transition to modernised energy systems by supporting investments in renewable energy, energy efficiency, energy storage and modernisation of energy networks
- NECPs: Carbon-intensive Member States were asked to consider just transition aspects in their NECPS and some, including Slovakia and Poland, are developing "Just Transition Strategies" in response.

[2] Just Transition funding sources: https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/actions-being-taken-eu/just-transition-mechanism/just-transition-funding-sources_en

6 Governance

6.1 Overview

The European Commission is organised into policy departments, known as Directorates-General (DGs), that are responsible for different policy areas. These DGs are responsible for the development, implementation and evaluation of EU policies, measures and certain funding programmes.

In terms of climate and energy-related activities, the following DGs are of particular relevance to the present discussion of the low carbon transition and are responsible for all of the key existing policies in Section 3.2:

The **Directorate-General for Climate Action (DG CLIMA)**, set up in 2010, leads the European Commission's efforts to fight climate change at EU and international level. The remit of DG CLIMA includes implementing the ETS as well as monitoring how Member States are implementing their national targets in sectors outside the EU ETS under the Effort Sharing Decision.

The **Directorate-General for Energy (DG ENER)** department is responsible for the EU's energy policy with the aim of achieving "secure, sustainable, and competitively priced energy for Europe." DG ENER'S activities include governance of the energy union, which includes monitoring of the integrated national energy and climate plans (NECPs) and national long-term strategies, outlined in Section 3.2.5, as well as the Energy Efficiency Directive (Section 3.2.2)

The **Directorate-General for Environment (DG ENV)** is responsible for EU policy on the environment and its remit includes the Industrial Emissions Directive (IED), discussed in Section 3.2.4.

The **Directorate-General for Taxation and Customs Union (DG TAXUD)** is responsible for developing the proposals for the carbon border adjustment mechanism.

DG GROW has responsibility including industry competitiveness and innovation as well as circular economy.

Other relevant departments in the context of supporting a just transition include the **Directorate-General for Regional and Urban Policy (DG REGIO)**, responsible for EU policy on regions, and **Directorate-General for Structural Reform Support (DG REFORM)** which supports structural reforms in EU countries as part of their efforts to support job creation and sustainable.

Besides DGs, service departments deal with administrative tasks while executive agencies manage programmes set up by the Commission, for instance the Executive Agency for Small and Medium-sized Enterprises (EASME) which manages several EU programmes in the fields of SME support & innovation, environment, climate action and energy. The Joint Research Centre (JRC) provides independent scientific advice and support to EU policy and contributes to Horizon Europe.

As outlined in Sections 2 and 3, the European Commission takes a mixed approach to the governance of environmental policy, with a combination of overarching Regulations, Directives and direct support to certain sectors. The approach can be said to have developed in response to increasing levels of privatisation and loss of power of national governments to monopolies and mergers, driving the need for greater regulation at European level (European Parliament, 2017). The design of EU legislation also balances the powers of the European Union institutions defined under the Lisbon Treaty against national governments' authorities and politics

Box 5.Types of EU legislative instruments

A **Regulation** is applied as law across the whole EU. These ensure consistency between Member States. An example is the Monitoring and Reporting Regulation of the EU ETS which sets out the requirements for monitoring and reporting of emissions under the EU ETS: prescribing this as a Regulation ensures equivalence in determining a tonne of CO_2eq (equivalent to an EU Allowance Unit – EUA).

A **Directive** sets out the goals and minimum requirements that EU Member States must achieve. Member States must transpose Directives into national legislation for these to become law. In doing so, there are elements of flexibility in how Member States achieve the required goals or go beyond the minimum standards.

A **Decision** is binding on those to whom it is addressed (e.g. an EU country or an individual company).

A **Recommendation** is not legally binding but forms a suggestion to guide or support action.

An **Opinion** is also not legally binding but allows EU institutions to formally state their position.

Directives are more commonly used than Regulations, and therefore Member States often have a degree of flexibility in pursuing the wider goals and commitments that are agreed at an EU level and consequently there is variation in the approaches followed and level of ambition between countries. Furthermore, several Member States have devolved authority to sub-national level which means there can be variation also within countries in how legislation is adopted and implemented. An advantage is that this can allow for policies and measures to be tailored and administered to best suit the local situation. However, it can result in variation and potentially some level of competitive distortion between companies operating in different jurisdictions.

During development of new legislation there is normally an ex-ante impact assessment developed to assess different options and help inform selection of key aspects of the policy design. Ex-post evaluations are also undertaken after legislation has been in place for several years in order to assess whether it is achieving the intended outcomes and continues to be fit for purpose.

Box 6. Impact Assessments

Modelling the impacts of regulations and policies in so-called 'Impact Assessments' is an important part of the Commission's decision-making process and has helped shape all notable energy and climate policies in recent years.

For example, in the review of the RED, modelling showed that providing more direct support for renewables would lead to lower ETS carbon prices, reducing incentives for decarbonisation in sectors covered by the EU ETS, including energy intensive industries, and overall leading to a more costly delivery of GHG emission reductions (European Commission, 2016b).

Impact assessments are used to inform decisions on appropriate new legislation in view of the anticipated impacts on economic dimensions and assessments of issues of political economy, social impacts of transitions:

- Investment
- Jobs / education / skills
- Impacts on trade / international competitiveness
- Innovation (e.g. R&D spending, number of patents)
- Environmental co-benefits (air and water emissions)

As well as playing a role in supporting the development of environmental legislation, the European Commission has responsibilities for monitoring the subsequent implementation in Member States. To facilitate this, there are various obligations for reporting progress, either under the specific legislation or in an overarching way against higher level goals. For example, as outlined in Section 2.2.5, the Commission is now monitoring the policies of Member States by stipulating that they submit NECPs and LTSs, while triennial National Energy Efficiency Action Plans (NEEAPs) must also be submitted under the EED. The Commission has a role in reviewing the progress made against the requirements and objectives, and if necessary, requesting corrective action or ultimately launching infringement proceedings through the European Court of Justice.

Despite the increasing level of legislation at European level, coherence with Member States' national policies is generally sought. Section 6.2 outlines some examples of policies implemented at Member State level that are aimed at driving industrial decarbonisation and discusses how these have interacted with European-wide policies.

6.2 National policies, targets and strategies

In addition to the EU-wide policies and directives detailed in Section 3.2, Member States may also develop their own policies aimed at achieving decarbonisation. This section provides a selection of case studies of such additional national legislation and highlights the importance of achieving coherence between policy mechanisms at national and EU level.

The national policies, targets and strategies in this section were selected as they offer interesting examples of how policies at national level interact with EU-level policy. In particular, they demonstrate how policies that may be successful at a national level can simultaneously undermine wider policies or lead to the possibility of 'double counting' of emissions reductions. These examples also show how some of these inconsistencies have been overcome through policy amendments.

6.2.1 UK carbon pricing

The following carbon pricing instruments currently apply to the UK:

- EU ETS, covering electricity, industry and EEA flights
- Carbon Price Support (CPS), a carbon tax levied on electricity generation
- Climate Change Levy (CCL) on non-domestic use of electricity, gas and solid fuels

The UK's CPS was designed to top up EU ETS prices and provide a greater incentive for the decarbonisation of power generation. The CPS tops up the EU allowance price in the UK electricity sector by charging fossil fuel electricity generators an additional fee. This resulted from the UK's commitment to channel £200 billion investment to low-carbon energy by 2020 and a concern over low EU allowance prices (HMRC, 2010).The CPS was one of several policies that together succeeded in driving decarbonisation of the UK electricity sector at a faster rate than the rest of Europe (Newbery *et al*, 2018), with the UK's use of coal for electricity generation decreasing by 87% between 2013 and 2018 (Carbon Brief, 2019).

However, it is thought that the CPS may have led to increased emissions elsewhere in the EU ETS, the so-called 'waterbed effect' i.e. within the EU-wide emissions cap, reducing emissions in one place allows for higher emissions in another place. This is because, although introduction of the CPS may have caused additional emissions reductions in the UK power sector, it may have led to lower equilibrium EU ETS allowance prices, reducing the efficiency of the ETS (Perino et al, 2019). Recent changes to the EU ETS with the introduction of the Market Stability Reserve (MSR) and specifically the invalidation of allowances from the MSR in the event of prolonged excess supply have reduced the risk of a waterbed effect occurring in future.

Following the UK's departure from the European Union, the UK government is expected to develop a UK ETS that is linked to the EU ETS. A UK ETS linked to the EU ETS has been favoured by stakeholders as it will maintain predictable climate policy and access to the established European carbon market, thus indicating the strength of a large carbon trading system as a means of driving industrial decarbonisation (HM Government, 2020).

6.2.2 Italian Tradeable White Certificate (TWC)

The TWC scheme, implemented in 2005, was the first in the world with the aim of improving energy efficiency and reduce emissions in all energy end-use sectors. Under this pioneering scheme, gas and electricity distributors with more than 50,000 end users could achieve certain primary energy

saving targets in order to obtain white certificates, which could then be traded. The scheme also allowed for voluntary participation by, for example, energy service providers.

The scheme is generally considered to have been successful, with 37% of the energy savings achieved in Italy over the period 2011-2017 believed to have derived from the White Certificates obligation scheme (ENEA, 2018). The duration of the scheme has been extended and the ambition level of energy saving targets has been increased. The apparent achievements of the TWC has also led France and Poland to develop similar trading schemes (European Commission, 2008b).

However, concerns over possible “double counting”—or, more accurately, “double rewarding”— have been raised. Energy efficiency support mechanisms that cover the industrial sector inherently overlap with the EU ETS as ETS allowances are freed up as a result of those measures. This was not considered to be an issue at the inception of the Italian TWC as it mainly incentivised household projects such as air conditioning installations. However, as the scheme became more attractive to industry, overlap with the EU ETS became greater and the number of white certificates being issued to industry increased (Ricardo Energy & Environment, 2018). In 2017, the scheme was amended to exclude projects subject to other incentivising schemes.

6.2.3 International carbon credits

International carbon credits are financial instruments that represent a tonne of CO_2 removed or reduced from the atmosphere as a result of an emissions reduction project outside of the EU. As with the EU ETS allowances, these credits are designed to incentivise decarbonisation.

International credits are currently generated through two mechanisms set up under the Kyoto Protocol (UNFCC, 1998):

- Clean Development Mechanism (CDM) - industrialised countries with a greenhouse gas reduction commitment (called Annex 1 countries) can invest in projects that reduce emissions in developing countries as an alternative to more expensive emissions reductions in their own countries.
- Joint Implementation (JI) - industrialised countries can meet part of their required cuts in greenhouse gas emissions by paying for projects that reduce emissions in other industrialised countries.

The possibility of ‘double counting’ of emissions reductions became an issue with the accession of new Member States, who were participating in JI projects, into the EU. In response to this concern, the so-called ‘double-counting decision’ was adopted, as part of the Linking Directive that regulates the relation between the EU ETS and the Kyoto Mechanisms (European Commission, 2004b). This decision prevents CDM and JI projects being carried out in sectors covered by the EU ETS, although allows for the participation of other sectors and gases.

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