



Integrated Environmental Policies for Green Economy

**Sharing EU and China experiences
in policymaking**

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Foreword

In both the EU and China, early environmental policies focused on specific issues, but today's challenges for a green economy require a more comprehensive and integrated approach, use of different policy instruments and improved ways to analyse the effectiveness of policies and improve policy design.

Environmental policy in the EU has undergone a big transformation since the late 1990s, evolving toward a continued mainstreaming process to ensure environmental issues are reflected in all policymaking. Environmental issues are now taken on board as early as possible with continued consideration during implementation. This is environmental policy integration. Despite these progresses more can be done in line with sustainable development goals¹.

In China, a great deal of environmental policy has been adopted over the recent years. There have been challenges to integrate policies covering different areas and in ensuring their coherent implementation toward balanced economic, social and environmental development. Furthermore, policy effectiveness is yet to be evaluated. The need for environmental policy integration to be reflected across multiple levels of governance is increasingly important.

This study reviews the evolution of environmental policies in China and the EU, with a specific case study on transport. It looks into how environmental targets and obligations should be included in sectoral policies, for example transport, and the use of assessment tools to ensure that environmental issues are understood and accounted for in both policy development and implementation.

It also looks into how different environmental policies fit together to deliver desired environmental outcomes. In particular of interest is how different types of instruments work together, such

a command-and-control instrument and a market-based instrument.

Environmental policy integration is very challenging, not only in terms of difficult trade-offs between environmental and other sector objectives, but also in institutional commitment and coordination. Experience in the EU shows that clear political support, better coordination mechanisms, greater resources and capacity, and improved information, decision-support and public participation mechanisms can help to achieve better results.

This study is a good example of sharing of experience between the EU and Chinese policymaking and has proved to be valuable in achieving more convergence between the EU and China on environmental governance. A continued cooperation in the field of environment can bring benefits to both sides in terms of policy making and shared understanding. It can also contribute to a more consistent approach to pollution prevention and control, making requirements clearer for all stakeholders and ultimately improve people's wellbeing. We look forward to future EU-China cooperation to address key global issues, such as biodiversity loss, climate change and transboundary pollution.

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¹ As suggested by the European Commission reflection paper: "A Sustainable Europe by 2030" https://ec.europa.eu/info/publications/reflection-paper-towards-sustainable-europe-2030_en



Executive Summary

This study report explores integrated environmental policies for green economy in China, comparing these to parallel developments within the European Union (EU). In both China and the EU, early environmental policies focused on specific issues (e.g. air or water pollution), but today's challenges for a green economy require a more comprehensive and integrated approach, use of different policy instruments and improved ways to analyse the effectiveness of policies and improve policy design.

This study reviewed the evolution of environmental policies in China and the EU, with a specific case study on transport. China has adopted many items of environmental legislation over recent years, including revisions of previous laws. These now cover all core environmental issues. These are mostly of a command and control nature, although there are some economic instruments. While these are important developments, there have been challenges to integrate policies covering different areas and problems in ensuring their implementation. Further, economic sectoral policies have been difficult to influence. As a result, recent policy development has sought to tackle these problems – centralising enforcement and looking to market based instruments to influence economic actors.

The EU is different to a nation state in that its legal framework is limited by its Treaty. For this study, the main consequence of this is that while EU level legislation includes a wide range of comprehensive command and control measures (and financial support tools), many fiscal instruments are only at national level. However, the EU has sought to develop different approaches to delivering policy integration, such as detailed ex-ante and ex-post evaluation procedures and obligations for plans to achieve many different objectives which necessitate the assessment of how different policies interact.

From the analysis in this study, a range of conclusions and recommendations are made concerning future environmental policy development and integration in China. The study recommends that environmental protection should be mainstreamed into top-level policy design in China and the 14th Five-Year-Plan for national social and economic development. To do this the Ministry of Ecology and Environment should draft a plan to integrate economic and environmental policies during the 14th Five Year Plan period, setting out key areas where environmental development can contribute to high-quality economic and social development. This will require a coordination mechanism for inter-departmental consultation and collaboration in drafting key economic and environmental policies.

To achieve environmental protection and economic development, it is important to deploy fiscal and private resources more effectively. The State Council should coordinate relevant ministries and other bodies to further the greening of fiscal, financial and taxation policies, optimize the structure of fiscal spending, increase funding from fiscal and private capital to green industries and environmental protection. Specifically, the MEE should work with relevant ministries to improve the differential electricity and water pricing policies to encourage green and low-carbon transition. It should also work to introduce producer responsibility legislation in emerging industries such as plastics, packaging, electronic products, logistics and express delivery, new energy vehicles, etc.

China should accelerate the formulation and revision of green social policies to increase policy coverage and effectiveness. MEE should work with other relevant departments to enhance policies that promote green lifestyles and green consumption, including improving green labelling and green certification, improve market access for green and eco-friendly products and services, and use "Internet+" to promote green consumption. MEE should improve disclosure and public participation. It should also strengthen the incentive policies for environmental NGOs and volunteers through tax reductions, awards, and partner qualifications.

On transport specifically, it is recommended to integrate use of emission standards and taxation policy to promote green transport, by charging differentiated fuel tax according to vehicle emission volume as this is a positive experience in the EU. China should also consider establishing low emission zones and congestion charges, again learning from positive experience in the EU.

Beyond specific policy developments, a key lesson from the EU is the adoption of detailed procedures for ex-ante and ex-post policy evaluation. This not only ensures better targeted and more effective and efficient policies. It also is a tool to integrate the assessment of policy coherence as part of the policy making toolbox. China should, therefore, encourage departments to carry out ex-ante policy evaluations, interim evaluations and ex-post evaluations of environmental policies. It is important to establish a cyclical mechanism for policy assessment.

1. Background

1.1. ENVIRONMENT IN CHINA

China has made great progress in environmental protection in recent decades. Environmental legislation and policy have been continuously developed and the institutional framework has been improved.

The building of the concept of “ecological civilization” in China has been elevated to an important strategic level, and a series of major decision-making arrangements have been made to support it. The Amendment to the Chinese Communist Party (CPC) Constitution adopted by the 18th National Congress in 2012 incorporated “the Communist Party of China shall lead the people in building a socialist ecological civilization”. The CPC has also included progress towards ecological civilization in its action program and adopted a series of decisions to “build an ecological civilization supported by a well-designed system to protect the environment”² It emphasized that a sound legal system is important for environmental protection, and stressed the importance of the “Five Major Development Concepts”, i.e. innovative, harmonious, green, open and sharing.

In 2015, the Chinese government issued a *General Plan for the Reform of the Ecological Civilization System* and a framework document guiding the reform. It proposed that by 2020 a complete ecological civilization system should be put in place. It would be a comprehensive and integrated system featuring clearly defined property rights and multi-stakeholder participation and use both economic incentives and command and control instruments. Overall, the system would pave the way for the modernization of the country’s national governance system and capacity for ecological civilization.

In March 2020, the government issued *Guiding*

Opinions on Building a Modern Environmental Governance System, which explicitly mentioned that environmental governance systems will be put in place by 2025 to identify the responsibilities of various stakeholders and further engage market players and the public. As a result, an environmental governance system was initiated, characterized with clear guidance, informed decision-making, faithful implementation, effective incentives, multi-stakeholder participation and constructive interaction.

In September 2020 at the 75th UN General Assembly, China promised to scale up its intended nationally determined contributions by adopting more vigorous policies and measures and pledged to have its greenhouse gas emissions peak before 2030 and achieve carbon neutrality before 2060.

1.1.1. Environmental laws and regulations have been continuously improved.

With progress towards ecological civilization incorporated into a “five-pronged approach”³, the development of environmental rule of law has been put on a fast track and is supported by a combination of inner-party rules and national legislation. A number of important environmental laws and regulations have been enacted, revised and enforced since 2012, including:

- » *Environmental Protection Law* (2014)
- » *Air Pollution Prevention and Control Law* (2015, 2018)
- » *Environmental Impact Assessment Law* (2016, 2018)
- » *Environmental Protection Tax Law* (2016, 2018)

2 *Decision from Central Party Committee on Some Major Issues Concerning Comprehensively Deepening the Reform*, http://www.gov.cn/jrzq/2013-11/15/content_2528179.htm

3 The “five-pronged approach” means a comprehensive approach to promote economic, political, cultural, social and ecological progress in China.

- » the *Solid Waste Pollution Prevention and Control Law* (2015, 2016, 2020)
- » *Water Pollution Prevention and Control Law* (2017)
- » *Soil Pollution Prevention and Control Law* (2018).

A number of important environmental regulations and action plans have been drafted in various specific fields to contribute to improving environmental quality.

Air

On September 10, 2013, the State Council issued the *Action Plan for Air Pollution Prevention and Control*, marking the beginning of PM2.5 pollution control. It called for actions across all sectors of society towards preventing and controlling air pollution.

In July 2018, the State Council issued the *Three-Year Blue Sky Defense Action Plan*. The Plan aims to significantly reduce the total amount of major atmospheric pollutants, achieve coordinated reductions in greenhouse gas emissions, further lower PM2.5 concentrations, and significantly cut the number of days of heavy pollution. In addition, the government issued the *Action Plan for pollution Control of Diesel trucks* in December 2018, and put forward measures such as clean diesel vehicles, clean diesel engines, clean transportation, clean oil products and so on.

Water

China has developed comprehensive policies for water protection, covering a variety of subjects, including river, lake and marine pollution, and extending to areas like flood control and water saving. In April 2015, the State Council issued the *Action Plan for the Prevention and Control of Water pollution*. In addition, the government issued the *Implementation Plan for Winning the War to Treat Black and Odorous Water Bodies in Urban Areas*, the *Action Plan for Integrated Environmental Management in Bohai Area*, *Action Plan For Yangtze River Protection and Restoration*, and *Special Program Plans for Environmental Protection at Centralized Drinking Water Sources* to address prominent issues in improving water quality.

Soil and Waste

Policies on soil came relatively late compared with those on air and water, targeted at prevention and treatment of soil pollution. In May 2016, the State Council issued the *Action Plan for Soil Pollution Prevention and Control*. In December 2018, the *Work Plan for the Construction of Pilot "Zero-Waste Cities"* was issued, with aims to coordinate solid waste

management in economic and social development through the "zero-waste cities" pilots.

Nature and Ecosystems

Under the framework of the United Nations Convention on Biological Diversity, China has formulated and implemented the China Biodiversity Conservation Strategy and Action Plan (2011-2030). Eight strategic tasks are put forward in the plan, including: improving policies, regulations and systems related to biodiversity conservation; promoting the integration of biodiversity conservation into relevant plans; strengthening capacity-building for biodiversity conservation; strengthening in-situ biodiversity conservation and rational ex-situ conservation; promoting the sustainable development and utilization of biological resources; promoting the benefit sharing of biological genetic resources and related traditional knowledge; improving the capacity to respond to new threats and challenges to biodiversity; encouraging public participation and strengthening international cooperation and exchanges.

In addition, the government issued "Guidance on the Establishment of a Nature Reserve System Mostly Composed of National Parks". The aim is to establish a nature reserve system mostly composed of national parks.

Climate Change

China has successively issued guidelines such as the National Strategy for Climate Change Adaptation, National Planning for Climate Change Response (2014-2020), Urban Action Plan for Climate Change Adaptation, and the 13th Five-Year Plan for Controlling Greenhouse Gas Emissions to proactively implement national strategy for responding to climate change.

1.1.2. Further steps have been taken to improve environmental policy system.

Shift from pollution emission control to environmental quality.

This has been reflected in the revision of pollutants discharge permit, as well as government performance assessment for pollution control based on environmental quality criteria. A series of documents, such as the *Regulations on Central Environmental Inspection* and the *Measures for Holding the Government Officials in Charge Accountable for Environmental Damage*, have been rolled out to identify the responsibilities for environmental quality within jurisdictions.

Financial incentives for meeting the environmental quality objectives.

The government released a series of documents, such as the *Action Plan for Water Pollution Prevention and Control*, the *Measures for Managing the Special Funds for Air Pollution Prevention and Control*, *Measures of the Central Government for Transfer Payment to Local Key Ecological Functional Areas*, which have linked environmental quality with the performance and funding allocation, and highlighted the goal of improving environmental quality.

Environmental quality assessment aiming at improving peoples' livelihoods.

Demonstration zones for the construction of national ecological civilization all take public environmental satisfaction as important evaluation criteria, and the effectiveness of urban black and odorous water treatment also takes the satisfaction of surrounding residents as an important evaluation indicator, environmental quality data indicators are used for comprehensive evaluation, and the social benefits of environmental quality improvement are fully reflected.

Market instruments for environment is gradually established and improved.

The reform of environmental market-based policies is speeding up and China is seeking to build long-term incentive mechanism for environmental protection. **Firstly, economic policies on environmental considerations have been actively explored.** Green finance policies are practiced, an environmental damage compensation scheme has been fully tried out, and the trial compilation of a balance sheet of natural resources has been carried out. An environmental protection tax has been imposed and the pilot project of water resources tax reform has been further expanded. "Green credit" and "green insurance" are playing an increasingly important role. Information on environment offenses such as excessive discharge and false data are being included into the "basic financial credit information database". Pilot projects of environmental pollution liability insurance have been carried out in more than twenty provinces. The National Development and Reform Commission issued *Opinions on the Innovation and Improvement of the Price Mechanism for Promoting Green Development*. Steady progress has been made in developing the pilot scheme of emissions trading rights and the national carbon emissions trading market. **Secondly, green supply chains and green consumption policy have been improved.** The government issued *Guidance for Giving Full Play to the Role of Environmental Protection to Promote Supply-side Structural Reform*,

the *Industrial Green Development Plan (2016-2020)*, *Guidance for Developing the Green Manufacturing Standard and System*, and the *Notice on Introducing the Pilot Program of Supply Chain Innovation and Application*. All of these have greatly promoted green supply chain policies. Eight departments, including the General Administration of Market Supervision, jointly issued the *Opinions on Implementing the Enterprise Standards "Front-runner" System* to implement the "front-runner" system in the areas of consumer goods, equipment manufacturing, service for households and businesses, and emerging industries. **Thirdly, the development of the benefits balance mechanism for environmental protection is on the fast track, and a cross-jurisdiction ecological compensation scheme is being improved.** The compensation system covers key ecological functional regions and key areas such as river basins, air, forests, grasslands and oceans, and a diverse ecological compensation policy has been put in place.

A uniform environmental supervision system has been established.

China established the Ministry of Ecological Environment (MEE), formerly the Ministry of Environmental Protection, marking a step towards a uniform environmental supervision system that provides a solid foundation for the reform and innovation of ecological and environmental policies. MEE is responsible for the centralized planning and formation of policies and standards, centralized monitoring and evaluation, centralized regulation and law enforcement, and centralized inspection and accountability. Its regulatory mandate expanded to cover "5 link-ups", namely linking the ground and the underground, the on-shore and the off-shore, the land and the sea, urban and rural areas, pollution and climate, and seek to combine pollution prevention with ecosystem protection. The institutional reform has resulted in improvement of environmental protection, paving the way for environmental policy reform during the final two years of the 13th Five-Year Plan and the upcoming 14th Five-Year Plan. **The Administration for River Basin (Marine Area) Ecosystem Regulation has been set up.** The Administration, as a representative agency of MEE, is responsible for protecting the ecosystems of the seven major basins (marine areas), namely the Yangtze River, the Yellow River, the Huaihe River, the Haihe River, the Pearl River, Songliao and Taihu Lake. **The reform of integrated administrative law enforcement for environmental protection has been deepened.** Together with the General Office of the CPC Central Committee and the General Office of the State Council, MEE has issued guiding documents for the

deepening of the reform of integrated administrative environmental law enforcement, compiled a guidance catalogue for items of integrated administrative law enforcement in ecological and environmental protection, and planned to integrate 303 items of law enforcement, among which 46 items are newly classified as law enforcement items for land, water conservancy, forestry and other competent authorities.

Although China's policies concerning ecological civilization and environmental protection have produced important results, further improvement in the following areas is needed - inadequate harmonization and balances in the environmental policy system, lack of optimal decision-making and implementation mechanisms, inadequate environmental standards, laws and regulations, lack of effectiveness for long-term market-based environmental policies, and lack of the internal motivation for multi-stakeholder participation in environmental governance, and so on. These unsolved problems have prevented the integration of command and control instruments and market-based tools, limiting the effectiveness of the combined tools of economic incentives and binding policies. During the 14th Five-Year Plan period (2015-2021), China is determined to implement environmental policy reform and innovation. At the same time, it has to tackle the challenges from both environmental protection and the economic slowdown after the COVID-19 pandemic by deepening environmental policy reform. It must promote high-quality industrial and economic development while achieving high-level protection of the ecosystem and environment so as to join in the global endeavor in building a beautiful world.

1.2. ENVIRONMENTAL POLICIES IN THE EU

In understanding the policy making and implementation environment of the EU and in making comparisons with countries such as China, it is important to stress that the EU both has characteristics which are comparable to the institutions and law making in third countries as nation states and also characteristics which are quite different.

Since its foundation, the EU has established, through its Treaties, a division of competencies between the EU level and the Member State (national) level. In a few cases competence is vested entirely at EU level. An example is trade policy. In such cases policies (and laws) are developed and adopted solely by the

EU institutions and apply across all Member States. Some issues are largely the competence of Member States (e.g. much health and social security policy), although some EU laws do impact on specific aspects of these policy areas and EU level action may help to share experience.

In the area of environmental policy (as in many areas), competence is shared. This means that legislation may be developed at EU level as well as national level. For example, EU law regulates pollution from larger industrial activities, but most Member States have their own legislation that regulates smaller industrial activities. In the environment field, the expansion of EU law has meant that national level policy tends to cover fewer issues than in the past.

In developing environmental policy in the EU, it is important to recognize the range of instruments that may be developed. It is common for there to be different types of strategic document setting out objectives and priorities (and sometimes actions). Where such a document contains many actions, it may be termed an Action Plan. The EU may develop such strategies and action plans at different scales and one may lead to another. For example, at the highest scale are strategies such as the Europe 2020 Strategy and the Green Deal, which describe major EU-wide aspirations. The latter, for example, stated that a new Circular Economy Action Plan (CEAP) would be produced (and has been). The original CEAP led to the development of the EU Plastics Strategy, which in turn led to the development of law on single use plastics. As will be seen below, EU environmental policy is framed by the strategic Environmental Action Programmes, but sometimes these may develop sub-strategies, before leading to legal development. Such strategic policy framing of legal development is mirrored in national policy making in many countries around the world. However, one common element largely absent from this mix is the "plan", i.e. the implementation plan to action the legislation adopted under the strategies. This is because this is the competence of the Member States and, indeed, EU law may require Member States to develop plans specifically outlining how the obligations in that law will be implemented (there are odd exceptions to this, but this is largely the case).

In understanding EU law, it is important to highlight the different legal instruments that may be adopted at EU level. These include (as set out under Article 288 TFEU):

» Regulations.

- » Directives.
- » Decisions.
- » Recommendations.
- » Opinions.

Regulations, directives and decisions are binding legislation on those to which they directed. Recommendations and opinions are not binding, but can be important in delivering environmental outcomes. These varied instruments are different forms of legal setting. Finally, instruments may be developed that are not specified in the Treaty, e.g. the European Commission may develop a negotiated agreement with an industry sector to deliver a particular outcome.

The main division in EU law that is most commonly cited is that between regulations and directives, i.e. that regulations have “direct effect” and directives need to be transposed into Member State legislation before they have legal effect on the activities they regulate. In practice, this difference is not exact, but it is a useful one for the purposes of this report.

The “direct effect” of a regulation means that, once adopted, it has legal effect without subsequent action by Member States. Regulations, therefore, work best where clear requirements can be established at EU level. In the environmental field, regulations are less common than directives, but they are important in certain areas. In particular they dominate EU chemicals legislation. They are also the usual instrument used to introduce international law into EU law (such as the Basel Convention) or where much of the EU budget is spent (e.g. the Common Agricultural Policy, including environmental commitments within it).

Directives require transposition in the legislation of Member States. This does not necessarily mean one piece of Member State law – it could be several at national level, or include parts at local level. Some Member States transpose EU law in self-contained new laws that are easy to compare to the EU law, while others may take the respective requirements and integrate them into the existing national framework. One of the main reasons for use of directives is that some of the implementing arrangements need to be interpreted at Member State level. In most cases this includes institutional arrangements (e.g. giving powers to competent authorities – all of which differ across the countries), but also possible choices in approach in directives.

The EU, therefore, differs from all other inter-governmental organizations in possessing institutions able to adopt legislation that is binding on the Member States. Indeed, the EU is much more than an inter-governmental organization which is why it is often referred to as a supra-national organization. The development and adoption of EU law is also different to that of individual countries (inside or outside the EU). The legislative adoption process has evolved over time and, in fact, there is more than one process, with the powers of the institutions set out in Part 6 of the Treaty. However, for regulations and directives, the following key steps apply:

- » A draft of a regulation or directive is proposed by the European Commission. The Commission is headed by political appointees of Member States, but its technical staff are civil servants. A proposal arises out of a lengthy period of analysis and review (including formal policy evaluation – see later in this report) and consultation with officials and stakeholders across Member States.
- » The proposal is debated and amended, in turn, by the European Parliament (consisting of MEPs elected directly by the citizens of the EU) and the European Council (representing the Member State governments, e.g. the environment ministries). Procedures are in place for the Parliament and Council (in discussion with the Commission) to reach a final agreement on the text, which is then adopted as law.

Once legislation is adopted, it is the responsibility of Member States (and others to which the law applies) to ensure that it is fully implemented. The European Commission has a critical role in examining the state of implementation and taking action against Member States if it considers that implementation has been inadequate. Alongside this, the Commission may evaluate how well legislation has performed and undertake formal evaluations which may lead to revision of the law (see section 3).

Beyond the immediate legislative bodies of the EU (including the Commission’s own statistical office, Eurostat, and research arm, the Joint Research Centre), other EU organisations play an important role in shaping or implementing environmental policy. Key in the interpretation of law is the Court of Justice of the European Union (CJEU), which may make judgements clarifying EU law and rule against Member States for failure properly to implement the law. The Court of Auditors is important in reviewing the effectiveness of implementation of specific legislation and its findings can be important for the

Commission in evaluating legal implementation. The European Environment Agency is also important in gathering, analysis and interpreting environmental and related data to inform understanding of policy implementation as well as to flag issues that may need to be addressed by new policies. A wide variety of other bodies also gather information which may inform specific elements of EU environmental policy.

The basis for the adoption of EU environmental law is Articles 191-193 of the Treaty. This makes clear that the EU has competence in the field of the environment, but also that this competence is shared with Member States. However, there is also a sub-division in the decision-making processes for different areas of environmental law, which affects the nature and amount of that law at EU level. Most EU environmental law is adopted in the Council by Qualified Majority Voting (QMV). Without going into detail, QMV allows for EU law to be adopted where a significant majority of Member States agree to it. This avoids one Member State operating a “veto”. However, for a few specified areas, unanimity is still required. These include areas of quantitative water management, spatial planning and taxation. The latter in particular has proved controversial and, as a result, EU level green taxes have struggled to be adopted. It is for this reason that the mix of command and control and market-based instruments at EU level is different to that of its Member States and of comparable economies.

The first EU environmental law was adopted in the 1970s. To begin with it focused on specific issues (in particular those linked to the operation of the EU’s internal market or those with strong transboundary consequences). However, over time the older legislation has been revised to take account of new environmental, social and economic circumstances and the total body of EU environmental law has become much more comprehensive. As a result, EU environmental legislation gives relatively comprehensive coverage to chemicals, biodiversity, air and water pollution and waste management, etc.. Indeed, the pace of adoption of new EU environmental law has slowed in recent years. There has been a focus on evaluation of the existing body of law (with some revision as a result), but proposals for legislation in new areas is much less frequent than in the period 1980-2000.

However, some gaps remain, particularly in areas where QMV does not apply, such as in land-use planning and its links, for example, to traffic management. Such EU interventions as there are in these areas tend to be non-legislative, such as guidance or the provision of financial support for the exchange

of good practice.

The formulation of EU environmental law and policy is guided by different, overlapping strategic documents. Foremost among these are the Environmental Action Programmes (EAP), which identify priorities and specific actions to take place, or develop. The first EAP was adopted in 1973 and currently the 7th EAP is in place (running to 2020)⁴. The 7th EAP has three overarching objectives:

- » to protect, conserve and enhance the EU’s natural capital.
- » to turn the EU into a resource-efficient, green, and competitive low-carbon economy.
- » to safeguard EU citizens from environment-related pressures and risks to health and wellbeing.

The 7th EAP identifies four “enablers” to help deliver these goals:

- » better implementation of legislation.
- » better information by improving the knowledge base.
- » more and wiser investment for environment and climate policy.
- » full integration of environmental requirements and considerations into other policies.

Finally, it includes two further horizontal priority objectives:

- » to make EU cities more sustainable.
- » to help the EU address international environmental and climate challenges more effectively.

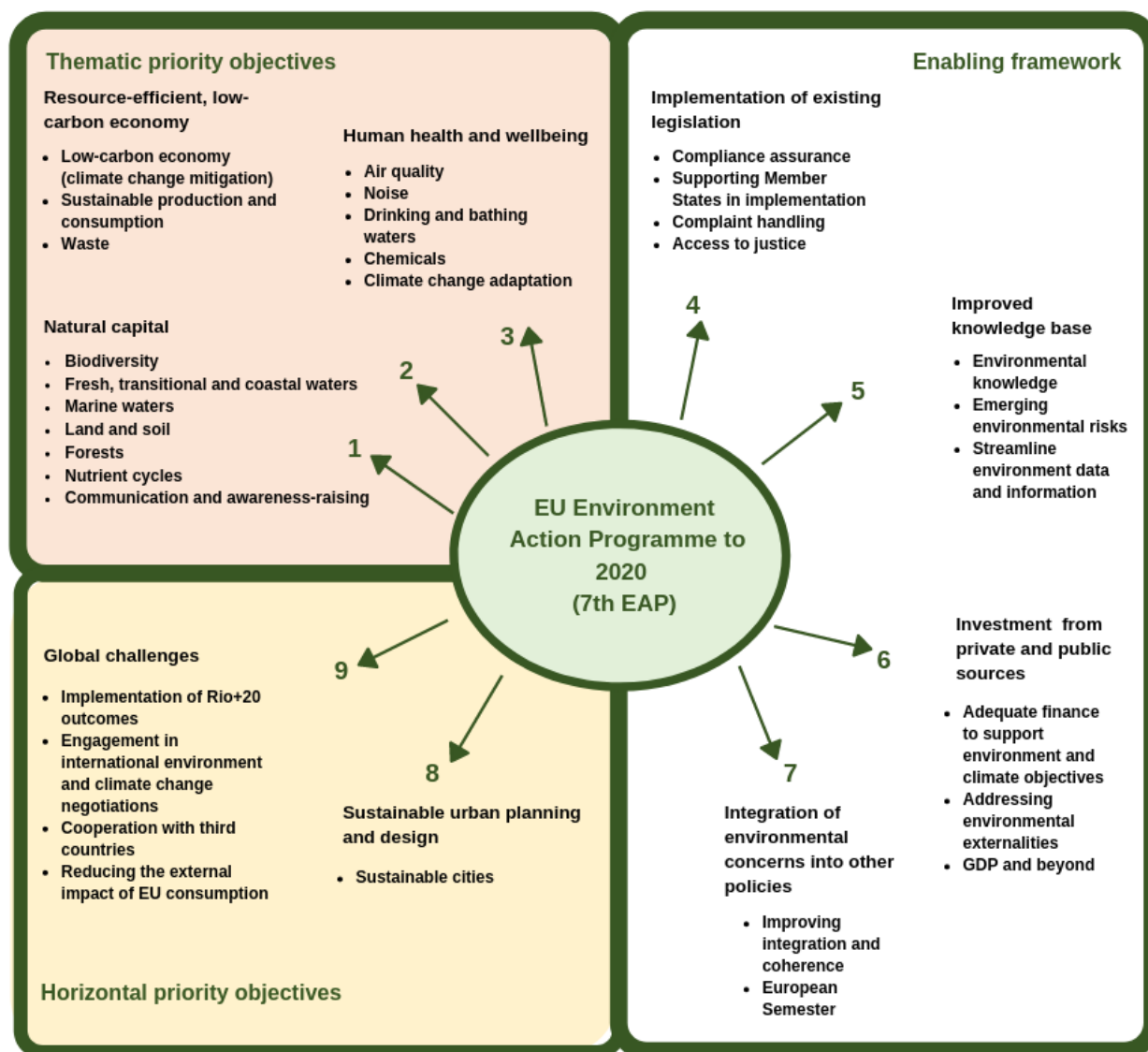
The structure of the 7th EAP is set out in Figure 1.

The Commission undertook an evaluation of the 7th EAP⁵, showing areas of progress and where prob-

4 On 14 October 2020 the European Commission proposed the next Environmental Action Programme to 2030. It’s final provisions will depend on agreement with the European Parliament and the European Council. <https://ec.europa.eu/environment/pdf/8EAP/2020/10/8EAP-draft.pdf>

5 Commission Staff Working Document Evaluation of the 7th Environment Action Programme to 2020 “Living well, within the limits of our planet”. (SWD(2019)181). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52019SC0181>

Figure 1: The Structure of the 7th EAP.



(Source: European Commission SWD(2019)181). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52019SC0181>

lems remain. The nature and scope of a new EAP is currently under consideration. The European Council, for example has called on the Commission to propose an 8th EAP, with a particular focus on climate, a toxic-free environment, circular economy and biodiversity⁶.

Strategic documents may also be developed for specific areas of environmental policy, such as climate change, water, waste, circular economy, chemicals, biodiversity, etc. Within these areas, further strategic

documents may be developed (e.g. on mercury, plastics, etc.). These issue-specific strategies enable an issue to be analyzed in more detail and for more precise information to be set out about actions to be taken.

It should be noted that most EU strategic documents are adopted by the European Commission although the Parliament and Council might comment on them, they usually remain Commission documents. Therefore, while any proposals for legislation will reflect the priorities of these strategies, such proposals are without prejudice both to a formal evaluation procedure and to amendment and agreement by the Parliament and Council.

6 European Council (2019). Council Conclusions: The 8th Environment Action Programme - Turning the Trends Together. <https://www.consilium.europa.eu/media/40927/st12795-2019.pdf>

1.3. INTEGRATION OF ENVIRONMENTAL POLICY

In this report, reference will be made to the integration of environmental policy in China and the EU respectively. It is important to note that there are two different aspects of integration that will be discussed and it is important not to confuse these.

The first is about how different environmental policies fit together to deliver desired environmental outcomes. In particular, of interest is how different types of instruments work together, such a command and control instrument and a market-based instrument. Each might play a particular role, but together they deliver the overall objective. This is important in learning lessons in both China and the EU as the effectiveness of any one instrument might only become apparent when it is considered in the context of the other instruments which have been established around it. Thus, integration in this sense is about how different environmental instruments fit together.

The second area is more common referred to as “Environmental Policy Integration” (EPI) and concerns how policy areas other than environmental policy take environmental objectives into consideration. This may include specific environmental obligations being included in sectoral policies (e.g. agriculture) and/or the use of particular assessment tools to ensure that environmental issues are understood and accounted for in both policy development (e.g. Impact Assessment procedures) and implementation (e.g. Environmental Impact Assessment).

These two different aspects of integration of environmental policy will be discussed in several parts of this report, including in the examination of policy evaluation procedures and in the particular focus on transport policy.

2. Environmental policy development in China

This study does not elaborate environmental laws and regulations but focuses on environmental policies enacted by government agencies beyond laws and regulations, inter alia, their interaction and integration. In the Chinese context and for this study's purpose, environment policies are divided into three categories according to their different regulatory approach and functions: environmental regulatory policy, market-based environmental policy and environmental social policy. Environmental technology policy and international environmental policy are not covered in this report.

2.1. ENVIRONMENTAL REGULATORY POLICIES

2.1.1. Evolution of environmental regulatory policies in China

Environmental regulatory policy mainly refers to state administrative regulation or other mandatory approaches through top-down binding means to serve environmental management needs and to achieve environmental protection targets. Since the reform and opening up, China has explored and implemented many measures in environmental protection and has achieved major improvement in environmental quality. During this process, environmental regulatory policies have played a critical role. Looking back, environmental regulatory policies in China at different development phases have been closely connected with the country's overall national development strategy, reflecting the features of the social, economic, and political status of the time. This evolution can be viewed as three phases.

Phase 1: Dominated by command and control instruments, the framework of environmental policies first took shape. In 1978, the *Constitution of the People's Republic of China* clearly stipulated for the first time that “the state protects the environment and natural resources and prevents and

controls pollution and other public hazards”, laying down the legal foundation for environmental protection in China as a landmark moment. In 1979, the National People's Congress passed the *Environmental Protection Law of the People's Republic of China (for trial implementation)*, China's first law dedicated to environmental protection. In the law, the “three simultaneous”⁷ and the principle of “polluters pay” are established, marking major progress in China's environmental legislation. Since then, the status of environmental protection has been elevated as a fundamental state policy. The third National Environmental Protection Conference, held in April 1989, concluded that three environmental principles and eight environmental management systems had been developed in China, including the principles of “prevention-centered and prevention and control combined”, “polluters pay” and “strengthening environmental management”, and the management systems of “environmental impact assessment”, “three simultaneous”, “pollution fees”, “responsibility to reach environmental targets”, “quantitative evaluation of overall urban environmental improvement”, “application, registration and permit for pollution discharge”, “pollution treatment within time limit”, “centralized pollution control” and others. In December 1989, the National People's Congress officially adopted the *Environmental Protection Law of the People's Republic of China* with further improvements made for trial implementation. This marked another landmark in China's environmental legal system – it served as the cornerstone of China's environmental policy. During this period, China successively formulated a series of separate laws in environmental protection, including the “*Water Pollution Prevention and Control Law*”, “*Air Pollution Prevention and Control Law*”, “*Marine Environmental Protection Law*”, “*Forest Law*”, “*grassland Law*”, “*Water Law*”, “*Soil and Water Conservation Law*”, “*Wildlife Protection Law*” and some

7 Three Simultaneous: the pollution prevention and control installations included in a construction project shall be designed, constructed and put to use simultaneously with the main body of the construction project.

other environmental resource protection laws, contributing to the basic legal framework of environmental protection together with the Environmental Protection Law.

An environmental regulatory policy system made up of the “three principles” and the “eight environmental management mechanisms” had been put in place. During this period, the use of command-and-control measures proved to be the most feasible and effective way for environmental management. At the beginning of reform and opening up, China formulated basic development policy centering on economic development, thus there was insufficient attention to environmental protection. It was believed that environmental problems occurred mainly due to mismanagement, so strengthened management could solve them. Although a basic framework of environmental policy was established, there still existed considerable gaps in many environmental areas, and environmental regulatory policy was dominated by a unilateral role of government, policy tool application was relatively simple, and the policy system urgently needed improvement.

Phase 2: Further improvement in environmental regulatory policies and measures targeted to address key environmental issues started to roll out. The growing environmental pressures in the 1990s made China establish environmental protection as a strategic priority. The sustainable development strategy was put forward, with more targeted measures towards specific environmental challenges rolled out at a larger scale. In 1996, the State Council issued the *9th Five-Year Plan for Environmental Protection and the Long-term Goals for 2010*, proposing to establish a sound environmental management system and a regime of environmental laws and regulations that is compatible with the socialist market economy. The concept of the sustainable development strategy was also defined in detail in the Plan, forming a detailed roadmap for realizing sustainable development. The document also emphasized that the focus of pollution prevention and control should be shifted from concentration (of pollutants)-oriented to mass emission cap control, and the measures should be shifted from end-of-pipe treatment to whole-process prevention. “Cap Emission Control” and “Green Project” Campaigns were launched across the country to contain environmental degradation. At the same time, the state passed a series of environmental laws to update the original environmental law and standard regime. After 1992, the State Council promulgated five laws, namely, the *Law on the Prevention and Control of Environmental Pollution by Solid Waste*, the *Law*

on the Prevention and Control of Noise Pollution, the *Law on the Prevention and Control of Sand Pollution*, the *Law on the Promotion of Clean production*, and the *Law on Environmental Impact Assessment*. Three laws were amended, including the *Law on the Prevention and Control of Air pollution*, the *Law on the Prevention and Control of Water pollution*, and the *Law on Marine Environmental Protection*. The State Council also formulated and revised over 20 environmental regulations, including the *Regulations on Nature Reserves*, and drafted and revised more than 200 environmental standards.

In 2006, the 6th National Environmental Protection Conference proposed comprehensive and coordinated economic and social sustainable development and accelerating “three transformations” of environmental protection: transforming from sole priority of economic growth to dual priorities of environment and economy, transformation from environmental protection lagging behind economic growth to synchronized environmental protection and economic development, transformation from mainly relying on administrative measures for environmental protection to comprehensive use of legal, economic, technological and necessary administrative measures to solve environmental problems, thus fundamentally contribute to coordinated development of environment and economy.




In general, at this stage, the importance of environmental protection was further highlighted, upgrading from a fundamental state policy to a national strategic priority – the sustainable development strategy. Such changes broke through the limitation of taking environmental protection as one separate concern in the process of economic development. Instead, it started to look at environmental protection and economic growth as a whole and highlighted the significance of a healthy ecosystem in ensuring sustainable development.

Phase 3: Guided by the concept of ecological civilization, progress is made towards a better environmental regulatory policy system. In November 2012, the 18th CPC National Congress proposed to incorporate progress towards ecological civilization into the country’s “Five-pronged approach”. In 2013, the state required to “develop a comprehensive system to support ecological civilization and protect the environment with well-designed policy and legal regimes”. Such systems include the system of natural resource property rights and the system of natural resource utilization control, the ecological conservation redlining system, the pricing system for natural resources, the ecological compensation system, and

ecological protection management system". *The Environmental Protection Law* revised in 2014 fully embodied the concept of ecological civilization - from the change of the legislative purpose of the law to the introduction of the responsibility division system based on environmental targets and a performance evaluation system based on progress towards those environmental targets, from the establishment of public interest litigation system to the provisions of daily penalty and third-party joint and several liability. It put into practice the concept of ecological civilization. In 2015, the CPC Central Committee and the State Council jointly issued the *Integrated Reform Plan for Promoting Ecological Civilization* with a roadmap for reform. The reform was designed to establish a systematic and complete institutional framework composed of eight systems for promoting ecological civilization with clearly defined property rights, diversified participation, and equal focus on incentives and restraints by 2020. It was also designed to modernize China's governance system and capacity for governance in environmental protection. These eight systems include a system of property rights for natural resource assets, a system for the development and protection of territorial space, a spatial planning system, a system for regulating total consumption and comprehensive conservation of resources, a system for payment-based resource consumption and compensating conservation and protection efforts, the environmental governance system, the market system for environmental governance and ecological preservation, and the system for evaluating officials' ecological conservation

performance and for holding those responsible for ecological damage to account. The framework will practice strict prevention at the source of pollution, exercise strict regulation over operations, and impose serious punishment for actions that have caused environmental damage. In October 2019, the *CPC Central Committee's Decision on Several Major Issues Concerning the Upholding and Improvement of the Socialist System with Chinese Characteristics and Advancing the Modernization of China's System and Capacity for Governance* was adopted to improve the framework for ecological civilization, promote harmony between people and nature, implement the most stringent environmental protection system, build a system of efficient utilization of resources, improve the ecological protection and restoration system, and enhance the accountability for environmental protection. In March 2020, the General Office of the CPC Central Committee and the General Office of the State Council issued the *Guideline on Building a Modern Environmental Governance System*, which explicitly mentioned that in environmental governance, the officials' accountability system, the corporate responsibility system, the public action system, the supervision system, the market system, the credit system, and the legal and policy system will be put in place by 2025 to identify the responsibilities of various stakeholders, and further engage the market players and the public. The aim is, therefore, for an environmental governance system with clear guidance, informed decision-making, faithful implementation, effective incentives, multi-stakeholder participation and constructive interaction.

Table 1: Three phases of environmental regulatory policy development in China

Phase I The framework of environmental regulatory polices first taken shape	Phase II Improvement in regulatory environmental regulatory polices with targeted measures for key environmental issues	Phase III Comprehensive and integrated environmental regulatory policies
 1978-1990 <ul style="list-style-type: none"> - Environmental Protection Law - Water Pollution Prevention and Control Law - Air Pollution Prevention and Control Law - Marine Environment Protection Law - Forest Law - Grassland Law - Water Law - Soil Conservation Law - Wildlife Protection Law - Three Key Policies - Eight Institutions 	 1990-2011 <ul style="list-style-type: none"> - Sustainable Development Strategy - Total Emission Control and Green Projects - The 9th FYP for National Environmental Protection and the Vision Goals for 2010 - Solid Waste Pollution Prevention and Control Law - Noise Pollution Prevention and Control Law - Clean Production Law EIA Law 	 2012-present <ul style="list-style-type: none"> - Ecological Civilization - 2014 Environmental Protection Law Amendment - Overall Plan for Institutional Reform of Ecological Civilization - Uphill Battle against Pollution - Guidelines for Modernizing Environmental Governance System - ...

At this stage, ecological civilization has been incorporated into the “Five-pronged approach” master plan, and the emphasis on ecological and environmental protection has never been stronger at state level. Guided by the concept of ecological civilization, the rationale behind the drafting of environmental policies, as well as the objectives of environmental policies during this period have transformed greatly – it has shifted from emission control and reduction towards improvement in overall environmental quality. Systems such as damage compensation, environmental liability, environmental governance, and environmental permitting regime have been established gradually, putting in place a more comprehensive framework for regulatory environmental policies.

Looking back at the evolution of China’s environmental policy, the regulatory environmental policies based on command-and-control tools have played an important role. Command-and-control instruments are usually law-based, hence are authoritative, mandatory, consistent, and operable – an effective tool for pollution prevention and control. The coercive force of the government is the guarantee for the implementation of command-and-control environmental policy, especially when facing environmental emergencies, where such policy tools can respond quickly and effectively. In addition, it can make use of the existing administrative agencies at all levels of government to form a comprehensive decision-making mechanism, which can effectively mobilize strength and resources of governments at all levels to deal with environmental problems. Environmental regulatory policies are strong in monitoring environmental performance, which help realize policy objectives and improve management efficiency. However, in review of the past experience, it is also recognized that the implementation costs of the command-control instruments are relatively high, and are, to a large extent, dependent on the government budget. However, many local governments think that environmental protection measures will negatively impact on local economic development, hence they lack motivation to prioritize delivery of environmental targets. There is also high resistance from companies towards strong command and control tools and it is difficult to involve the public during the process. All in all, opposition from many sectors towards command and control instruments is growing, significantly limiting the effects of such policies. Therefore, it is extremely imperative to use diverse and integrated environmental policies to ensure delivery of policy goals, improve the environmental governance capacity of local governments, strengthen the environmental

responsibility of companies, and enhance public participation in environmental protection.

2.1.2. Outcomes and challenges of environmental regulatory policies

Since the reform and opening up, China’s regulatory environmental policies have been based on clearly defined environmental protection responsibilities. Given the importance of party and government leaders in environmental protection at local levels, a number of mechanisms such as the Central Environmental Protection Supervision, “joint responsibility of the party and the government”, environmental responsibility list, performance evaluation (environmental targets incorporated), off-office auditing, etc, have played very important roles in holding local governments accountable for environmental protection. Regarding pollution prevention and prior supervision, environmental planning, environmental impact assessment and “three simultaneous systems” have long been important policy measures for the government to implement pollution prevention and control. Regarding end-of-pipe pollution control, pollution discharge permit scheme and environmental non-compliance penalty measure have been gradually improved and are playing important roles.

Central Environmental Protection Supervision is an innovative administrative measure that plays an important role in the administration by central government leading supervision group responsible for supervision and mobilization of local party committees and local government to actively cooperate in environmental governance in China. The central environmental protection inspectors make use of administrative measures to supervise local party, local government and local industries, which has proven to be a significant break-through from the past rigid inefficient operational model to the current one of shared responsibilities for local party committees and governmental officials and has urged local government to perform their duties of regulating environmental performance within their jurisdiction. In 2019, The national government issued “*Rules for Central Environmental Protection Supervision*”, which has further improved central and provincial environmental protection supervision system.

The party and the government share the same responsibility, the “one post and two responsibilities” mechanism seeks to hold the “key links” and “key people” accountable, making itself an important tool to promote progress towards ecological civilization. In 2015, the *Measures for Holding Party*

and Government Leadership Accountable for Ecological and Environmental Damage (for trial implementation) requires key leadership of the party committee and the government to bear the main responsibility for environmental protection. A list of environmental protection responsibilities is also developed to clarify the roles of officials in environmental protection. The environmental performance of officials will also be considered in the overall performance evaluation system for those officials. There is also the “off-office” auditing system to review the status of natural resources managed by the responsible official before he/she leaves office. Those who fail to perform their duties in taking care of the environment will be held liable for causing damage to the ecosystem and the environment.

The environmental impact assessment system (EIA) is to assess and evaluate the potential impacts on the environment of proposed construction projects, regional development plans and national policies. The ultimate purpose of EIA is to achieve sustainable development. As an ex-ante environmental management system, EIA in China has undergone continuous reforms and continues to play as an important tool in effectively preventing and mitigating major environmental risks caused by project development.

The pollutant discharge permit system refers to the permit issued by competent environmental authorities upon application from operators of installations with emissions. It prescribes requirements and conditions for the discharge of pollutants of the operating installations. In 2018, the MEE drafted the *Regulations on the Administration of Emission Permits* and vigorously implemented the issue and verification of emission permits to cover all stationary pollution sources. The goal is to implement the system industry by industry – through “permit one industry, clean up one industry and standardize one industry”. The fourth Plenary session of the 19th CPC Central Committee proposed to “build a stationary pollution source management system with the permit system as the core”, hence established the core position of the pollutant discharge permit system in stationary pollution source management. By April 2020, more than 341,000 emission permits for 33 key industries, had been issued across the country, over 2.5 million companies had been registered for pollutant discharge, over 1,551,000 air pollutant discharge outlets and 1,140,800 water pollutant discharge outlets had been included in the system.

Despite the constant improvements in China’s environmental regulatory policies under the joint efforts

of government and society, the weaknesses of command and control as a government-led instrument has started to emerge in its implementation and enforcement.

Firstly, earlier environmental regulatory policies were drafted to address acute environmental problems and are not forward-looking. Most of them were formulated after the emergence of serious environmental problems and public concerns. They were usually responsive and remedial and were often regardless of cost. Sometimes they may cause chain reactions and trigger other public concerns and other environmental problems. As a result, the environmental regulatory policies always lag behind the needs of the situation and fail to meet long-term environmental targets.

Secondly, the regulatory policies for different environmental sectors are usually separate and lack integration. Environmental issues are usually cross-regional, inter-departmental, and cross-sectoral. For example, air pollution and water pollution usually require interaction of policies and coordination of interests across administrative regions, government departments and hierarchy. However, in China, the regulatory environmental policies are usually targeted at one specific sector – for example, it manages air pollution, solid waste and water pollution separately, and the competent department for each environmental sector only cares about its own mandate. As a result, a unified goal and direction is missing, and the ecosystem is not treated as an integrated functional whole. It is common to see overlapping policies, leading to low efficiencies in policy implementation.

Thirdly, regulatory environmental policies require good capacity from the government. At the same time, there remains conflict between priorities on GDP and environmental protection at various levels. Since the reform and opening up when the focus was on economic growth, both the central and local governments have taken economic development as the most important objective at different levels. Despite the various measures put in place, e.g. the ecological civilization performance evaluation and accountability system, the “party and government responsibility sharing” mechanism, environmental target responsibility list, environmental indicator in the official’s performance assessment, the shift in mindset still takes time. The pursuit of economic growth and environmental protection is unbalanced, which makes effective implementation of environmental regulatory policies difficult – their implementation is subject to many factors, including

change of government officials, changes in economic situation and so on.

2.1.3 Improvement in environmental regulatory policies

Since the 18th CPC National Congress, China has carried out a series of fundamental, groundbreaking and long-term environmental protection programs, and successively issued and implemented the *Air Pollution Prevention and Control Action Plan*, the *Water pollution Prevention and Control Action Plan* and the *Soil Pollution Prevention and Control Action Plan*, involving a series of command and control instruments. The measures cover environmental regulations, adjustment of industrial structures, regional cooperation, monitoring system etc. It is characterized by all-sector action and extensive participation by multiple stakeholders. Within a few years, a large number of new systems and laws have been introduced. The intensity of pollution control measures and the strictness of law enforcement are unprecedented. As a result, the environmental quality in China has been significantly improved. In general, China's ecological civilization system and regulatory framework for environmental policies have been established. In the future, while further improving the system, the priority lies with ensuring more effective enforcement of the policies. The goal is to maximize the advantage of the regulatory system and to achieve the expected outcome of the modernization of environmental governance capacities. This will involve the following elements.

Multi-stakeholders Participation

Participation of multiple stakeholders needs to be mobilized to maximize the advantage of command and control tools. In theory, command-and-control instruments are more effective in addressing environmental problems through their coercive power and consistency. However, in practice, they are easily affected by factors such as the practical needs for economic growth of local governments and the fragmentation in policy enforcement caused by administrative divisions. When implementing regulatory policies, it is often difficult for local governments to fully consider individual and regional differences and to ensure classified and rational enforcement, significantly affecting the policy outcome.

An environmental regulatory policy framework with multi-stakeholder participation enables effective

interaction among government, public and the companies. It requires the whole process of policy formulation, implementation and revision to be open, fair and transparent. For example, when formulating pollution emission standards for an industry, policy makers invited industry associations, NGOs and involved companies to participate in the discussion to understand better their opinions concerning the feasibility of the policy objectives, the level of technological development and the cost of pollution control so as to maximize the environmental and economic benefits at the same time. The fundamental difference between governance and management is that governance involves multi-stakeholder participation. The voice and the concerns of the public should be heard and addressed throughout the process of policy making. In a word, interaction among different stakeholders is necessary for information sharing and environmental governance, and in adjusting and revising environmental policies.

Equal emphasis on restrictive tools and incentives

China should develop a framework of regulatory environmental policies with equal emphasis on restrictive tools and incentives. For a long time, China's regulatory environmental policies have taken restrictive and punitive measures as the main means of implementation. This leads to the problem that the motivation of companies to contain pollution and pursue environmental technological improvement is limited – sometimes they even resist environmental requirements. Despite the high deterrence of central-level environmental inspection and the increasingly strict environmental law enforcement, there is the repeated emergence of environmental violations of companies driven by interests. At the same time, the use of increasingly stringent command and control tools will not only increase the cost of government law enforcement and supervision, but also increase the information cost and the pollution control cost of the companies. Law enforcement can never cover all aspects and may cause the “Bad money drives out good” effect in the market. In addition, there may be “government failure” in applying command and control tools, leading to government corruption and bureaucracy caused by rent-seeking and other reasons. It undermines the power of government intervention and weakens the intensity of administrative law enforcement and the penalties.

Instead, China should explore environmental regulatory policies that are moderately stringent with

equal emphasis on restrictive requirements and incentives. For example, when formulating and implementing environmental standards, incentive should be given to companies which accomplish outcomes beyond the basic standards and those with innovative environmental protection technologies, so as to improve the market competitiveness of companies with high environmental performance. A list of encouraged, restricted and eliminated technologies, processes, equipment, materials and products should be developed. Rewards should be given to companies with outstanding performance in energy saving and consumption reduction and those which play a leading role in the green development of the industry; in the environmental credit evaluation system, while punishing companies with poor environmental performance in accordance with the law, financing concessions should be given to companies with outstanding environmental compliance records and advanced environmental technologies.

Overall planning, coordination and evaluation

China should improve overall planning, coordination and evaluation of environmental regulatory policies. Environmental regulatory policies should start to coordinate the relationship between environment, economic growth and social development at the early stage of policy formulation. Environmental policy involves not only environmental issues, but also many other consequences caused by environmental problems. Isolated environmental policies often fail to achieve the desired results. When formulating environmental policies, it is important to consider environmental policies against the economic and social background. Environmental policies should be integrated with economic and social policies to ensure mutual benefits and to form synergies in promoting economic and social progress.

When introducing environmental regulatory policies, it is important to carry out ex-ante impact assessment, process monitoring and ex-post evaluation. Quantitative analysis of the impacts of environmental policies on economy should also be valued. Both short-term and long-term benefits of the proposed regulatory policies should be reviewed, and the economic costs for environmental policies should be calculated rationally. Regulatory environmental policies should play a role in optimizing the allocation of environmental capacities, urging the integration of environmental management functions and policies of various departments. A more science-based and democratic decision-making mechanism is needed

to provide organizational and institutional basis for the coordination and development of innovative environmental policies and the establishment of an integrated environmental governance structure.

2.2. MARKET-BASED ENVIRONMENTAL POLICIES

2.2.1 Evolution of market-based environmental policies in China

Market-based environmental policy refers to policy means which regulates or influences the behavior of market entities by means of fiscal, taxation, price, credit, finance, insurance measures to achieve environmental objectives.

Since the 21st century, the focus of China's environmental policy has shifted from pollution control to green development. At the same time, the range of available policy instruments has gradually expanded, from administrative command and control tools alone to the use of market-based incentives. A framework of market-based environmental policies has taken shape, including fiscal support, environmental pricing and subsidies, ecological compensation, emission trading, green taxation, green finance, environmental markets, environment and trade, and environmental resource value accounting. During this period, while regulating pollution and energy-intensive companies with command and control measures, China has improved the use of economic instruments in environmental policy and encouraged the development of environmental protection industries. The goal is to reduce management costs and mobilize all stakeholders in environmental protection. In 2002, the state issued a policy to comprehensively implement the franchise system, launching marketization reforms in environmental-related areas such as water supply, heating, sewage treatment, and waste disposal; it also started to implement pricing policies for environmental resources to include compensation for environmental costs when pricing power and water supply. Incentives have been provided for power pricing to fully mobilize the willingness of the companies to upgrade their environmental facilities; Favorable taxation policies were also rolled out, including the "three exemptions and three halves" for energy-saving and environmentally friendly companies. At the same time, the investment and financing environment for the environmental protection industry has been improved, programmes like "green loans and bonds", loans for

energy-saving and emission-reduction facilities have been launched. In recent years, China has launched even more economic and environmental policies. Over 300 pieces of market-based environmental policies have been issued at national level, and over 700 fiscal environmental policies, environmental tax and fee policies, and environmental resource pricing policies by provincial level governments. From top-level design to implementation-level rules, efforts have been continuously made to cover almost the entire production chain with strong incentives provided. At present, China has developed a comprehensive, cross-regional, and cross-sectoral market-based environmental policy system, including the development of trading markets in “water, energy, emission and carbon emission”, the ecological compensation system, the pollution fees system, the environmental tax and subsidies and green finance. These policies have delivered many positive environmental outcomes.

Environmental subsidies for electricity tariffs

Environmental subsidies for electricity tariffs are incentives for coal-fired power plants with better emission reductions. Once the coal-fired power plants construct and operate environmental protection facilities and meet emissions standards, their on-grid electricity price will be higher than the regular market price. Specifically, it includes electricity price for power generation with desulfurization facilities, electricity price for power generation with de-nitration facilities, electricity price for power generation with dust removal facilities, and electricity price for power generation with ultra-low emission. Environmental subsidies for electricity tariffs are an important market-based policy in pollution control and emission reduction in China. The use of price and market incentives to promote ultra-low emission transformation of the power industry has played a positive role in improving the air quality in China.

The electricity price for power generation with desulfurization facilities is one of the most influential market-based environmental policies in China. In the 1990s, controlling SO₂ emissions was one of the priorities of China's environmental policies. Early policies focused on administrative control tools. For example, in 1992, the government required coal-fired power plants in China to build desulfurization facilities, but because of the increase in power generation costs, the commissioning rate of such facilities was low; in 1998, the State Council delineated an area of 1.09 million square kilometers as an acid rain and SO₂ control area and restricted the use of high-sulfur coal and prohibited the construction of new coal-fired power plants. Given the fact that

SO₂ emission is corporate behaviour with negative environmental impact, the effect of this regulatory policy was very limited - the companies lacked the incentives for behavioral change. Since 2000, China entered the phase of rapid industrialization, leading to further increase of national SO₂ emissions from 2000 to 2005 with an annual growth rate above 5%. To address the mismatch between incentives and restrictions, China issued a policy in 2004 to subsidize electricity price for newly-built coal-fired plants with desulfurization facilities, which increased the opportunity cost of power plant emissions. Since 2007, existing coal-fired power plants have also been included in the subsidy programme to fully incentivize companies to install desulfurization facilities. As a result, significant sulfur dioxide emissions reduction was achieved, making the policy one of China's most effective market-based environmental policies. Data shows that in 2007, China's installed capacity for coal-power generation with desulfurization was 270 million kilowatts, accounting for about 50% of the total installed capacity of the year; the electricity generated by the desulfurized power plants was 938.786 billion kilowatt-hours, accounting for 41.2% of the on-grid electricity throughout the year. Correspondingly, SO₂ emissions of power sector in 2007 were 12.27 million tons, a decrease of 9.1% compared with 2006, and continued to decrease by 14.5% year-on-year in 2008. According to estimates by the environmental protection departments, desulfurization of power generation companies contributes about 70% to the reduction of SO₂ emissions in China.

In order to consolidate the incentivizing and restrictive power of the price leverage, the state issued more policy documents on environmental subsidies for the electricity price. In 2011, the National Development and Reform Commission adjusted the electricity prices of major power grids across the country, and proposed to conduct de-nitrification electricity price pilot programmes in 14 provinces (autonomous regions and municipalities) including Beijing, Shanghai, Tianjin, Zhejiang, Guangdong, and Ningxia – an additional of 0.8 cents per kWh would be compensated to the power plant for its electricity connected to the grid and generated by facilities with de-nitrification facilities. After the introduction of the pilot programme, in 2012, independent thermal power plants removed 1.116 million tons of nitrogen oxides, a removal rate of 10.2%, and an increase of 4.1 percentage points from the previous year. In 2013, the National Development and Reform Commission decided to level up the subsidy programme by expanding the scope of de-nitrification electricity price to all coal-fired plants nationwide, and

increased the subsidies for de-nitrification electricity price from 0.8 cents per kWh to 1 cent.

In 2015, the National Development and Reform Commission, the Ministry of Environmental Protection, and the National Energy Administration issued the *Notice on Issues Concerning the Implementation of the Support Policy for Ultra-Low Emission Electricity Prices for Coal-Fired Power Plants* to further promote ultra-low-emission coal-fired power plants, clean coal use, and air pollutant reduction. The Notice stipulates that an extra of 1 cent per kWh will be compensated to the plant for electricity generated by ultra-low-emission facilities and connected to the grid before January 1, 2016 and 0.5 cents for the newly purchased generators connected to the grid after January 1, 2016. So far, a relatively complete environmental subsidy programme for the electricity price has formed in the sector of on-grid electricity price for coal-fired power companies. At present, the subsidy for the desulfurization electricity price is 1.5 cents per kWh, 1 cent per kWh for denitration electricity price, and 0.2 for dust removal electricity price. Encouraged by subsidies, power companies are more active in upgrading their desulfurization, denitrification and dust removal facilities, which has effectively ensured the realization of emission reduction targets.

Green Finance

China was the first country in the world to establish a systematic green finance framework and it has established the world's largest green finance market to provide financial services for financing, operating, risk management of projects in environment, energy-saving, clean energy, green transportation, green building sectors etc. In 2007, the former State Environmental Protection Administration, the People's Bank of China, and the former China Banking Regulatory Commission jointly issued the *Opinions on Implementing Environmental Protection Policies and Regulations to Prevent Credit Risks*, marking the formal establishment of China's green credit and loan system. Immediately afterwards, market-based environmental policies such as environmental liability insurance, green securities, and green bonds were issued, which contributed to the initial development of China's green finance system. In 2016, seven institutions including the People's Bank of China and the Ministry of Finance jointly issued the *Guiding Opinions on Building a Green Finance System*, taking green finance in China to the fast track of development. In terms of incentive policies, fiscal, monetary and regulatory policies to support the development of green finance have also been introduced. For example, the People's Bank of China has included qualified green

credits and green bonds in the scope of qualified collateral for monetary policy intervention; it has also included the performance of green loan and green bond of deposit financial institutions in macro-prudential assessment. In addition, local governments are actively formulating policy measures to support the development of green finance. For example, Huzhou City in Zhejiang Province and Jiangsu Province have successively introduced incentives to provide finance discounts to green loans and green bonds. Inspired by these policies, various sectors of green finance have developed rapidly. According to information released by the China Banking and Insurance Regulatory Commission, as of the end of June 2017, the green loan balance of 21 major domestic banks was 8.22 trillion yuan, up 12.9% year-on-year, and the proportion of green loans increased rapidly. The green bond market is also developing rapidly. The amount of green bond issuance reached 230 billion yuan in 2016, close to 40% of the global green bond issuance. In 2017, the issuance of green bond increased by 9.4% year-on-year. In terms of green insurance, by the end of 2017, environmental liability insurance provided 30.6 billion yuan as risk safeguards for more than 16,000 companies, playing an important role in corporate risk management.

Environmental Taxation

China has undergone the transformation from charging pollution fees to collecting environmental taxes. Over the years, pollution fees became a relatively mature environmental governance tool in China, and played an important role in enforcing corporate environmental responsibility. In December 2016, the Standing Committee of the 12th National People's Congress passed the *Environmental Protection Tax Law of the People's Republic of China*. The Law stipulates that environmental taxes will be collected for discharge of air pollutants, water pollutants, solid waste and noise, and that collection of pollution fees were to be replaced by the environmental tax. In August 2019, the *Resource Tax Law* was adopted by the Standing Committee of the National People's Congress. As an important component of China's green tax system, its adoption shows that environmental costs are now formally incorporated into the price mechanism for natural resources and have become an important part of green taxation in China.

Environmental Credit

An environmental credit system can be an important tool for targeted environmental management, as well as in-process and ex-post supervision. As an innovative management model which brings together the government, the public, and companies, the environmental credit assessment is carried out by competent

environmental authorities based on the company's environmental performance in accordance with prescribed indicators, methods, and procedures. A company will receive an environmental credit rating and the result will be public and also used by relevant departments, agencies and organizations. Since 2013, the Ministry of Ecology and Environment, the National Development and Reform Commission and other relevant departments have successively issued the *Measures for Corporate Environmental Credit Evaluation (Trial)* and the *Guiding Opinions on Strengthening the Building of Corporate Environmental Credit System* to carry out environmental credit evaluation of companies in over 30 provinces (districts and municipalities). Both the national government and the local governments have continued to strengthen the research and practice in environmental credit evaluation. To further improve the designing of the system, efforts have been made to develop the legal framework and improve the evaluation mechanism. At present, many provinces in China have formulated tailored evaluation methods for corporate environmental credit. In general, the procedure for corporate environmental credit evaluation is as follows: first, collect corporate environmental information, then process and evaluate their environmental performance according to the evaluation method, and finally release the evaluation results. By sharing the result of the evaluation with multiple stakeholders, relevant departments can take joint decisions of incentives and penalties for the companies, contributing to the development of a credit society.

Emissions Trading

The emissions trading system is a market-based approach to reduce emission. Under the system, companies may trade their unused emission quota for economic benefits, hence a motivation for companies to take proactive measures to achieve emission reduction. The ultimate goal is to control the cap of pollutant discharges across the country. In 2002, initiated by the former State Environmental Protection Administration, a pilot project for sulfur dioxide emission trading was carried out in pilot provinces including Shandong, Shanxi, Jiangsu, Henan, Shanghai, Tianjin and some state-owned companies. However, given the limited scope of the pilot projects, and the lack of institutionalization of the policies, the result was not satisfactory. In 2007, relevant departments of the State Council again set up pilots for the trading of emission rights in 11 provinces, autonomous regions and municipalities including Jiangsu, Zhejiang, Tianjin, Hubei, and others. This time implementation followed the principle of "resources are valuable assets" and the scope of the pilot projects was expanded compared to the previous attempt.

The success of the second trial accelerated the institutionalization of the emissions trading system in China. While participating in the trading, the pilot regions have formulated a series of local policies and worked to build a functional emissions trading platform within their jurisdictions. In August 2014, the State Council promulgated the *Guiding Opinions on Further Promoting the Paid Use and Trading of Emission Permits*. As of 2017, the system of paid use and emissions trading has taken its initial shape, and the pilot projects have been completed.

Ecological Compensation

Ecological compensation has played a remarkable role in China's ecological conservation. The formulation of China's ecological compensation policies can be traced back to the *Opinions on Strengthening Ecological Protection* issued by the former State Environmental Protection Administration in 1997. In 2007, feasibilities were explored to carry out trials of ecological compensation mechanisms in nature reserves, key ecological function zones, mineral resources development areas, and river-basin protection areas. Then in 2016, the State Council officially issued a document proposing to implement ecological compensation based on different ecosystems such as forests, grasslands, wetlands, deserts, oceans, water flows, and farmlands. The introduction of the *Pilot Program for Reform in Ecological and Environmental Damage Compensation* marks the beginning of judicial protection for state ownership of natural resources established by China's *Constitution*, *Property Law*, and various environmental and resource laws. The Program proposes that the provincial people's government may file requests for compensation towards those who caused ecological damage - together with the environmental public interest litigation brought by NGOs, the polluters pay principle stipulated in the new *Environmental Protection Law* becomes better implemented. In recent years, the scope and scale of fiscal transfer payment programs for key national ecological function areas have been constantly on the rise. In 2016, the central government issued a total of 1.9 billion yuan for ecological compensation funds. In 2017, 899 million yuan was allocated as ecological compensation funds to support engineering projects of pollution sources management at river-basins, ecological protection, comprehensive improvement of rural environment, environmental risk prevention and others. The total number of counties and cities that enjoyed transfer payments increased from 676 to 816 in 2017, and the transfer payment budget was 62.7 billion yuan, an increase of 10% over 2016. As of 2018, the central government has provided a total of 4.99 billion yuan in ecological compensation

funds (including 1.8 billion yuan for Xin'an River and 800 million yuan for Jiuzhou River, 599 million yuan for Tingjiang-Hanjiang, and 900 million yuan for Dongjiang. 900 million yuan to support the "Diverting the Luan River to Tianjin" Project.).

Financial Support

The Chinese government has invested a lot in financial subsidies for pollution prevention and control. Subsidies include various financial support tools to encourage industry to reduce pollution, including earmarked funds, loans below market interest rates, tax subsidies such as tax exemptions for installation of polluting reduction equipment or conditional tax discounts for certain measures. In 2017, the special funds of China's central budget for air, water and soil pollution prevention reached 49.7 billion yuan. On top of that, water pollution prevention and control projects with a total investment of about 300 billion yuan has entered China's central-level project list. Sectors such as new energy, green agriculture and other enjoy environmental protection subsidies. Subsidies are also actively introduced at local level. In 2017, Beijing completed the "shifting from coal to clean energy" programme in more than 900 villages, and Tianjin completed the "coal to power" heating project for 166,000 residents. The Beijing-Tianjin-Hebei Region have accelerated the process of pollution control, and the air quality in the region has improved significantly.

With further development of the market economy in China, economic instruments in environmental policies will play an increasingly important role in China's future environmental governance due to their low implementation cost, flexibility and strong incentives.

2.2.2. Outcomes and challenges of market-based environmental policies

Compared with the "external restrictive driving force" of traditional administrative instruments, economic tools in environmental policies can, if well designed, stimulate the growth of "internal motivation". They, therefore, enjoy more advantages in promoting technological innovation, enhancing market competitiveness, reducing environmental governance costs and administrative regulation costs. However, there are still gaps in understanding for environmental policymakers in formulating market-based environmental policies. Moreover, given the fact that such policies have higher requirements for marketization levels, many challenges have been exposed during the implementation of market tools.

Budget shortage for fiscal subsidies

Firstly, as the reform of ecological civilization deepens, there is considerable budget shortage for fiscal subsidies. China's growing efforts to support the uphill battle against pollution means that the central government has been providing all kinds of funding to support environmental improvement programmes, e.g. the special fund for awards for pollutant emission reduction, subsidies for energy saving, and the fund for urban environmental protection infrastructure construction. However, the shortage in fiscal funds for environmental protection remains large. Moreover, the imbalance in China's economic development has exacerbated the funding gap in less developed regions. For example, Guizhou province, in southwestern China which is less economically developed yet is rich in natural resources, has been shouldered with a heavy task with a high pressure on the local budget. As a pilot province for ecological civilization reform, Guizhou has been experimenting with policies such as raising the compensation standards for the public forests and the redemption of commercial forests in key areas so as to offer profit motive for forest farmers to actively protect forest resources. However, most of the province's forest areas are poor counties and cities with very limited financial resources. At the moment, the funding gap remains large.

Inadequate environmental and resource taxes

Secondly, the scope of environmental and resource taxes is relatively narrow and the standards are low. In addition to environmental and resource taxes, other taxes related to environmental protection in China include the consumption tax, vehicle purchase tax and vehicle and ship use tax. Although the principle of "polluter pays" is pursued, in fact, due to the overlapping of these taxes and fees, the purpose of tax collection is ambiguous, greatly affecting the guiding role of taxation for company and public behavior. Such taxes that do not consider externalities are inefficient or ineffective, and their contribution to environmental improvement is much smaller than their contribution to fiscal revenue. Studies have shown that "the lighter the tax and fee burdens on a company, the stronger the company's willingness to take active measures to protect the environment; the higher the level of government regulation (i.e., the stronger the level of law enforcement), the stronger the enterprise's willingness to take the environment into consideration". In addition, the standards for resource tax

are low. Since 2007, China has been gradually raising taxes on the use of resources such as coking coal, lead and zinc ore, but the price of resources remains too low to be effective. As a result, companies seldom consider improving utilization efficiency in the process of mining, excessive use and waste of resources happen. Moreover, the scope of resource tax collection is limited – these taxes are only imposed on certain non-renewable resources and the consumption tax was initially only collected for five types of consumer products. Actors who need to pay for the resource tax are only the large and medium-sized state-owned enterprises. On top of that, there is a lack of coordination among different economic instruments in environmental policies, many of them are separate and fragmented.

Limited environmental impact of emission trading

Thirdly, although emission trading can effectively reduce the total emission of certain pollutants, its role in stimulating transition towards green development is limited. Emissions trading's effectiveness is reflected in two aspects – one mid-term goal is to encourage companies to reduce pollution emissions through market incentives, another long-term goal is to improve the technology and overall industrial productivity eventually to achieve green development with continuous environmental and economic benefits. Since 1988, China started to develop its emissions trading system, but its implementation has never been as effective as expected. On the one hand, laws and regulations on emissions trading are still missing. At present, the rules for emissions trading are mainly set by the *Guiding Opinions on Further Promoting the Paid Use and Trading of Emission Permits* - a low-level policy tool without legislative support. This leaves the implementation measures and procedures missing at operational level. However, there is no effective supervision and regulation over emissions trading. In some less developed areas in China, there is even lack of emission monitoring technology, and at grassroot level, environmental monitoring capacity is very limited. All these factors make it impossible to ensure scientific objectivity, information transparency and market fairness in the current emissions trading system in China.

If we look at the overall emission reduction by emissions trading, most of China's studies focus on the effect of reducing SO₂, a single pollutant, and believe that emissions trading has effectively reduced SO₂. However, many studies also show that emissions trading has by far failed to promote green

development in China. To a certain extent, the emission trading mechanism has addressed the inefficiency in the allocation of SO₂ emission rights, but it has not proved the Porter Hypothesis (proper environmental regulation can enhance innovation and competitiveness) in China. That is, the emissions trading mechanism has not promoted economic development while saving energy and reducing emissions. Based on panel data from 30 provinces in China from 2001 to 2015, some scholars used the PSM-DID method to analyze the overall effect of the emissions trading on air and pollution reduction and on green development. The study found that it has effectively reduced industrial SO₂ and wastewater emissions, and can continue to contribute to SO₂ emission reduction, but it has not contributed much on total green productivity and green technological progress. This is due to the fact that the innovation made by the companies does not match the innovation needed to achieve green development. As a result, the emissions trading system at the current stage has not contributed to green development.

Green finance system fails to comprehensively support green companies.

Fourthly, the green finance system fails to comprehensively support green companies. Although there appears to be various forms of green finance developed, the gap for investment into the environmental protection sector remains large. During the "13th Five-Year Plan" period, China's demands for green investment amounted to 2 to 4 trillion yuan per year, while the financial support to the area was about 300 billion yuan, accounting for up to 15% of the total investment. At the same time, the biggest challenge for green finance to effectively internalize environmental externalities remains unsolved. The difficulty of internalizing environmental externalities will also lead to insufficient "green" investment and excessive "brown" investment. Moreover, there is no unified standard for what a "green" product is, and the evaluation system needs further improvement. More importantly, sometimes there is a risk of "greenwashing or green sheen" in certain green finance projects as they claim to be sustainable but cannot demonstrate their environmental benefits and cannot connect themselves with environmental quality improvement based on systematic evaluations. Lastly the internal and external incentive and restraint mechanisms for financial institutions are generally absent. At present, China mainly relies on government discounts interest and subsidies to improve green industries – the support is far from enough. The complexity of the application

procedures for such discounts and subsidies makes it impossible to reach the vast number of small and medium-sized companies across the country. The incentives provided by investment for financial institutions and companies are too limited to stimulate follow-up market investment.

The ecological compensation mechanism does not address cross-jurisdictional problems.

Fifthly, there's still room for improvement in cross-regional and cross-river basin governance under the ecological compensation mechanism.

At present, cross-city and cross-county environmental compensation for water quality and water environment are being piloted in Henan, Hebei and Zhejiang provinces, and the environmental compensatory payment system is being piloted in key regions such as Inner Mongolia, Jiangxi and Qinghai. Despite the local attempt with the ecological compensation system, there is still a long way to go before it is replicated nationwide. Currently, the types of projects carried out under China's ecological compensation system mainly include those protecting natural forests, converting slope farmlands to forests and restoring vegetation in mining areas. The geographical scope of implementation is small, and most places that provide ecosystem services are not entitled to ecological compensation. On the one hand, the ecosystem services are underpriced or even provided free of charge; on the other hand, enterprises that destroy the environment try to circumvent responsibilities for providing compensation. Therefore, the ecological compensation system is unfortunately stuck at the initial or trial stage even after years of experiment with diverse forms. There is still much to be done to deepen the ecological compensation reform at the cross-regional and cross-river basin level.

2.2.3. Improvement in market-based environmental policies

In the past decade, China's economic instruments for environmental policy have developed rapidly in both types and coverage. However, for market-based instruments, there is considerable room for improvement, if the following actions are implemented.

Set out clear priorities for market-based environmental policies

Firstly, applicable areas for market-based environmental policies need to be clarified. Although

market-based environmental policy is an important tool to regulate rational resources allocation and promote green industrial development, there are still problems that cannot be solved and market failures often happen. When designing market-based environmental policies, it is important to identify where these policies should focus and what roles they have in specific areas, in order to fully exert flexible market forces and have effective complementarity with environmental regulatory policies. For example, excessive use of tax policy could destroy normal market prices and tax equity, it may even make some enterprises ignore management and technological innovation or pay higher tax planning costs. Although financial subsidy can be effective in putting subsidies in place quickly, it is difficult to manage their flow. When formulating market-based environmental policies, central government should focus on areas where environmental regulatory policies are weak and areas where market-based policies can exert maximum effectiveness. An evaluation system should also be established to assess local government performance and encourage innovation to achieve a maximum effect overall.

Develop legislation to support market-based instruments

Secondly, legislation regarding market-based instruments for environmental policy needs to be accelerated. The effective use of market-based instruments in developed countries relies a lot on their well-established legal environments. For example, the Emission Trading Scheme in the EU and the Clean Air Act in the US set out legislation on trading rules for emission rights, which guarantees a high level of corporate compliance in emission trading. In contrast, the absence of a legal basis for certain environmental investment policies in China has led to a great deal of waywardness in investment activities and poor policy implementation. In addition, the emission trading policies that are being piloted in some cities have encountered implementation difficulties due to the lack of support from higher-level law. Without legal basis, the efficacy and economic efficiency of those economic incentives for environmental policy will be merely empty talk. Therefore, the government must provide legislative safeguards when using economic incentives for environmental governance.

Improve market mechanisms nationwide.

Thirdly, market mechanisms need to be further improved. Economic instruments rely on the

“invisible hand” of the market. A mature, open and flexible market mechanism is key to the success of the economic instruments. Although China has sped up reforming and opening the market in recent years, its immaturity remains an obstacle that prevents economic instruments from fully playing their role. The utmost priority is to level the playing field. In China’s unique market economy, various forms of public ownership play a dominant role alongside substantial private and foreign enterprises. In recent years, the government has taken many measures to improve business environment, support private enterprises and SMEs, and strive to create a fair market and improve competition. Meanwhile, China must clarify a set of market rules as soon as possible, such as rules for market access, competition, trade and so on. Moreover, economic instruments for environmental policy must be tailored to local economic structure and circumstances in a timely manner to ensure they are appropriate for target groups or sectors. The market should play a decisive role in allocating resources and strike a balance between economic development and environmental protection.

Focus on capacity building

Fourthly, management capacity and the government’s role in regulating market instruments need to be strengthened. It is important to strengthen capacity-building for those who make and implement policies. Before selecting instruments, the competent authorities must develop a good knowledge of the instruments for environmental policy, fully aware of their strengths, weaknesses and scope of application. A good knowledge will enable the authorities to fully harness the strengths of selected instruments and choose instruments that are complementary to each other. Also, the government management skills and expertise are key to the effective implementation of market instruments for environmental policy. For example, in implementing the emission trading scheme, the government’s role is to control the total amount and maintain market order. The local environmental departments, as the competent authorities, are mainly responsible for allocating environmental carrying capacity as a kind of resource, checking if the resources allocated to enterprises are permit-based or whether the intermediary agencies operate according to law, and maintaining market order. The competent departments should also provide enterprises with market information, set trading rules and supervise market players, thereby reducing the transaction costs for enterprises and encouraging them to engage in

trading of emissions. The government, as a manager, must fully understand the policies and equip itself with expertise and technical know-how during the implementation of the emission permitting scheme. Only by enhancing its supervision capabilities, can the government create a fair and orderly market for emission trading.

Integrate market-based instruments with other environmental policies

Fifthly, economic instruments for environmental policy need to be integrated and put the environmental policy portfolio to a good use.

In recent years, the increasing use of economic instruments for environmental policy in China also caused overlapping in policy intervention, which tangled the roles of different departments and undermined the positive interaction between different policy instruments. Continuous reform is needed to clarify the environmental rights and responsibilities at both central and local level, and to establish a standardized and reasonable financing mechanism for environmental protection at the central and local levels. Fiscal and price subsidies have gradually moved from the production side to the consumption side to encourage green consumption. Further work should be done around environmental taxation to integrate and improve the tax framework that covers environment-related taxes (resource tax, consumption tax, vehicle and boat tax, etc.) and environment-related tax policies (corporate income tax policy, value-added tax policy, etc.). Moving forward, it is important to further integrate the existing economic instruments for environmental policy, set the right targets, coordinate various policy instruments, strengthen the integration of diverse instruments, and set up an economic instrument chain that includes environmental taxes and fees, ecological and environmental compensation, information disclosure, green credit, environmental credit evaluation, etc. It is very important to create synergies between different policies, strengthen policy coordination and technical support, and maximize the policy efficacy. Moreover, it is also important to step up the research on the localization of economic instruments for environmental policy. Most of China’s economic instruments for environmental policy are borrowed from developed countries, regardless of the huge differences in political, economic, social, and environmental regimes. The policy tools applied in developed countries to address environmental pollution may not be suitable for China’s circumstances (or at least require some modification). Therefore, more studies on the localization of those

economic instruments for environmental policy are necessary to maximize their efficacy in addressing the environmental challenges in China.

2.3. ENVIRONMENTAL SOCIAL POLICIES

2.3.1. Evolution of environmental social policies in China

Environmental social policy refers to policies to solve environmental problems through comprehensive utilization of social driving forces and social means. Since the start of the 21st century, environmental protection in China no longer relies solely on government efforts or market measures alone. Instead, China has started its transition towards integrated environmental governance that involves reform in systems and institutions, implementation and enforcement and multi-stakeholder participation.

Environmental social policies mainly target social entities participating in environmental governance, including individuals, families, communities, civil society organizations, think tanks, media, etc. Environmental social policies, through public awareness raising and environmental education, can help disseminate the concept of protecting the environment among the public and business. It prompts companies and individuals to take proactive action to protect the environment, all contributing to an environmental governance structure that involves all sectors of the society. Unlike command and control instruments which use administrative restrictive

tools, or economic instruments which use market mechanisms to incentivize environmental friendly behavior, environmental social policies, once mature, will actively change public behavior (and influence behavior of businesses) and have long-term effects.

Since the 1980s, China's environmental problems have become increasingly prominent. The growing environmental concerns brought negative political, economic, ecological, cultural, and social impacts as China deepened its participation in globalization. Public attention to environmental issues increased rapidly. Environmental disputes and mass incidents caused by environmental pollution emerged one after another, pushing the government to gradually shift the original one-size-fits-all pattern of environmental management to a more tailored and flexible new governance model. In this context, the country proposed a series of strategies and initiatives such as "sustainable development", "green development", "beautiful China", and "green is gold", demonstrating the determination of the country to modernizing its national governance system and governance capacities.

In fact, China's legal system has long incorporated the concept of social governance. Article 6 of the *Environmental Protection Law 1989* stipulated that "all units and individuals have the obligation to protect the environment and have the right to report units and individuals that pollute and damage the environment." In the early 1990s, China's environmental community accepted the theory of environmental rights and deepened its understanding of public

Table 1 Forms of Social Environmental Policies in China

Forms		Explanation
Information Tools	Environmental Information Disclosure	Three types: corporate environmental information disclosure, government information disclosure, and internal information disclosure and exchange among different government departments.
	Eco-labels	Products with eco-labels show consumers that all their production, uses and recycling process meet environmental standards. They are environmentally friendly and resource-saving.
	Education Campaigns	Environmental courses are incorporated into the Party Training system – to enhance party and government leadership's knowledge in environmental policies and laws. "Green Establishments" Campaign – building Green Community, Green Schools, Green Government.
Public Participation	Environmental Complaints	The public may file environmental complaints, report environmental pollution or provide suggestions or comments. Competent authorities must take action within a certain time-frame upon receiving such reports.
	Environmental Public Interest Litigation	Public and qualified NGOs may file litigation at courts in accordance with the law towards civil subjects or administrative organs to defend the environmental interests of the public.
	Voluntary Agreements	A non-binding agreement between government, companies and NGOs to improve energy efficiency and environmental quality.

participation. After the Rio Conference in 1992, *China's Agenda 21* was formulated – it set up a comprehensive system of objectives, policies, and action plans for China's public participation mechanism, and made clear requirements on the public's right of information and participation. In the late 1990s, the state formulated the *Outline of National Environmental Protection (1998-2002)* and other documents, and further improved and developed rules of public participation. The *Environmental Impact Assessment Law* promulgated in October 2002 included rigid requirements on the measures, procedures, and effectiveness of public participation. For example, it stipulates that "construction projects that may have a major impact on the environment and should prepare EIA reports must hold consultation meetings, public hearings, or other forms to discussions to solicit opinions from interested units, experts, and the public on the draft of the environmental impact report before submitting it for approval." Article 6 of the *Environmental Protection Law* 2015 stipulates that "citizens shall enhance environmental protection awareness, adopt a low-carbon and energy-saving lifestyle, and consciously perform the obligations of environmental protection". In March 2020, the *Guideline on Building a Modern Environmental Governance System* issued by the State Council prioritizes the improvement of the environmental governance system that features multi-stakeholders and proposes to strengthen social supervision, give roles to various civil groups and improve the environmental awareness of citizens, among others.

China is in urgent need for policy, institutional and systematic innovations to better engage the public and business in environmental governance, to shift from the government-led "management" pattern towards the multi-stakeholder participation. Development of social environmental policies will contribute to building a modernized environmental governance system, which China is striving to create, and the benefits will be shared by all parties.

2.3.2. Outcomes and challenges of environmental social policies

Environmental social policy tools can enhance the determination and motivation of the public to participate in environmental governance, improve their environmental awareness, and at the same time promote the openness and transparency of government environmental information, effectively reducing the cost of government environmental regulation and improve the efficiency of environmental supervision. Environmental supervision with public

participation helps to protect the citizens' own environmental rights; it can also ensure a democratic decision-making process and indirectly improve the public's living standards. On the other hand, public participation in decision-making requires sufficient access to information, but currently the government's information disclosure on environmental issues is relatively limited, and information disclosure is expensive and challenging. Moreover, social environmental policies in China are implemented differently across the country, and in many places the public's willingness and capacity for participating in environmental matters needs to be further improved.

Regarding environmental information disclosure, the 2007 *Environmental Information Disclosure Measures (Trial)* was China's first comprehensive sectoral regulation on environmental information disclosure. It stipulates that environmental information disclosure is compulsory and requires competent environmental protection authorities and polluting companies to release important environmental information to the public. The *Measures for Disclosure of Environmental Information of Companies and Public Institutions* issued in 2014 further regulates the disclosure of information by polluting enterprises. However, in practice China's environmental information disclosure still faces many problems and challenges, including the lack of special laws on environmental information disclosure, the scope of government departments required for mandatory environmental information disclosure is not extensive, the public's access to environmental information is relatively narrow, and corporate environmental information disclosure is small in number, limited in scope, and uneven in quality. Although both the government and the public have been requesting companies to disclose environmental information truthfully and completely, but relevant research shows that the overall level of environmental information disclosure by companies in urban area is relatively low. A large part of the reason is that the government has failed to supervise companies in environmental information disclosure, and the government has never provided training, recommendations or guidance for corporate environmental management practice. For many companies and government departments, environmental information is only released for the sake of it, and it never seriously addresses the true demands of the public. Many environmental mass incidents (protests) took place because of the lack of effective environmental information disclosure.

The latest improvements in China's legal system provides a basis and guarantee for public participation

in environmental protection. The public participates in environmental protection and supervises environmental governance through formal and informal channels. The types of actors engaged in public participation are increasingly diverse, including NGOs, individuals, communities and villages. Participation channels have been greatly expanded, such as writing complaints, environmental hotlines, public hearings, demonstration meetings, public announcement, expert opinions, appeals, litigation, awards, assistance etc. The areas that involve public participation are expanding too – they have grown from mere public campaigns to legislation, decision-making, enforcement and judicial process. The role of the public has changed from following the government to an independent “third party” voice. However, given that public participation in China is usually organized “top-down” and is “government-driven”, it has many limitations - limited scope of participation, relatively weak independence, and weak restrictive impact. The current environmental public participation in China is based on obligation, as a result, it is passive and limited – it cannot fully mobilize the public to use its own initiative to effectively contribute to environmental governance. With the use of internet and media, although many forms of participation, such as the ways of reporting environmental complaints and environmental hearings have been improved, the public’s own limitation in environmental knowledge and understanding of environmental issues have turned many such complaints and public hearings a mere formality. As a result, the effectiveness of public participation is affected.

Voluntary environmental policies are still in their initial stages. They mainly include measures such as implementation of stricter standards by the company, hiring a director responsible for environmental protection, signing a commitment letter, disclosure of pollution control equipment and joining green supply chain. Article 28 of the 2003 *Clean Production Promotion Law*, amended in 2012, mentioned that companies other than high-polluting ones can voluntarily coordinate with competent cleaner production and environmental protection departments to sign an agreement on further resource-saving and emission reduction measures. The *General Technical Rules for Voluntary Energy Conservation Agreement* implemented in 2011 clarified the rights, obligations, implementation procedures and technical requirements of the parties to the voluntary energy conservation agreements, and stipulates that third parties can join the process. In addition, the ISO14000 environmental management system and China End Use Energy Efficiency Program are all practices of

voluntary environmental policy tools. However, the implementation of environmental policies often needs to give way to local economic goals, and companies and consumers lack the environmental awareness and capacities to be governed by voluntary measures. A large number of small and medium-sized enterprises may not be able to fully implement voluntary environmental agreements, and choose low-cost defaults to obtain profits instead. On the other hand, contract governance may have the problem of lack of involvement of government fiscal support. Under such circumstances, how to supervise the source and use of funds, how to ensure the fair distribution of funds, and how to ensure the independence of companies in the public-private partnership are all questions need to be addressed in voluntary environmental policies.

2.3.3. Improvement in environmental social policies

To address the problems of insufficient policy design and inadequate participation in environmental governance in China, efforts need to be made on the following aspects:

Firstly, when using environmental governance tools, the rights and obligations of different stakeholders should be clarified. Wherever the public is engaged, in order to ensure effective public participation, the premise is that the rights, responsibilities and obligations of the various actors involved need to be clearly defined. In multi-stakeholder environmental governance, the government should establish rules for public participation, adopt fair and strict law enforcement measures to guide compliance, and protect the legitimate interests of individuals, businesses, and NGOs to maintain government credibility. Companies should bear strict responsibilities to ensure compliance, fulfill their environmental and social responsibilities, and strive to avoid unexpected economic losses caused by externalities such as public environmental concerns. Environmental NGOs are important participants in environmental governance. They should participate in government decision-making and supervise the government in accordance with the law, carry out environmental awareness and public education campaigns, help resolve environmental and social conflicts, and protect public environmental interests through public interest litigation and other means. The public should fulfill their responsibility of environmental compliance, actively participate in environmental governance, and engage in environmental supervision and reporting. In short, effective

environmental governance requires efforts from all stakeholders. It is important to cultivate the idea of governance, break the single-actor model of “environmental protection depends on government”, and form an inclusive pattern of environmental governance where the government, companies, and the public join together in protecting the environment.

Secondly, it is important to promote comprehensive information disclosure. The government should increase the disclosure of effective environmental information so that the public can have an immediate and dynamic understanding of information. The government should build an open, efficient and transparent information sharing platform to urge polluting enterprises to improve information disclosure in accordance with the law. The government should hear about public opinions and try to avoid mis-interpretation of environmental risks in the process of information dissemination. In particular, it is necessary to work with the news media and NGOs, and establish a channel for multi-stakeholder communication where the government, the media and the NGOs can sit together and talk. Through objective and truthful reporting on environmental facilities and timely clarification of the facts, the public “panic” towards environmental-sensitive projects can be better managed. Companies should disclose environmental information in accordance with the law, fulfill its environmental and social responsibility in accordance with the law, and build mutual trust in information sharing with the whole society. A company with green branding and mutual trust with the public will contribute to the virtuous cycle of effective environmental governance.

Thirdly, it is important improve the structure of the environmental governance and enhance the effectiveness of social governance. A governance structure based on the principles of equality, openness, and cooperation should be established. To ensure extensive public consultation, a full and effective communication mechanism should be established through ways such as roundtable meetings, solicitation of opinions, and public hearings. Through such platforms, list of actions, progress of actions, and responsible parties and individuals can be disclosed to interested parties regularly or based-on-demands, so that the public becomes the mainstay in the efforts of environmental quality improvement. In the reform of ecological civilization, resources and efforts of all parties in the society should be mobilized and coordinated, part of the authorities and responsibilities of environmental protection from government mandates can be appropriately removed, government procurement of

social services can be encouraged, and NGOs can be relied on to build a bridge between the government and the public. By doing so, the potential of all stakeholders can be brought to contribute to the effectiveness of China’s environmental governance.

2.4. ENVIRONMENTAL POLICY INTEGRATION

2.4.1. Progress in research and practice

Since the 18th National Congress of the CPC, China has made many successful attempts in formulating multi-stakeholder environmental governance policies, as well as environmental policies with equal emphasis on command and control tools and incentives. Integrated environmental policies require the process of policy formulation to be more forward-looking, systematic and comprehensive. China’s 2018 National Conference on Environmental Protection was of the highest level in history, which adhered to the concept of harmonious coexistence between man and nature, and took winning the uphill battle against pollution prevention and control as one of the three major battles for building a well-off society in an all-round way. China is also committed to reform in its environment policy system, and will stick to the new concept of development, which is innovative, coordinated, green, open, and sharing development, and pursue high-quality development. In mid-June 2018, the State Council issued “*Opinions on Comprehensively Strengthening Ecological and Environmental Protection and Resolutely Winning the Battle against Pollution Prevention and Control*”, proposing to accelerate the construction of an ecological civilization system to ensure that by 2035, a resource-saving and environmentally friendly spatial planning, a new industrial structure, a clean production model and green lifestyles are formed; by the middle of this century, the goal of modernization of the national governance system and governance capacity in environment protection will be realized.

At present, China’s economic development has entered a period of profound adjustment. The conflict between economic/social development and ecological/environmental protection remains outstanding. The resource and environmental capacity of certain regions in China has reached or approached the upper limit. New and old environmental problems are intertwined, and regional and structural

environmental risks are prominent. In addition, environmental problems have brought other impacts in various ways regardless of time or boundaries and single regulatory environmental policy alone cannot solve the problems. In the past, China tended to think the responsibility of environmental protection lies solely with environmental departments. However, it is now clear that separate departments and divided regions can never fully address the increasingly complex ecological and environmental problems. Integrated environmental policy formulation as well as inter-departmental and cross-regional coordination and cooperation in environmental governance is the ultimate choice to effectively deal with ecological and environmental problems.

In promoting green development, China seeks to integrate environmental policies delivering both environmental and economic benefits. The green industrial policy was born in the context of increasingly prominent conflicts between environmental protection and economic development. It can be traced back to the days when environmental policy concerning industrial development and structural adjustment was promulgated and implemented by the government. Over the years, it has evolved from pollution-control and energy-saving focused to requirements for measures to address climate change, circular economy and finally ecological civilization. In September 2015, the State Council further pointed out in the *Integrated Reform Plan for Promoting Ecological Civilization* that the institutional reform related to green development should be promoted, and China should accelerate the establishment of a green finance system oriented by ecological conservation, an agricultural subsidy system and a unified green product system. The Plan also put forward requirements to study and draft the method of incorporating green development as an indicator into the government officials' performance evaluation system. Both command and control tools and economic incentives are employed to mobilize all relevant stakeholders. In the "13th Five-Year Plan", green development has been listed as one of the five development principles for ensuring China's building of a well-off society. It also means that the party and government's understanding of environmental protection has changed from the past "to solve the negative externalities of the economic development" to a proactive strategy of "leading a new development model". In order to fully implement the "13th Five-Year" plan and the "Made in China 2025" strategic deployment to promote green industrial development, the Ministry of Industry and Information Technology issued the "Green Industrial Development Plan (2016-2020)", and proposes to increase

favourable financial and tax policies to support the transformation of traditional industries, carry out pilot demonstrations of green manufacturing, and achieve comprehensive utilization of resources. The 19th National Congress of the CPC in 2017 once again emphasized green development - China should accelerate the establishment of a legal system and policy framework for green production and consumption, and promote green, low-carbon, and circular economy. However, if we look at the existing policies, the current policy system remains heavily reliant on command and control tools. The development of market-oriented policies and voluntary standards still lags behind. For example, in energy conservation and emission reduction policies, caps control, task break-down, administrative accountability, and inspections and random checks are the main tools deployed. Such strict command and control measures may have certain effects in the short-term but they may also mismatch resources. In the process of policy formulation, coordination among relevant standards is missing. As a result, for one single issue, the policies are usually developed by different competent authorities and the rules are usually scattered in multiple documents. For one actor may enjoy incentives, but there are often incentives at different dimensions (supply, demand), different links (R&D, manufacturing, sales) and in different types (fiscal, financial, taxation, etc.). Moreover, sometimes the consistency between various measures is missing, coupled with frequent changes in policy standards, resulting in great resistance to policy implementation and difficulty in ensuring policy efficacy.

In clean energy transformation, China has introduced a variety of policies of different levels to promote green energy consumption. The "13th Five-Year Plan" outlines the need to promote energy revolution, transformation of energy production and utilization, optimization of the energy supply structure, improvement in utilization efficiency, and a clean, low-carbon, secure and modern energy system. On the consumer side, driven by the needs for pollution prevention and control, China's national energy authority has introduced incentives and favorable policies such as ultra-low-emissions upgrade for the thermal power industry, poverty alleviation through photovoltaic power industry, power grid transformation in rural areas, oil quality upgrades, and clean heating in winter in the northern region to develop a green and diversified energy supply system. At the supply end, supply-side structural reform has been launched to develop high-quality coal production capacity in an orderly manner following the principle of gradual phase-out, and force the withdrawal

of inefficient and low-quality production capacity. While promoting the large-scale development of clean energy, the state vigorously develops distributed clean energy, improves policy guarantees, market mechanisms and standard systems, promotes the expansion of pilot demonstrations, and strives to achieve balance in regional energy supply and demand.

In the iron and steel industry, the government has adopted a comprehensive range of policy measures. In capacity restructuring, in order to resolve the excessive steel capacity, it is now strictly prohibited to build new steel capacity projects. Every project construction must prepare a capacity replacement plan to implement equal-amount or reduced-amount replacement. Based on the annual capacity replacement target set by the projects, transactions of capacity allowance are allowed between regions. As such, a market mechanism is used to enable rational allocation of production capacities across the country. By setting the target of "total capacity reduction", the capacity structure can be optimized, and the objective to reduce total amounts of pollutants discharged by the steel industry can be achieved. However, in practice there are no uniform quantitative indicators to define what is the optimized capacity—as a result, there is no connection between capacity phase-out and emission reduction goals, weakening the effect of the policies. In terms of regional layout, the principle is to increase the concentration level of iron and steel enterprises, and transfer heavily polluting enterprises to areas with high environmental capacity. For example, Hebei Province eliminated scattered, small and backward production capacity in the industry, and concentrated more than 90% of the province's production capacity into the top 15 large-scale companies. In Shandong and Jiangsu, on top of reducing the number of small companies, the provinces have transferred their steel production capacity from inland to coastal areas, i.e., moving emissions to areas with higher environmental capacity. In terms of pollution control, both command and control tools and incentives are applied. Since 2012, the national standards for the steel industry have been tightened to promote ultra-low emission upgrade across the industry, and certain incentives and compensation measures have been provided to companies that have completed the technical upgrade. Most of China's production capacity in steel is located in the Beijing-Tianjin-Hebei region with low environmental capacity. Since 2017, administrative control measures for emission reduction have been adopted for companies in the region. In autumn and winter, companies should take shifts in production to avoid peaking production at the same

time; during heavy pollution air quality days, companies should halt production. In general, China's policies for regulating the steel industry range from policies targeted at the project construction stage to end-pipe pollution control, from administrative measures, standards and regulations to economic incentives - various types of policy tools have been deployed to ensure pollution reduction in the steel industry. In addition, the state encourages adjustment of the transportation structure of the iron and steel industry to reduce air pollution from traffic sources. This involves the shift transport of goods from key steel companies and industrial parks by road to rail transportation, and significantly increase the proportion of railway and waterway transport for bulk cargo in key regions. Companies that have completed the change of transport mode will be given economic incentives and can enjoy more flexibilities in production during peaking time. Through a series of multi-level and comprehensive policies, the iron and steel industry takes on more environmental protection responsibilities, and it is more proactive in accelerating energy-saving and emission-reduction transformation, forcing the phase-out of outdated technologies and contributing to green development.

To sum up, integrated environmental policy means that both the capacities of the government and of the public need be improved simultaneously. While the government should play a leading role in environmental governance, society should be able to take the initiative to act as well. The two parties have different functions and they complement each other. Integrated environmental policy requires not only end-pipe pollution control, it is more about green transformation and development of the entire economic and social system from the source. It is a process that needs overall improvement of national governance capabilities, and a process that must be taken to achieve the progress towards ecological civilization.

2.4.2. Prospect of environmental policy integration

Judging from the progress China has made in the reform and building of an ecological civilization since the 18th CPC National Congress, it is safe to say that its environmental governance has pulled off the transformation from single-element control to multi-stakeholder governance. Despite its efforts to move from over-reliance on regulatory tools to using a combination of legal and economic means as well as public consultation, the performance and

effectiveness of integrated environmental governance are far from satisfactory. To be more specific, the combination of policy tools remains to be optimized; cross-regional cooperation, inter-department coordination and public participation are insufficient. All in all, the challenges facing environmental policy integration and ecosystem governance remain daunting.

Firstly, environmental policy integration should aim for the balance between economic development and environmental well-being.

As environmental issues are increasingly becoming the focus of attention, China has adopted a strict regime to protect the environment. Stringent emission cap control, target break-downs, accountability and central environmental inspection, and one-vote-down system are the core policy tool mixes to restrain the environmental behavior of the local governments. Strong environmental policies have paid off, but some local governments under the top-down pressure tend to go over-board or take oversimplified measures in policy implementation. The “one-size-fits-all” approach will not only harm the economy and employment, but also undermine the credibility of the government and the health of industries in the long run. For example, some pollutant emission control standards at the local level are subject to frequent changes, resulting in many uncertainties for enterprises to invest in environmental protection, and even causing a waste of resources in some cases. Environmental policy integration should be effective in coordinating the relationship between the environment and the economy, smoothing over the transition of policies, and preventing short-sighted officials from seeking economic gains at the expense of environmental interest. Environmental policy integration should seek to harmonize interests between different economic sectors. Policy-makers should be forward-looking and always bear in mind the big picture at the initial stage of policy making to achieve high-level environmental protection and high-quality economic development.

Secondly, environmental policy integration should combine the role of the government and that of the market in resource allocation.

A salient feature shared by China’s conventional policies is the intention to replace the market mechanism with the government’s decisions, flouting the rule of survival of the fittest in market competition by introducing the government-imposed technologies, routes and techniques. For these selective policies to work, the government must be accurate in predicting the future development, costs and demands for certain technologies. However, accurate, or not, this can

only be found out through the market-based trading and pricing mechanism, through the trial and error of market players, and through the competition mechanism. One big advantage of the market is that it can accurately reflect a consumer’s demand and choices. Also, the market encourages risk-taking, profit-seeking and creative activities, which in an ideal state can achieve the optimal allocation of resources and ensure the fittest survive. It is such a competitive environment of continuous entry, innovation and withdrawal that can unleash productivity and leave an enterprise, region and even a country with comparative advantages. Therefore, under the triple constraints from economy, environment and society, an integrated environmental policy system should not only be set to give full play to the supervisory and regulatory role of the government, but also let the market play a fundamental and decisive role. Incentive measures should be adopted to revolutionize green technologies so as to create an enabling environment for industrial green development and technological green innovation, and to level the playing field.

Thirdly, environmental policy integration should place equal importance on incentives and command and control tools to enhance the efficacy of policy implementation.

A single environmental policy tool, with limited scope and targets, can undermine the efficacy of environmental governance. Studies show that the environmental policies with strong restrictive and punitive nature have raised the cost for SMEs to break the law. However, if we overly rely on strict environmental administrative policies without providing incentives to SMEs in resources, technology and capacity for environmental management, the implementation can become costly and difficult. Currently, environmental and economic policies with incentive effects work well with large corporations, mainly because the owners and managers of SMEs believe that the government and large enterprises should be responsible for environmental protection, or it is either too difficult for well-behaved SMEs to get a reward or too easy for those ill-behaved to get away without punishment. In the end, it usually boils down to the poor awareness of environmental management of SMEs, the information asymmetry between the government and enterprises and the possible rent-seeking behavior. For example, the tax system has included preferential provisions for investment in environmental protection facilities, which only extends to a certain type of facilities. Those outside the type scope are considered ineligible for the preferential treatment. Also, with incomplete financial information and tax data, many SMEs find it difficult to apply for

environmental protection tax concessions. Therefore, the design of environmental policies must integrate both restraints and incentives in order to maximize the efficacy of the policies and to further expand the policy scope. In applying environmental policies, the government should focus on guiding and improving the enterprises' environmental behavior, lower the threshold for incentives application, strengthen the management of policy implementation, improve its efficacy, and give full play to the role of environmental and economic policies in environmental management and establish an environmental management system with equal emphasis on incentives and restraints.

Fourthly, capacity building for public participation and public self-governance must be strengthened to identify and address environmental issues.

Integrated environmental governance entails the growing public awareness of environmental protection and the maximizing of the role of public participation as the driving force, in both of which China still has a lot to improve. To this end, on one hand it is necessary to improve China's current mode of environmental mobilization by employing more creative means such as community mobilization and online platforms to motivate the general public to participate in environmental protection; on the other hand the environmental information disclosure should be further enhanced to promote public participation. *Environmental Protection Law* 2015 requires the governments at prefecture and municipal level to make public the list of key pollutant discharge entities, and the *Air Pollution Prevention and Control Law* explicitly stipulates that pollutant discharge enterprises must install automated monitoring equipment and disclose the monitored results in real time. However, there is much to be done to implement all these requirements. Mobilizing the public to supervise any violation of environmental laws through environmental policy integration can improve the efficacy of environmental law enforcement and strengthen law enforcement at the grass-roots level. The different environmental problems and their impacts caused by different industries should be identified and addressed respectively. In order to identify environmental problems and improve the accuracy of environmental governance, in-depth participation of the public is needed, and it is necessary to have faith in people in the process of participation. To this end there must be a well-developed public information and participation platform to create conditions for public participation in environmental decision-making and supervision.

Fifthly, environmental policy integration should serve the overall goals and systematic agendas, fill the gap of existing policies, and improve policy coordination.

For a long time in the environmental area, China's policymakers tended to use goal-oriented command-and-control tools, oblivious to the motivation or agency of the public, and thus failing to see the big picture. As a result, some of the policies are too sweeping to be effective, i.e. there has been a lack of industry-specific policies. Take wind power, a priority industry which is currently supported by renewable energy policies, as an example--the pricing mechanism lacks clarity; relevant quality standards, certification system among other policies are absent. These problems have deterred many prospective investors and slowed the growth of demand. In addition, many policies are devised to solely promote the development of a certain industry or technology, with little regard to the development of supporting industries or technologies. For example, China has introduced a series of policy measures such as financial subsidies and tax breaks for green industries such as new energy industry, energy saving and environmental protection industry, NEV industry, etc., but these policies invariably focus on technological innovation in these areas, overlooking the coordination of supporting industries. Admittedly, aiming for coordination with other policies in policy making may leave that single policy with multiple objectives at the same time, hence leading to multiple policies targeting one single area all at once. One of the examples is the interaction between carbon emissions trading schemes and renewable energy subsidy policies, which may weaken the effectiveness of both. Therefore, the bigger picture must be borne in mind in policy integration. Status analysis and impact assessment are integral to policy formation so as to maximize the policy benefits while minimizing its costs.

2.5. EVALUATION OF CHINA'S ENVIRONMENTAL POLICIES

2.5.1. The Importance of environmental policy evaluation

The MEE has issued environmental policies addressing various environmental media such as air, water, soil. With unprecedented intensity and frequency of policy introduction, the transition into green and low-carbon development is speeding up. At present, China's battle for pollution prevention and control has entered the critical period with a

comprehensive and systematic planning launched by the 14th Five-year Plan for environmental protection. The role of environmental policies in the building of an ecological civilization and environmental protection is further accentuated. But at the same time, there remain such challenges as limited environmental capacity and resources, grim environmental pollution, the deep-seated problems in the system and mechanism, institutional and policy deficiencies threatening to weaken the efforts of environmental protection. Therefore, it is imperative to establish and improve a comprehensive assessment mechanism of policies to evaluate the effectiveness of environmental policies in an all-round way. Coordination between different policies should be improved to secure effective implementation.

Environmental policy evaluation can improve policy cooperation.

In recent years, more than 30 ministries at the central level have rolled out several environmental policies to address various issues and areas which sometimes may contradict one another. Environmental policy-making, more than ever before, tends to encounter deep-seated institutional problems with growing interaction between each link. Therefore, the policy system should be more systemic, comprehensive, and coordinated. A holistic and multidimensional approach is needed, as a single measure at a single level no longer works. For this reason, policy evaluation is necessary to make policies better aligned with the overall target. It is also important to strengthen the foundation, draw on the strengths, shore up the weaknesses, and prevent promoting one policy at the expense of another. At the same time, an in-depth study of the coupling of various systems is needed to make them harmonize with one another target-wise, reinforce one another implementation-wise, complement one another effect-wise, hence synergizing the policy system as a whole.

Environmental policy evaluation can review the effectiveness of policy implementation.

The implementation of environmental policies is a complex process. Due to the lack of coordinated way of thinking, differing ecological objectives and ineffective coordination mechanism at the local level, the implemented can deviate from the original intention to varying degrees, such as the expansion of policy boundaries, selective implementation, delay of implementation, dogmatic implementation and so on. Policy evaluation can test the attainability of objectives, the 'suitability' of the measures regarding the objective pursued, and the internal and external conditions, capabilities, mechanisms and supporting measures to avoid any implementation deviations.

Policy evaluation can assess the cost-effectiveness of implementation.

Environmental policies in key areas may have an economy-wide impact. Policy evaluation should be carried out before or after the implementation of environmental policies to analyze the multiple impacts of this very policy and related policies that target the same area, the same industry, and the same region. In this way, we can work out the amount of investment in management, intermediate input, and operating costs for policy implementation, and evaluate whether the recipients of implementation can afford those costs and input. It can also help work out the management cost associated with policies while reducing the unexpected costs of implementation so as to generate environmental, economic and social benefits all at once.

The development of ecological civilization and the formulation of environmental policies have reached a critical juncture from which there would be no turning back, with a growing number of "tough nuts" to crack. At the top-level design of environmental governance, the environmental policy system should consist of immediate measures, follow-up institutional arrangements and policy evaluation. The decision of the CPC Central Committee on some major issues concerning how to uphold and improve the system of socialism with Chinese characteristics and advance the modernization of China's system and capacity for governance was adopted at the fourth plenary session of the 19th CPC Central Committee, which mentions China "must improve the decision-making mechanism, step up research, demonstration and risk assessment of major decisions, and strengthen the implementation, evaluation and supervision of major decisions." In addition to the requirements for the implementation of the green development concept and environmental governance, the 2019 Central Economic Work Conference also specifically stressed the importance of policy comprehensive impact assessment. i.e. "it is necessary to take a holistic approach and always bear in mind the big picture. We must follow the laws of socioeconomic development. Comprehensive impact evaluation is needed before introducing or changing any major policies. We must see to it that policies are faithfully implemented and say no to all kinds of formalism and bureaucracy." All these have provided a theoretical and practical basis for environmental policy evaluation.

Undoubtedly, environmental policy evaluation must be carried out in tandem with environmental governance, as the testing of the latter often depends on the results of the former. In the process

of governance, the efficacy of environmental governance should be carefully evaluated at different stages and on different types of policy tools, which would not only effectively verify the positive and negative impact of policy implementation, but also minimize the loss caused by unscientific and unreasonable policies. As a result, the efficacy of environmental governance can be optimized.

Environmental policy evaluation, combined with the practice of environmental governance, can in return help test and improve environmental policy evaluation methods so as to further the development of environmental policy related research.

2.5.2. Progress in research and practice of environmental policy evaluation

Environmental policy assessment mainly refers to the assessment of environmental policy implementation, including effectiveness, efficiency, impact and overall assessment. China’s research and practice in policy evaluation have always been around the development of environmental policy evaluation framework, environmental policy effectiveness assessment and policy impact assessment, which includes the development of evaluation framework, the development and application of tools and methods, and the application of evaluation results.

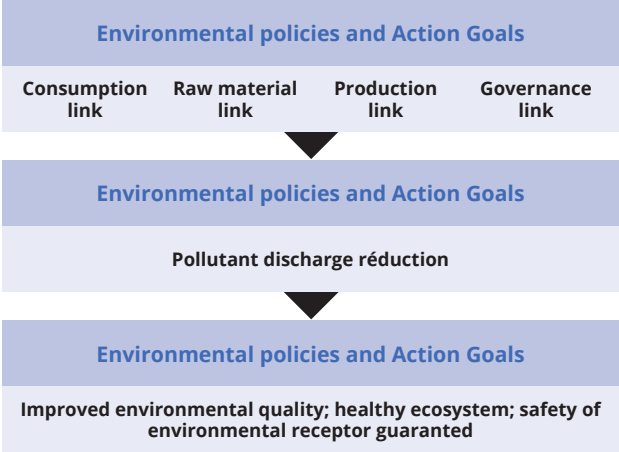
Progress of research on environmental policy evaluation

With the deepening of reform of ecological civilization system and the strengthening of environmental governance, Chinese academia started their exploration of the theory of the system of environmental policy evaluation, involving evaluators, evaluatees, criteria and indicators, methods, tools, procedures and other aspects. Generally, organizations and individuals who have direct or indirect relations with environmental policies should be included in environmental policy assessment, while evaluation objects are targeted environmental policies. Environmental policy assessment criteria should include several aspects: environmental policy input, environmental policy efficiency, environmental policy efficiency, environmental policy fairness and environmental policy responsiveness.

Analysis of environmental policy objectives should be conducted before policy evaluation to establish a logical chain for causality analysis of the effect of the policy, and determine the scope of evaluation. As the target of an environmental policy is usually

the polluter, the causal relationship between the ultimate goal, the link goal and the action goal of environmental policy will be established (figure 2) to determine the scope of policy evaluation and, in specific analyses, to further determine the environmental elements of pollutants. Specifically, policy evaluation should generally look into the ecosystem status, the receptor status, environmental quality, pollutant discharge control, environmental policies and measures analysis, environmental management mechanism analysis, etc.

Figure 2: Causality Analysis Model of Environmental Policy



Procedure-wise, evaluation is generally divided into internal evaluation and third-party or external evaluation. Stage-wise, it can be divided into pre-evaluation, in-process evaluation, and post-evaluation. Indicator-wise, scholars have not reached an agreement on a universally applied index system. Instead, evaluators are encouraged to select appropriate evaluation indicators policy by policy. Currently, attempts have been made to build the index system for air pollution control evaluation, the index system for water pollution prevention and control, and the index system for environmental expenditure. The evaluation criteria should be both objective and measurable (specific enough). Collecting data and information is essential to provide solid science for evaluation. The first-hand data may come from research, such as survey sampling, interview, case study, field experiment and so on. Second-hand data mainly refer to literature and documents, including data pulled from environmental departments such as annual reports on environmental statistics, assessment reports on pollution sources, urban environmental quality reports, as well as statistical yearbooks, water resources bulletins of river basins, water quality monitoring reports, fishery ecological and environmental bulletins, agricultural yearbooks, summary health statistics, forestry

development reports and other basic information, as well as study reports of certain periodicals and research institutions. The evaluation methods may include SMART, cost-benefit analysis, expert evaluation, and other methodology that are widely used in mathematics, sociology, environmental economics, and other disciplines.

Regarding the application of the results, some scholars have evaluated the effect of urban sewage treatment, the treatment of rural living environment in water source reserves and the policies for reduction of water pollutant discharge, and concluded that there is a large gap between the effect of water pollution control and the expectation from the public. The conclusion also mentioned that for the water pollution policies to be effective, new concepts should be introduced, such as sustainable development, improving the evaluation system, strengthening the role of grass-root community and local governments, promoting public participation, and developing new sewage treatment technologies. Some have evaluated China's pollution control policies, and concluded that with clear targets, the current pollution control policies have been effective in controlling pollutant discharges. However, there is more to be done in providing legislative guarantee for the evaluation system. Also, the evaluation methods and the system and the disclosure of evaluation results should be improved. In addition, Chinese academia have examined different urban or regional environmental policies with a focus on the micro and regional level and investigate the impact of regional environmental policies.

Progress in management practice

In recent years, the central government has also issued policies to strengthen the top-level design for environmental policy system and evaluation in an orderly manner. In 2020, the central government issued *Guideline on Building a Modern Environmental Governance System* which set the target of modernizing the system and capacity for environmental governance. Under this modern system, the responsibilities of various actors will be implemented, and the participation of market players and the public shall be encouraged. An environmental governance system with clear guidance, science-based decisions, rigorous enforcement, effective stimulation, diversified participants, and sound interactions will be established. To standardize the policy formulation, the *Notice of the General Office of the State Council on Strengthening the Formulation and Supervision of Administrative Regulatory Documents* stipulates that "administrative normative documents must be formulated and issued strictly in accordance with

statutory procedures and significant administrative normative documents must strictly go through assessment and appraisal, public solicitation of opinions, legality review, collective deliberation and decision and public issuance". "Serious assessment and appraisal. The comprehensive appraisal of the necessity, feasibility and reasonableness of the formulation and issuance of administrative normative documents is an important precondition for their legality and effectiveness.....One should assess the anticipated effect and possible impact of the relevant administrative measures, and consider such matters as whether the document complies with laws, regulations and national policies, whether it complies with the socialist core values, and whether it meets the requirements for fair competition review" To further improve the scientific nature, effectiveness and harmonization of environmental policies, the Ministry of Ecology and Environment has drafted and compiled the *Guidelines for Eco-Environmental Policy Assessment (for trial implementation)*, which defines the scope of policy assessment, including individual policies, it also includes the policy contents contained in major plans, plans, programmes and other documents. It is stipulated that the policy evaluation should include the basis for policy formulation, the feasibility of the policy objectives, the coordination between policies, the cost-effectiveness of policy implementation, the potential impacts on interested stakeholders, the timing of policy introduction and so on. By setting out the procedure for policy assessment, it provides guidance for China to carry out environmental policy evaluation in the next stage.

2.5.3. Considerations and recommendations for environmental policy evaluation

Guidelines for environmental policy evaluation.

The MEE should introduce guidelines for environmental policy evaluation and clarify evaluation objects, scope, methods, procedures and requirements for standardizing and directing relevant departments to carry out environmental policy evaluation so as to improve the science-based, regulated and effective policy evaluation.

Evaluation on new environmental policy

The MEE should undertake pre-assessment of environmental policies before policy-making or revision, conduct scientific assessments on environmental, economic and social impacts of new policies in accordance with guidelines, carry out scientifically

objective analyses between new policies and relevant existing policies as well as possible interactions between new policies and other proposed policies, predict policy implementation challenges, effect and potential risks, coordinate various policies in different time periods and in relevant fields, seek for positive integration and ensure scientific, effective and coordinated policy formulation.

Pre-assessment of environmental policy should focus on the following: Firstly, consistency between measures and policy objectives as well as policy expectations should be ensured; Secondly, new policies may have cross impacts or conflicts among different factors such as air, water, soil etc. Thirdly, coherence and consistency between new policy and existing policies in time and spatial regions should be considered; Fourthly, the consistency and compatibility between newly formulated policies by environment department and by other government departments should be coordinated.

Evaluation on existing environmental policy under implementation

The MEE should establish interim evaluation and post-evaluation mechanism to carry out independent evaluation on environmental policies implemented by various departments or third parties. Follow-up evaluation and post-evaluation on important nation-wide environmental policies implemented should be carried out on regular basis, special focus should be given to environmental policies with higher impact, active responses from local industry and greater public concerns. Such evaluation can raise timely recommendations on policy adjustment and optimization and support the achievement of policy targets.

Environmental policy mid-term evaluation and post-evaluation should focus on the following aspects: Firstly, whether implemented policies are on schedule and have achieved expected policy objectives, what are the difficulties and challenges, how to solve the problems encountered; Secondly, environmental benefit, economic cost and social impact of policies under implementation should be evaluated, and suggestions proposed according to new environmental management requirements and situation; Thirdly, good practices and experiences in policy implementation should be summarized to provide reference for formulating and implementing relevant policies in the next step.

3. EU experience on integrated environmental policies

The EU has developed an extensive body of environmental law and policy that is relatively comprehensive in its coverage of issues. Today it includes different types of instruments which do the following:

- » Ban certain activities and products.
- » Set environmental outcomes to be achieved.
- » Set exposure standards to be achieved.
- » Establish impact assessment procedures that must be followed.
- » Establish process or performance outcomes to be met.
- » Establish emission limits for substances from specified activities.
- » Reduce emissions or resource use through use of market-based instruments (MBI).
- » Establish management processes that must be undertaken.
- » Require Member States to adopt measures. These may be specified (command and control, MBI, etc.) or left to the discretion of the Member State.
- » Establish minimum product standards to be met (or other product conditions).
- » Establish a liability regime.
- » Set minimum obligations for information to the public on the environment and on access to justice in environmental affairs.
- » Provide financial support for environmental projects.
- » Establish obligations regarding environmental monitoring and monitoring of performance and compliance by regulated activities.
- » Establish requirements for Member States to collaborate.

As a result, for the period 2013-2050, there are 82 binding targets and 84 non-binding objectives in EU law and policy⁸. This chapter is principally focused around the use of command and control (CAC) instruments and MBIs in the EU. However, as many of these are developed through the planning obligations, this aspect is also explored as will the role of financial instruments. The chapter also explores how different instruments are brought together to achieve a particular environmental outcome and the integration of environmental issues into other policy areas (including the EU's policy evaluation regime). This chapter concludes with some key lessons from the development and implementation of these instruments in the EU.

Note that Chapter 4 on transport will also give examples of other instruments, e.g. product standards (vehicles, fuel). Reference will be made to the EU institutions and decision-making processes as well as the division of competencies between the EU level and the Member States described in the introduction to this report.

8 EEA 2016. Environmental taxation and EU environmental policies. EEA Report No 17/2016. European Environment Agency, Copenhagen. <https://www.eea.europa.eu/publications/environmental-taxation-and-eu-environmental-policies>

3.1. PLANNING OBLIGATIONS IN EU ENVIRONMENTAL LAW – FRAMING THE CHOICE OF INSTRUMENTS

One important approach in EU environmental law is the requirement for Member States to undertake some form of planning activity within which the Member State may be required to adopt measures to achieve an objective. The measures adopted may be CAC instruments, MBIs or even voluntary agreements. This leaves much flexibility which, in theory, should allow countries to target measures at issues which will deliver the most benefits and also to design measures which are the most efficient (delivering the benefits and least cost). This approach in EU environmental law is illustrated by plans for air quality, river basins and waste management.

3.1.1. Air Quality Management Plans

Directive 2008/50/EC⁹ establishes binding air quality standards (“limit values”) for air pollutants. In order to meet their obligations, Member States are required to adopt plans where air quality standards are not met. The plans must identify specific areas of excess pollution, trends, details of measures or projects adopted or planned.

It is important to note that there are CAC measures in EU law controlling different air pollutants – from industrial and transport sources (see elsewhere in this report) and these requirements apply both in areas with air quality management plans and outside of these areas. The measures to be adopted in air quality management plans, therefore, usually need to be additional to these EU level CAC measures. In most cases in the EU, air quality problems arise from transport emissions. Measures in cities to reduce air pollution are potentially large, including some CAC measures, MBIs (e.g. congestion charges), public information, spatial planning, funding of public transport, etc. These issues are explored in the Chapter 4.

In practice, Member States have developed air quality management plans that do include a wide range of measures. However, in many cases the European Commission has concluded that there has been insufficient ambition to adopt measures sufficient to deliver air quality objectives. As a result, it has

initiated legal action against many Member States. In 2019 the Commission published the results of an ex-post evaluation (Fitness Check) of EU air quality legislation¹⁰. This found that the legislation had had some success in decreasing the exceedances for most air pollutants over the past decade. However, problems remain, with air quality still poor in several parts of the EU.

3.1.2. River Basin Management Plans

In 2000 the Water Framework Directive¹¹ was adopted. This marked a major change in EU water policy, moving from CAC instruments that either controlled specific water pollution sources or which set water quality standards for specific pollutants. The directive introduced a comprehensive ecosystem-based and catchment-based planning process – River Basin Management Plans (RBMPs). In brief, these require waters to be characterized and their status to be determined. Where waters are not in a good status, an assessment is required of the pressures on water bodies which might be causing the failure and a Programme of Measures (PoM) developed, setting out the measures to tackle the pressures and achieve good status. Further, there are monitoring and evaluation requirements and the plans must be revised every six years. The directive (and supporting legislation) is more complex in that it includes some specific standards to be met for certain substances, requirements for economic analysis and requirements for full cost recovery of water services.

Since the adoption of the directive, the Commission has undertaken several implementation studies and two ex-post evaluations, the most recent being a Fitness Check published in December 2019¹². This concluded that the directive had been successful in setting up a governance framework for integrated water management for the more than 110,000 water bodies in the EU, slowing down the deterioration

9 Directive 2008/50/EC of 21 May 2008 on ambient air quality and cleaner air for Europe <https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX%3A32008L0050>

10 European Commission. 2019. Fitness Check of the Ambient Air Quality Directives. SWD(2019)427. https://ec.europa.eu/environment/air/pdf/SWD_2019_427_F1_AAQ%20Fitness%20Check.pdf

11 Directive 2000/60/EC of 23 October 2000 establishing a framework for Community action in the field of water policy <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32000L0060>

12 European Commission 2019. Fitness Check of the Water Framework Directive, Groundwater Directive, Environmental Quality Standards Directive and Floods Directive. SWD(2019)439. [https://ec.europa.eu/environment/water/fitness_check_of_the_eu_water_legislation/documents/Water%20Fitness%20Check%20-%20SWD\(2019\)439%20-%20web.pdf](https://ec.europa.eu/environment/water/fitness_check_of_the_eu_water_legislation/documents/Water%20Fitness%20Check%20-%20SWD(2019)439%20-%20web.pdf)

of water status and reducing (mainly point source) chemical pollution. However, it has not delivered on its objectives to improve water bodies' overall status.

A key problem is that lack of ambition in the adoption of measures by Member States. They are often determined by what can be delivered with the budgets and policies already in place, rather than being the result of an integrated approach. Further, they rely on easy technological fixes that address point source pollution, while leaving diffuse sources of pollution largely unaddressed. The Commission concluded that "Insufficient use is being made of the principle of cost recovery, while exemptions based on disproportionate costs are not always adequately justified".

3.1.3. Waste Management Plans

Waste management plans are the requirement of the Waste Framework Directive¹³. Each plan shall analyse the current waste management situation and set out the measures to be taken to improve environmentally sound preparing for re-use, recycling, recovery and disposal of waste. In particular each plan must state how it will support quantitative targets for recycling, landfill, etc. They must be reviewed and updated every six years. The directive sets out issues that must be (and may be) included in plans. The directive also requires Member States to establish waste prevention programmes, which may be integrated into the waste management plans. The aim of the measures shall be to break the link between economic growth and the environmental impacts associated with waste generation.

A study on the implementation of waste management plans¹⁴ found that there are major discrepancies in the proper implementation of directive – around half did not include all of the mandatory elements. Further, targets from the directive (e.g. on recycling), as well as from other directives (e.g. packaging, waste electricals, landfill, etc.) were often not properly included. As a result, many plans simply did not have sufficient detail on individual measures, even for instruments that are already in place. Included are CAC approaches (regulatory permits)

and MBIs, such as landfill taxes. Implementation remains a challenge.

3.1.4. Conclusion

The three examples of planning in EU law are not the only ones, with others covering marine waters or nature conservation areas. However, across all of these plans there are similar features – EU law establishing objectives and Member States being required to establish plans including own measures to deliver those objectives. The main variations are in whether the objectives are precisely prescribed in the EU law or are to further elaborated at Member State level and how much detail is given on what types of instruments have to be included or may be included.

A key outcome of including planning requirements in EU law is to allow flexibility of instrument choice to Member States. In theory this should allow them to analyse options and choose measures that are the most cost-effective and work with stakeholders to ensure buy-in of those measures. This approach also overcomes the limitations at EU level on the adoption of certain MBIs as these can be more readily adopted at national level. However, while these are the theoretical benefits, in practice the flexibility has resulted in significant implementation gaps across many areas of EU environmental law. The Commission has put much effort in developing guidance and support tools for different legislation, but the implementation gap remains.

3.2. COMMAND AND CONTROL INSTRUMENTS

Command and control (CAC) instruments are the most common instruments adopted at EU level to deliver environmental outcomes. EU level CAC instruments take a variety of different approaches:

- » The banning of certain activities.
- » The establishment of specific performance requirements that a regulated entity should comply with.
- » The establishment of a CAC regulatory regime, but the details of what regulated entities should do is established at Member State level.

13 Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32008L0098>

14 Report to the Commission on Waste Management Plans. 2018. https://ec.europa.eu/environment/waste/studies/pdf/WMP%20assessment_final%20report.pdf

- » The establishment of environmental objectives (e.g. an environmental standard) and an obligation on Member States to ensure activities meet those objectives. This may require adoption of a national level CAC regime.

3.2.1. The banning of certain activities

Bans are a simple and blunt form of CAC. The EU has a long tradition of restrictions on some substances being placed onto the market or for them to be used in specified products¹⁵. Further possibilities are always under review, e.g. a restriction on certain uses of microplastics. More recently, EU law has included bans on certain types of products, e.g. single use plastics¹⁶.

3.2.2. Specific performance requirements

On specific performance standards, these might either be requirements for a specified activity or they might be standards that would apply to any activity. EU environmental law had a larger number of these in its earlier legislation than it does today. Today, examples are:

- » The Urban Waste Water Treatment Directive¹⁷ sets performance standards for sewage treatment plants, with emission limit values and minimum percentage reductions.
- » The Nitrates Directive¹⁸ sets performance standards for nitrogen application by farmers.
- » The Landfill Directive¹⁹ sets conditions on the operation of landfill sites.

15 Directive 2011/65/EU of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32011L0065>

16 Directive (EU) 2019/904 of 5 June 2019 on the reduction of the impact of certain plastic products on the environment. <https://eur-lex.europa.eu/eli/dir/2019/904/oj>

17 Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A31991L0271>

18 Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A31991L0676>

19 Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A31999L0031>

- » The Mining Waste Directive²⁰ establishes specific conditions for mining waste.
- » The Carbon Capture and Storage Directive²¹ includes some specific requirements on CO₂ stream acceptance criteria.

There are few items of EU CAC law which apply not matter what activity undertakes them. The directives covering the deliberate release of GMOs and contained use of GMOs are examples. In conclusion, EU environmental law contains some specific provisions that businesses or individuals must apply in their operational/process activities without any provision for flexibility. However, it more usually establishes a CAC regime which is applied with aspects to be developed at Member State level (although much detail of what this might include may be set out in the EU law).

3.2.3. The establishment of a CAC regulatory regime

This approach is one that most typifies the EU approach to regulation of industrial activities. The Industrial Emissions Directive (IED)²² establishes a complex CAC regime. It (to a large extent) does not specify performance standards by industrial installations, but requires Member States to do this. However, in practice it is more complex than this. The IED does not apply to all industrial activities in the EU. However, it does cover all major activities. It establishes principles for the performance of installations:

- » All appropriate measures are taken against pollution.
- » Best Available Techniques (BAT) are applied.
- » No significant pollution is caused.
- » Waste generation is prevented in accordance with the Waste Framework Directive.

20 Directive 2006/21/EC of 15 March 2006 on the management of waste from extractive industries and amending Directive 2004/35/EC <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32006L0021>

21 Directive 2009/31/EC of 23 April 2009 on the geological storage of carbon dioxide <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32009L0031>

22 Directive 2010/75/EU of 24 November 2010 on industrial emissions (integrated pollution prevention and control) <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32010L0075>

- » Energy and resources are used efficiently.
- » The necessary measures are taken to prevent accidents and limit their consequences.
- » On cessation of activities, the necessary measures are taken to return the site to a satisfactory state.

Operators of installations have to apply for a permit, where they have to show how it will comply with the principles set out above, including the techniques to be applied and expected pollution emissions. After due consideration (and public consultation), a competent authority will issue a permit which will include specific emission limit values for the installation and requirements on the operator to monitor its activity and report to the regulator. Therefore, the IED is a CAC instrument which requires Member States to apply principles to develop individual CAC decisions in permits specific for each installation. However, there is a greater degree of prescription at EU level that this simple statement would suggest.

The directive requires the European Commission to organise exchange of information to develop so-called BAT reference documents (BREFs)²³. These describe the techniques that are appropriate to different categories of industry, which are considered “best” and where developments are occurring. They also set out emission limits associated with these best available techniques. Drawing on these, the Commission adopts Implementing Decisions, the so-called “BAT Conclusions”.

Having described the core regulatory framework of the IED, it is important to note that the directive does include a wide range of specific emission limits. These are all developed from much older EU law, much of it evolved since the 1970s.

3.2.4. Compliance monitoring

A critical aspect of ensuring the implementation of CAC instruments is an effective compliance monitoring regime. The IED includes a requirement for Member States to set up a system of environmental inspections for installations addressing the examination of all relevant environmental effects from those installations. Further, the authorities are to develop inspection plans covering the installations they

are responsible for. The plan should include procedures for both routine and non-routine inspections and procedures for co-operation between authorities. Importantly, the programme for routine environmental inspections shall include the frequency of site visits for different types of installation. This shall be based on “a systematic appraisal of the environmental risks of the installations” and shall not exceed one year for those posing the highest risk and three years for those posing the lowest risk.

These obligations for inspection built on a much earlier, non-binding Recommendation²⁴. This includes more detail than the IED on undertaking inspections for industrial activities. It was also a major stimulus for the network of environmental regulators in the EU (IMPEL - The EU Network for the Implementation and Enforcement of Environmental Law) to share experience and develop guidance on undertaking inspections (and also other regulatory issues such as determining permits)²⁵.

3.3. MARKET-BASED INSTRUMENTS (MBIS)

MBIs include a variety of different types of interventions. Very few MBIs have been adopted at EU level, i.e. in EU law. The main reason for this is that instruments such as taxation require unanimity amongst the Member States to be approved (which is difficult to achieve). As a result, MBIs in EU law and policy tend to be found as:

- » Rare examples of MBIs as EU law, such as the EU Emissions Trading Scheme.
- » Examples of specific obligations on Member States within EU law focused on wider issues, such as a requirement for water pricing and full cost recovery of water services in the Water Framework Directive or requirements to develop extended producer responsibility schemes.

²³ The latest BREFs can all be found here: <https://eippcb.jrc.ec.europa.eu/reference>

²⁴ <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32001H0331>

²⁵ It is important to stress the role of networking of enforcement bodies from the Member States in supporting the proper implementation and enforcement of EU environmental law. Apart from IMPEL, other relevant networks include: The Chemicals Legislation Enforcement Network (CLEEN), The European Environment and Sustainable Development Advisory Councils (EEAC), The European Enforcement Project (EEP), The European Network of Heads of Nature Conservation Agencies (ENCAnet), The European Network of Heads of Environment Protection Agencies (NHEEPA).

- » Establishment of targets in EU law, where Member States may establish their own MBIs to stimulate behavioural change to meet those targets. This is where most MBIs in the EU relevant to EU policies occur.

General Commission policy on MBIs for the environment was explored in a 2007 Green Paper²⁶, which concluded that they are a flexible and cost-effective instrument. This section draws on a recent extensive survey²⁷ of MBIs for the environment across EU Member States, which explored different types of MBIs for different environmental policy objectives as well as a study by the EEA in 2016²⁸.

3.3.1. Tradable permits

The EU's greenhouse gas Emissions Trading Scheme²⁹ is the best known EU level MBI, first adopted in 2003 and subsequently amended and extended (most recently in 2018). It limits emissions from more than 11,000 significant energy-using installations and airlines, covering about 45% of the EU's GHG emissions. The ETS is structured around trading periods (the current 3rd period ends in 2020). The legislative framework for phase 4 was revised in 2018 to support the EU's 2030 emission reduction targets under the Paris Agreement. This has:

- » Strengthened the ETS to drive investment by increasing the annual reductions in allowances to 2.2% and reinforcing the Market Stability Reserve (established in 2015 to reduce the surplus

of emission allowances and improve resilience of the ETS to future shocks).

- » Maintaining the free allocation of allowances to protect the international competitiveness of sectors at risk of carbon leakage.
- » Helping support innovation.

The EU ETS works on the 'cap and trade' principle. The cap is reduced over time so that total emissions fall. Within the cap, companies receive or buy emission allowances. The limit on the total number of allowances available ensures that they have a value. After each year a company must surrender enough allowances to cover all of its emissions, otherwise fines are imposed. If a company reduces its emissions, it can keep the spare allowances to cover its future needs or sell them.

The ETS has had criticisms and there have been challenges, especially where the market was disrupted (e.g. following the 2008 financial crisis). However, emissions have consistently fallen. In 2020 emissions from ETS activities will be 21% lower than 2005 and in 2030 it is predicted they will be 45% lower than 2005, so contributing to EU climate objectives and its Paris Agreement commitments. Under the 2020 European Green Deal³⁰, the Commission will present a plan to increase the EU's GHG reduction target, including for the EU ETS. Therefore, the instrument remains subject to evolution and revision to accommodate changing circumstances and objectives.

The EU ETS has been the subject of extensive analysis^{31, 32, 33}. It is useful to highlight the following:

- » It is important to set the cap realistically to provide an incentive.

26 European Commission 2007. Green Paper on market-based instruments for environment and related policy purposes (COM(2007)140). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52007DC0140>

27 Watkins E., Withana S. and ten Brink P. 2017. Capacity building for environmental tax reform. *Capacity building, programmatic development and communication in the field of environmental taxation and budgetary reform* by IEEP, DCE Aarhus University, ENT Environment and Management, Eunomia, Green Budget Europe, IVM, PBL, Cambridge Econometrics, Denkstatt, Galovic Savjetovanje, SEI, Ekokonsultacijos, Janis Brizga, Katja Kavcic Sonnenschein and Prof. Theodoros Zachariadis (Cyprus University of Technology). Institute for European Environmental Policy, Brussels / London.

28 EEA 2016. Environmental taxation and EU environmental policies. EEA Report No 17/2016. European Environment Agency, Copenhagen. <https://www.eea.europa.eu/publications/environmental-taxation-and-eu-environmental-policies>

29 Consolidated text: Directive 2003/87/EC of 13 October 2003 establishing a system for greenhouse gas emission allowance trading within the Union and amending Council Directive 96/61/EC. <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1585298580371&uri=CELEX:02003L0087-20180408>

30 The European Green Deal. (COM(2019)640) https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf

31 European Commission. EU ETS Handbook. https://ec.europa.eu/clima/sites/clima/files/docs/ets_handbook_en.pdf

32 ERCST, Wegener Center, ICIS, I4CE and Ecoact 2019. State of the EU ETS Report <https://www.i4ce.org/wp-core/wp-content/uploads/2019/05/2019-State-of-the-EU-ETS-Report.pdf>

33 Mušils, M., Colmer, J., Martin, R., and Wagner, U. 2016. Evaluating the EU Emissions Trading System: Take it or leave it? An assessment of the data after ten years. Grantham Institute Briefing paper No 21. Imperial College. https://www.imperial.ac.uk/media/imperial-college/grantham-institute/public/publications/briefing-papers/Evaluating-the-EU-emissions-trading-system_Grantham-BP-21_web.pdf

- » Any instrument should take account of other policies. For example, countries in the EU are making major structural changes to energy generation, such as phasing out coal generation. How such changes affect allowances must be factored in.
- » Prices have tended to be low and this has affected its ability to be a driver of change.
- » An ETS can be initially designed around some activities and expanded to cover others (such as aviation). This allows different sectors to be accommodated and adjustments made.
- » It is important to allow for evolution in the design of the instrument, so the introduction of the Market Stability Reserve in 2019 is an important development as it is expected to tackle the historical surplus of allowances.
- » The EU ETS has not been found to have a significant negative economic impact.
- » In the EU the companies affected are largely able to pass on costs to consumers.

3.3.2. Environmental taxes and charges

EU level policy

Various strategic EU policies have emphasised the importance of environmental taxes and charges to deliver environmental outcomes. For example, the EU Flagship Initiative for a Resource-Efficient Europe³⁴ called for environmental taxes to account for 10% of total tax and social contribution revenues by 2020. However, EU level environmental taxation has been difficult to develop. In the 1990s a carbon tax was considered, but was opposed by some Member States and stakeholders. A directive on energy taxation was adopted in 2003. There is also consideration being given to a carbon border tax. There were also proposals to include a plastics-related 'tax'³⁵.

However, many environmental taxes and charges are found at Member State level. The summary

here draws on the recent examinations of MBIs in Member States undertaken by the European Environment Agency³⁶ and Watkins et al.³⁷, together with some further supplementary information.

Taxes and charges in the Member States

Energy taxation

The directive on energy taxation³⁸ sets minimum levels of taxation and lays down the conditions for applying tax exemptions and reductions. Member States are free to apply rates above these minimum levels. All revenues go to the budget of the Member States. The objective is to support the proper functioning of the internal market by avoiding double taxation. It also contributes to the achievement of EU policies, including environment and climate change. In 2019 the Commission published an evaluation of the directive³⁹. It found that the contribution of the minimum levels of taxation set by the directive is limited. The conditions of energy production, the enlargement of the EU and other objectives, such as climate commitments, have changed significantly since the instrument was adopted in 2003.

Further examples of energy taxes are provided in EEA (2016) and some EU countries have introduced carbon taxes. The EEA considers that the difference in objectives of energy and carbon taxation is "energy taxes aim mainly to decrease energy consumption, while carbon taxes aim to incentivise a shift in the energy mix away from carbon-intensive energy sources". Early examples are carbon taxes in Finland and Sweden. These have evolved since the 1990s to include France, Portugal, Croatia, Poland, Estonia and Latvia, with perhaps the most detailed being the climate change levy in the UK.

34 A resource-efficient Europe – Flagship initiative under the Europe 2020 Strategy. (COM(2011)21)) <https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A52011DC0021>

35 Proposal for a Council Decision on the system of Own Resources of the European Union (COM(2018)325), <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1527242435118&uri=CELEX%3A52018PC0325>

36 EEA 2016. Environmental taxation and EU environmental policies. EEA Report No 17/2016. European Environment Agency, Copenhagen. <https://www.eea.europa.eu/publications/environmental-taxation-and-eu-environmental-policies>

37 Watkins, E., Brink, P., Withana, S., Russi, D., Illes, A., Mutafoglu, K., Ettlinger, S., Andersen, M. S., and Branth, A. (2017). Capacity building, programmatic development and communication in the field of environmental taxation and budgetary reform. <https://ieep.eu/uploads/articles/attachments/de8980ef-e9cc-49f2-b66e-ac7a71be9e15/ETR%20and%20Civil%20Society%20Final%20Report%20191217%20FINAL.pdf?v=63680917736>

38 Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32003L0096>

39 Evaluation of the Council Directive 2003/96/EC. SWD(2019)329. https://ec.europa.eu/taxation_customs/sites/taxation/files/energy-tax-report-2019.pdf

Air Pollution taxes

There is a range of different types of air pollution taxes and charges in the EU (Watkins et al.). These include air pollution fees in the Czechia and Slovakia; air pollution load charges in Hungary; a NO_x fee and an SO₂ tax in Sweden; and a tax on fluorinated greenhouse gases in Spain.

The rates applied have a strong impact on the effectiveness. The low level of air pollution fees in Slovakia and (before 2012) in the Czechia provided little incentive for companies to decrease their emissions. As a result, emission reductions were delivered through CAC instruments as well as industrial restructuring. However, the moneys raised can further support changes by industry. Thus the air pollution fee in the Czechia is paid to businesses that deliver emissions lower than would be expected by BAT under IED. In Sweden, the NO_x fee paid by installations is refunded to them if they achieve energy efficiency targets (so providing an incentive other than NO_x reductions).

Taxes and charges for waste management

These include landfill taxes (Austria, Greece, UK), PAYT (Belgium, Luxembourg and the Netherlands), plastic bag charges (Ireland, UK), packaging taxes and charges (Belgium, Latvia and Romania), deposit return schemes (Finland), an aggregates levy (UK), mineral extraction charge (Lithuania) and a tax on the use of peat for energy (Finland). In this area those paying the tax/charge probably vary more than other environmental areas. They include industrial operators, extractive industry, producers, waste companies, consumers and households.

The effectiveness of the instruments varies depending on the level applied, interaction with wider policies, engagement with stakeholders, and efficiency of the administration. In some cases, there has been stakeholder opposition or lack of cooperation between government departments. However, several have shown significant success, including landfill taxes reducing landfill rates, PAYT (reduced household waste generation), deposit return scheme, and plastic bag levy.

Taxes and charges to address water pollution

On water quality, taxes and charges are applied to particular discharge sources or different substances that can result in water pollution. Examples include wastewater fees (Poland), taxes on pesticides (Denmark, Sweden, Italy) and fertilizers (Denmark). Note that taxes and charges on packaging (see above) may also contribute to litter reduction in rivers and seas.

The effectiveness of the instruments has varied. The Swedish fertilizer tax led to a reduction in the application of excessive application by farmers. However, Denmark shows the need to keep instruments updated. The animal feed mineral phosphorus tax became ineffective as it did not increase as inflation increased. In contrast, its pesticide tax has been adjusted over time specifically to improve its effectiveness.

Taxes and charges to address water quantity management

As noted earlier, the Water Framework Directive obliges Member States to adopt water pricing to recover the costs of water services. However, the Commission found that water pricing in the EU often does not fully cover the principles of the directive. In about one third of Member States only public water supply and waste water collection/treatment are covered. In more than one third of Member States a rather wide definition of water services is used, including activities that have a significant impact on water bodies, e.g. hydropower, navigation and flood protection, abstraction for irrigation and industrial purposes. The Commission found it difficult to determine whether Member States were using incentive pricing and whether the charges incentivise lower water use, especially for major users such as agriculture.

Taxes and charges to deliver biodiversity protection

There is a range of different taxes and charges aimed at protecting biodiversity (noting those described above on littering, water pollution or water use also contribute to biodiversity objectives). Examples include fishing and hunting fees, public and/or private financing for the conservation and sustainable use of forests, and payments for ecosystem services, including a forest public benefit fee (Croatia), forestry-related payments (Slovenia and Spain), fishing fees (Ireland), hunting and fishing fees (Estonia), offsetting (Germany), ecological fiscal transfers (Portugal).

The environmental effectiveness of some of the taxes has been limited. Some have had more impacts, such as reduced salmon fishing (Ireland) and improved forest management (Croatia). Some positive economic impacts have been observed, including job creation (German offsetting) and contributions to municipal budgets (Portugal). Social benefits include increased recreational and tourism activities related to forests (Spain, Slovenia, Croatia).

Conclusions on the effective design of taxes and charges

Watkins et al stressed the following lessons learned from the design and application of the instrument across the EU to ensure they are well designed:

- » Prior to the introduction of a tax or charge, it is very important to define precise objectives and to carefully design the instrument to deliver these.
- » The tax rate applied (and future change) has a strong impact on the effectiveness in stimulating behaviour change. Successful approaches include adopting a low initial tax rate with predictable increases or a high initial rate to give a strong behaviour signal.
- » The scope of the tax base, where/on whom it is applied and how it is calculated influences both effectiveness and acceptability.
- » Managing administration costs can help convince economic operators that an instrument will not be unduly burdensome.
- » Introducing economic instruments as part of a wider package of measures can ensure coherence with other policies.
- » Clear communication to affected stakeholders and civil society is critical to success.
- » How revenues are used has an influence on their impact, political and public acceptability, and potential to mitigate adverse impacts.
- » Regular monitoring, evaluation and revision are critical to ensure continued effectiveness.

3.3.3. Producer responsibility schemes

A key instrument in the delivery of management of materials in products is extended producer responsibility (EPR) where producers are responsible for products when consumers have finished using them. This is an important part of EU policy on different product types – packaging, vehicles and electronic goods. EU law typically requires Member States to ensure EPR schemes are established at national level. With large companies (e.g. motor industry), they may organise their own take back schemes, but for others, such as packaging, one or more producer responsibility organisations (PROs) may be established through fees levied on manufacturers.

For some issues, EPR is working relatively well. For end-of-life vehicles, there is relatively good achievement of the 95% reuse/recovery targets⁴⁰. For waste electrical and electronic equipment (WEEE)⁴¹, Leroy⁴² stated that for many Member States there is a major gap between current collection rates and the targets in the law. One major concern is that two thirds of WEEE are not reported and, therefore, cannot be accounted for. Therefore, improved tracking and, in particular, enforcement is necessary.

There is a wide diversity of EPR schemes for packaging⁴³ in the EU and interesting lessons can be learnt from these⁴⁴. It is also useful to note that the new 2019 Directive on single use plastics also requires the adoption of EPR schemes and that money raised from such schemes can be used for different purposes, such as awareness raising schemes for the public to help reduce littering.

In conclusion, EPR schemes are a useful instrument to stimulate improved performance by companies, both in the management of waste products, but also in improving product design. Moneys raised can also be used for other beneficial purposes, such as raising public awareness.

40 Directive 2000/53/EC of 18 September 2000 on end-of life vehicles <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02000L0053-20130611&qid=1405610569066&from=EN>

41 Directive 2012/19/EU of 4 July 2012 on waste electrical and electronic equipment (WEEE). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32012L0019>

42 Leroy, P. (2019). Bridging the distance to target. Proceedings of the First International Symposium on Electronic Waste and End of Life Vehicles. 19-22 May 2019. Jeju, South Korea. Pp. 16-24.

43 Consolidated text: European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:01994L0062-20150526>

44 Watkins, E., Gionfra, G., Schweitzer, J.P. Pantzar, M., Janssens, C. and ten Brink, P. (2017). EPR in the EU Plastics Strategy and the Circular Economy: A focus on plastic packaging. Institute for European Environmental Policy, Brussels. <https://ieep.eu/uploads/articles/attachments/9665f5ea-4f6d-43d4-8193-454e1ce8ddfe/EPR%20and%20plastics%20report%20IEEP%2019%20Dec%202017%20final%20rev.pdf?v=63680919827>

3.3.4. Liability

Liability is an important financial instrument to ensure those which cause damage to the environment pay for that damage and so costs for restoration are met and there is a disincentive to pollute, etc. The EU's liability regime⁴⁵ (ELD) imposes a strict liability obligation on the operator of a list of activities regulated under existing EU environmental laws to remedy or prevent three types of damage to the environment: to protected species and natural habitats, water and land. It also imposes fault-based liability on all other occupational activities for damage to species and habitats. The liabilities are imposed by means of public, administrative law, rather than private, civil law, meaning that enforcement is confined to actions brought by public authorities, with private individuals and groups limited to requesting action from those authorities.

The most recent implementation study⁴⁶ found that between April 2007 and April 2013, Member States reported 1,245 confirmed incidents of environmental damage which triggered the application of the ELD. However, the number of cases varied greatly, so only two Member States accounted for 86% of all cases and six Member States reported most of the rest. Some did not report any cases, but that may be because they use national systems. The Commission concluded that effectiveness of the directive varies significantly. This is partially caused by the directive, which provides for many exceptions, options and flexibility. There are insufficient data to determine whether the directive is having an incentivising effect. The Commission has developed a programme⁴⁷ to make the regime more fit for purpose. The goal is to make the ELD deliver better on its original objectives – to prevent and to remedy environmental damage based on the polluter-pays principle.

In conclusion, the liability regime in the EU is recognised as an important pillar in incentivising environmental performance and supporting restoration of damage. However, more needs to be done to make

this regime effective. It should also be noted that liability is linked to the application of civil and criminal regimes for environmental offences, which while guided by EU law, have much diversity across the EU (and which is beyond the scope of this chapter)⁴⁸.

3.3.5. Green public procurement

Another approach is Green Public Procurement (GPP). Due to the purchasing power of public institutions this can stimulate a critical mass of demand for more sustainable goods and services. Many Member States may have requirements for GPP on their public administrations. Such requirements must be consistent with the basic requirements of EU law on the operation of the single market and fair competition. The European Commission has stated that, to be effective, GPP requires the inclusion of clear and verifiable environmental criteria for products and services in the public procurement process. It has developed a range of guidance documents and other support tools for GPP⁴⁹. It is not possible to explore GPP further within this chapter, but it is important to highlight the importance of this instrument within the overall policy mix.

3.3.6. Comparison of instruments

In examining the relative importance of these MBIs to environmental protection, it is first important to stress that while some types of instrument might have limited impacts, this does not mean that it does not play a key role. The second important point is that, across all MBIs, their effectiveness depends on the details of their design and implementation. An ETS or a tax will not deliver what is expected of it if it is not well designed.

In a national suit of instruments, for the MBIs considered here, it would be reasonable to perhaps adopt some types and not others depending on need. However, one instrument at least should be adopted in any case – that of a liability regime. There should be a strong presumption of principle that those causing environmental damage should pay for it. The EU regime is somewhat limited (and

45 Directive 2004/35/EC of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02004L0035-20190626&qid=1568193390794&from=EN>

46 Report from the Commission on environmental liability with regard to the prevention and remedying of environmental damage. (COM(2016)204). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2016:204:FIN>

47 Multi-Annual ELD Work Programme (MAWP) For the Period 2017-2020 "Making The Environmental Liability Directive More Fit For Purpose". https://ec.europa.eu/environment/legal/liability/pdf/MAWP_2017_2020.pdf

48 For a detailed examination of civil and criminal environmental regimes in the EU see: Farmer, A.M., Faure, M. and G.M. Vagliasini, G.M. (2017). *Environmental Crime in Europe*. Bloomsbury Publishers. <https://www.bloomsbury.com/au/environmental-crime-in-europe-9781509914012/>

49 For information of guidance, criteria, best practice, etc. see: https://ec.europa.eu/environment/gpp/index_en.htm

rather complicatedly linked to national regimes). Liability will not deliver many environmental outcomes, but it has a key specific role.

Green public procurement (or some variation of it) also is a straightforward policy to adopt. If Government considers certain objectives are important, it is not unreasonable for it to require that public spending is consistent with those objectives. This can go further than immediate purchases to influencing the supply chains of suppliers. Both China and the EU have large public spending budgets, so the potential impact of such a policy is enormous.

With environmental taxes, design is critical. The rate must be sufficient to change behaviour and effort must be made to ensure stakeholders at least understand the reasons for its introduction (even if there is still resistance). They can be extremely effective if they are well targeted. Changes in behaviour for packaging, for example, can occur quickly by millions of consumers. Therefore, the effects might be delivered more quickly than with other instruments. However, when trying to influence industry, care needs to be taken to understand other market and price signals and trends. Often behaviour might change, but the instrument might have had a negligible effect.

Finally, an ETS is a major instrument to introduce. There are not only complexities of design, but its implementation requires markets for trading, significant effort to ensure annual changes provide sufficient (but not damaging) pressure and there is a need for good compliance assessment. The conditions in any country (pricing, objectives, expected industry behaviour) will vary.

3.4. FINANCIAL INSTRUMENTS

The EU has a several financial instruments which may support environmental outcomes, which may be additional to the primary purpose of those instruments. Further, where spending is directed to non-environmental objectives, these instruments have conditions attached that, at a minimum, aim to avoid negative consequences to environmental objectives and, often, aim to add environmental value to the spend. This chapter provides a brief overview of the Regional Funds and European Agricultural Fund for Rural Development as well as the EU's dedicated environment fund, LIFE.

There are several further EU funding programmes which can support environmental outcomes, such

as the European Fisheries Fund, EU Solidarity Fund, Civil Protection Financial Instrument and Competitiveness and Innovation Programme. Further there is the EU's research programme, Horizon 2020, which has nearly €80 billion of funding available over 2014 to 2020 and includes several areas of support for environmental research. However, further detail on these programmes is not possible within the limitations of this chapter.

The amount and distribution of these financial resources is set periodically by the EU institutions in a multi-annual 'Financial Perspective'. This includes the maximum amounts of financial commitments and payments for different categories of spending priorities to be respected in annual budgets.

3.4.1. EU Structural and Investment Funds

The European Regional Development Fund (ERDF)⁵⁰ aims to strengthen economic and social cohesion in the EU by correcting imbalances among its regions. For 2014-2020 it concentrates on four key priorities: innovation and research (including eco-innovation), the digital agenda, support for SMEs and the low-carbon economy (e.g. energy efficiency, renewable energies, smart distribution grids, sustainable multimodal urban transport). Around €110 billion is dedicated to these sectors, of which at least €27 billion supports the shift to a low-carbon economy. Together with the European Social Fund (ESF), it comprises the EU Structural and Investment Funds. The Cohesion Fund is intended to strengthen economic and social cohesion in the EU through the provision of EU finance to programmes and projects in the poorest Member States, specifically in the fields of environmental protection and transport infrastructure.

To implement these funds, Member States produce one or more Operational Programmes which set out the spending priorities justified against the needs of the countries/regions and consistency with the EU priorities. The Commission evaluates these before they are implemented. Examples of spending include water and waste management and support to nature protection.

50 Regulation (EU) No 1301/2013 of 17 December 2013 on the European Regional Development Fund and on specific provisions concerning the Investment for growth and jobs goal and repealing Regulation (EC) No 1080/2006 <https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A32013R1301>

3.4.2. The European Agricultural Fund for Rural Development (EAFRD)

The EAFRD⁵¹ is known as the ‘second pillar’ of the Common Agricultural Policy and consists of a framework to support sustainable rural development objectives and has a budget of around €100 billion for 2014-2020. The three objectives for 2014-20 are:

- » Fostering the competitiveness of agriculture.
- » Ensuring the sustainable management of natural resources, and climate action.
- » Achieving a balanced territorial development of rural economies and communities including the creation and maintenance of employment.

The implementation of the EAFRD is guided at Member State level by the production of Rural Development Plans. These are checked by the European Commission to ensure their priorities meet EU requirements. For example, at least 30% of funding for each RDP must be dedicated to measures relevant for the environment and climate change.

3.4.3. LIFE

The LIFE programme for 2014-2020⁵² has four objectives to:

- » Help move to environmental and climate governance at all levels, including better involvement of civil society, NGOs and local actors.
- » Support the implementation of the 7th Environment Action Programme.

The LIFE programme is supported by a multi-annual work programme, revised every two years and these provide more specific detail on the kinds of projects that can be supported. The current work programme for 2018 has a budget of €1,243.81 million for projects focused on nature conservation and the environment and €413.25 million for climate action.

3.5. POLICY INTEGRATION AND EVALUATION

Policy integration is complex and involves different approaches in the EU. This section considers two aspects of policy integration:

- » How different instruments are brought together to deliver an objective.
- » How environmental objectives might be integrated within other policy areas.

This section also examines the EU’s approach to policy evaluation, itself a mechanism for policy integration. A variety of different instruments are developed at EU level. For many environmental problems more than one instrument is focused on that problem and the question arises as to how these different instruments interact and, in particular, how CAC instruments and MBIs interact. The nature of these interactions is complicated by the fact that few MBIs are adopted at EU level. Therefore, there is very limited experience of co-designing an EU CAC instrument and an EU MBI that interact with each other. There are EU level instruments which encourage or even require MBIs to be developed by Member States. Clearly such Member State level MBIs have to be consistent with the EU level instrument, but they are not co-designed.

3.5.1. Interaction between an EU CAC Instruments and EU MBIs

It is useful to begin with the interaction of two key EU instruments – the IED (CAC) and the ETSD (MBI). It is first important to note that even for industry the scope of the two directives is different – there are industrial activities which are regulated by IED, but which are not subject to the ETSD; there are also industrial activities that are captured by the ETSD, but are not regulated under IED. However, core major industrial activities are subject to both instruments.

Under IED, as described earlier, installations should apply BAT and authorities should set conditions in permits consistent with BAT, including pollutant emission limit values (which could include greenhouse gases). BAT also applies to other issues, such as energy efficiency. There are, therefore, different elements that could interact with emissions trading. As a result, when the IED was adopted in 2010 it included a specific Article 9 which states that “Where emissions of a greenhouse gas from an installation are specified the ETSD, the permit shall not include

51 Regulation (EU) No 1305/2013 of 17 December 2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) and repealing Council Regulation (EC) No 1698/2005 <https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX:32013R1305>

52 Regulation (EU) No 1293/2013 of 11 December 2013 on the establishment of a Programme for the Environment and Climate Action (LIFE) and repealing Regulation (EC) No 614/2007 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2013.347.01.0185.01.ENG

an emission limit value for direct emissions of that gas” also “for activities listed in the ETSD, Member States may choose not to impose requirements relating to energy efficiency on the site”. Therefore, an attempt was made to ensure that the CAC and MBI instruments at EU level are compatible with each other in their practical implementation on the ground.

3.5.2. Impact assessment as an integrating mechanism

Impact assessment legislation is an important part of EU environmental law. There are two key instruments – the Environmental Impact Assessment (EIA) Directive⁵³, which applies to individual development proposals, and the Strategic Environmental Assessment (SEA) Directive⁵⁴, which applies to plans and programmes which may form the framework for development consents.

The EIA Directive applies to a wide range of defined public and private projects. It is mandatory to specified projects (tending to be larger), such as long-distance railway lines, motorways, waste installations, etc. and is discretionary for a second list of projects. This is done by the “screening procedure”, which determines the effects of projects based on thresholds/criteria or a case by case examination and authorities must take into account the criteria in the directive. For each project the developer must supply at least the following:

- » A description of the project with information on site, design and size.
- » The data required to identify and assess the main effects on the environment.
- » A description of measures to avoid, reduce and possibly remedy significant effects.
- » An outline of the main alternatives.

The last full implementation study⁵⁵ of the EIA Directive found good compliance with compulsory projects. When establishing thresholds for discretionary projects, Member States often exceeded their margin of discretion, which had a major impact on the amount of EIA activity. For this reason, the Commission produced guidance⁵⁶ clarifying the scope and definition of project categories to ensure that projects likely to have significant effects on the environment do not fall outside the scope due to issues of interpretation. Further, there were cases in which cumulative effects were not taken into account and also problems remained when it came to eliminating ‘salami slicing’ practices, especially for big investment plans.

An SEA is mandatory for plans and programmes for many activities and which set the framework for future development consent of projects listed in the EIA Directive. It also covers those which have been determined to require an assessment under the Habitats Directive (the EU’s main legislation for biodiversity protection). For other plans and programmes, Member States must screen those and if they might have significant environmental impacts, they should also be subject to SEAs. The SEA is that an environmental report is development identifying the environmental impacts of the plan and setting out reasonable alternatives, along with requirements for public consultation.

The Commission’s last implementation report⁵⁷ found most Member States have acknowledged that the proper consideration of the alternatives can influence the content of plans and programmes, but in practice the alternatives focus mainly on reducing or mitigating the negative impacts, but this can effectively ensure environmental protection. Many Member States also noted that SEA is more likely to influence small scale and regional plans and programmes (e.g. land use) rather than national plans and programmes for which the strategic decisions are often taken at political level.

53 Dating from 1985, but amended and consolidated as Directive 2011/92/EU of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32011L0092> and since amended by Directive 2014/52/EU <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014L0052>

54 Directive 2001/42/EC of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32001L0042>

55 Report from the Commission on the application and effectiveness of the EIA Directive (Directive 85/337/EEC, as amended by Directives 97/11/EC and 2003/35/EC). (COM(2009)378). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52009DC0378>

56 A wide range of guidance documents have been developed to support EIA: <https://ec.europa.eu/environment/eia/eia-support.htm>

57 Report from the Commission on the assessment of the effects of certain plans and programmes on the environment. COM(2017) 234. <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1494874134751&uri=COM:2017:234:FIN>

The environmental assessment directives have significantly changed the decision making in the EU both for individual development activities and plans and programmes. By ensuring environmental impacts are set out in a transparent way and that alternatives are explored, the processes effectively act as mechanisms to deliver environmental policy integration.

3.5.3. Bringing instruments together at national level

Several key EU environmental laws establish binding objectives on Member States and allow them to develop their own instruments to achieve those objectives. In some cases, some types of instrument to be used are specified, in others not. In most cases they can include CAC instruments or MBIs. Therefore, how these instruments are used together to deliver an objective is largely a matter for Member States. The context of the application of these different instruments are the planning instruments adopted at EU level described earlier. Within these different MBIs have been adopted. In all cases the challenge is for Member States to develop a basket of instruments which deliver the binding objectives set at EU level.

In the area of air quality, Member States have adopted different approaches and mix of instruments. The objectives are set at EU level. There are also some binding EU level instruments that contribute to achieving air quality objectives, including emission standards from vehicles and fuel quality standards and CAC approaches to industrial emissions. However, in many urban areas these are not sufficient on their own to deliver the air quality that is needed. Other measures adopted by Member States may include:

- » Additional CAC approaches not included in EU law, e.g. smaller industrial pollution sources.
- » Use of selective MBIs, such as congestion charging or NOx trading.
- » Bans, such as permanent or periodic restrictions of specified types of vehicles.
- » Planning decisions to manage traffic, re-site industry, etc.
- » Awareness raising.
- » Financial support or spending on public transport, electric charging, etc.

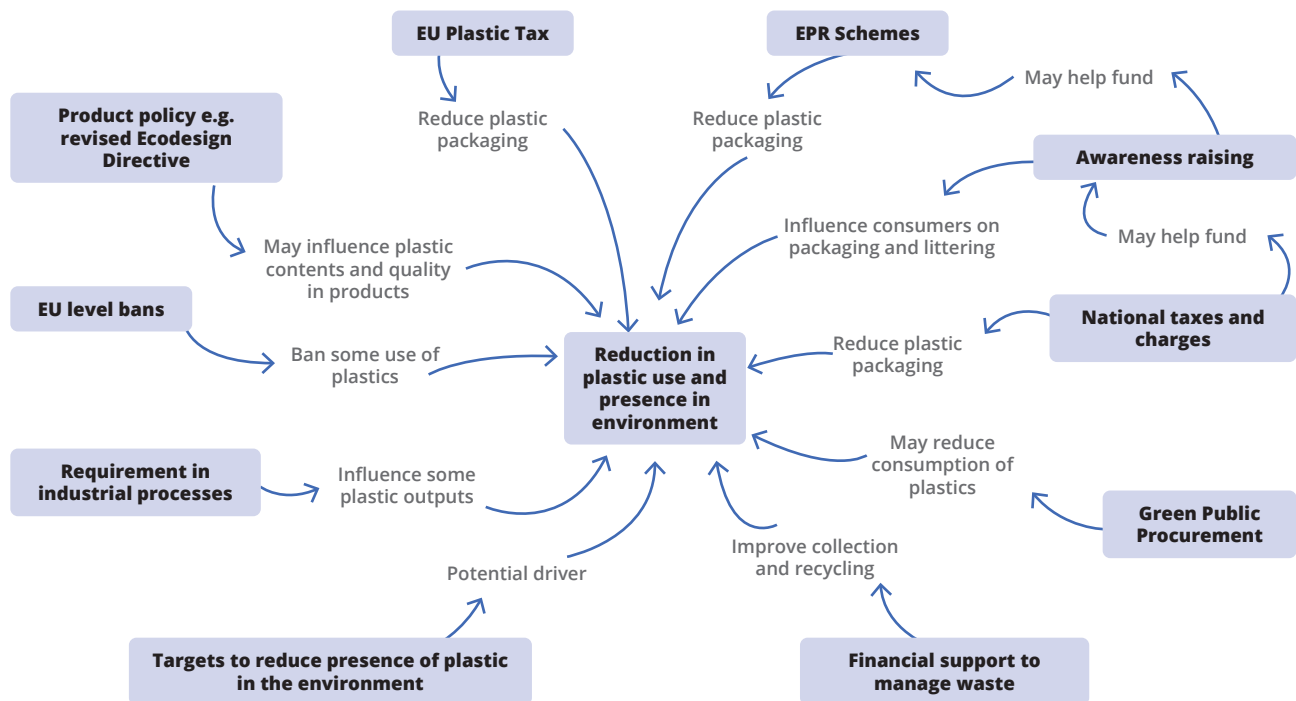
In the area of waste management and the circular economy the range of different instruments used at Member State level is large. At EU level there are binding targets, such as on rates of recycling, limitations on landfill, etc., but in some areas binding targets are lacking (e.g. on waste avoidance) although these are still a focus for Member State action. Instruments include:

- » CAC instruments derived from EU level, such as the Waste Framework Directive, Waste Shipment Regulation and producer responsibility directives.
- » Additional CAC instruments at Member State level.
- » Bans, such as on plastic bags.
- » MBIs such as plastic bag charges, landfill charges, pay-as-you-throw, incentivised deposit return schemes, etc.
- » EPR schemes – several are mandatory under EU law, while others are encouraged at EU level.
- » Fiscal instruments, e.g. differential taxation between primary and secondary raw materials.
- » Planning instruments, e.g. co-location of businesses to reuse materials, etc.
- » Awareness raising to facilitate better reuse, recycling, avoidance of littering, etc.
- » Financial support to innovation in material use, etc.

Figure 3.1 summarises the range of potential instruments contributing to use of plastics. It shows that the instruments include CAC, MBIs and others and that these are EU level instruments and those developed at national level. Interestingly each instrument affects different aspects of plastic production, packaging, products, consumption, waste management, etc. However, none of the instruments sets an overall target for the amount of plastic.

The challenge in bringing the different instruments together for waste management and the circular economy is the wide diversity of actors and of materials and further diversity in these across different urban and rural areas. The lessons from Member States are that objectives may be achieved using different types of instrument. For example, reducing plastic bag use has been achieved in some countries

Figure 3.1. An overview of different types of instruments that can be used to affect a reduction in plastic use and its presence in the environment



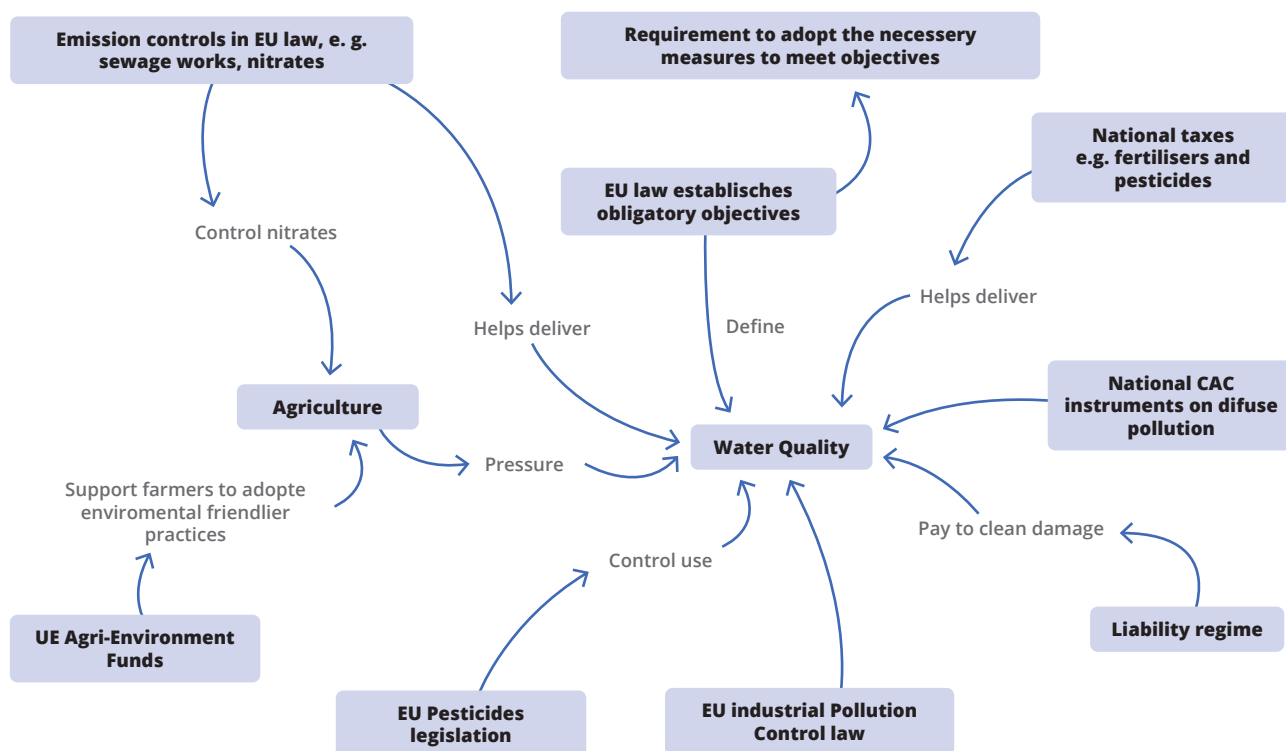
through use of charges and in others by using bans. Cultural differences between countries and historical situations also influence both the choice and mixture of instruments, e.g. whether to charge for bad behaviour or reward good behaviour, whether awareness raising works, etc. In countries where waste management is strongly influenced by criminal activity, different instrument approaches are required.

With regard to water, the primary management framework is the River Basin Management Plans required in EU law. These require the development of measures at Member State level to meet water quality and quantity objectives. Some are obligatory under the directive, such as CAC approaches to point and diffuse pollution or water abstraction (if these are a problem) and one MBI - that of water pricing. Beyond this the directive effectively requires Member States to adopt whatever instruments will achieve the objectives. These could include further MBIs (e.g. trading of water permits), fiscal instruments (pesticide or fertiliser taxes), planning (for water use, improved urban drainage, etc.), awareness raising and, in particular, financial support. Overall, with water management in the EU the main combination of instruments that has been most influential have been CAC instruments (mostly derived from the EU level) and financial support instruments.

Figure 3.2 summarises the different instruments (EU and national) affecting water quality – including strong CAC instruments, MBIs and others. Importantly, a major difference with the example of plastics (Figure 3.1) is that EU law sets out a binding objective for water quality (further broken down into its different elements). Therefore, there is a strong driver to develop different instruments and develop the mix necessary to achieve this target.

In conclusion, the nature of instrument mix within the EU is a complex issue. The EU is not like a country where the optimum mix of CAC instruments and MBIs might be determined. The limited development of MBIs at EU level means that what would be the most appropriate instrument mix may not be what is adopted. Further, increasingly much instrument development is left to the Member States. This means that the situation will vary across the EU. This has potential benefits in enabling the instrument mix to address very different situations. However, on some issues additional EU level action may be needed, especially if this affects the EU's internal market. Therefore, the nature of the optimal instrument mix and how different instruments (EU and national) and integrated is a rapidly evolving area.

Figure 3.2. An overview of the different types of instruments that can be used to deliver objectives for water quality



3.5.4 Integrating environmental objectives into other policy areas

Environmental Policy Integration (EPI) was a key area of policy debate in the EU and other regions of the world in the 1990s and early 2000s. Today in the EU the term is far less frequently encountered. This is because the earlier debate around political choices and processes has evolved into technical processes for policy evaluation which should deliver such integration.

EPI is the process of placing environmental considerations within the decision-making of sectoral policies such as energy and agriculture, i.e. that environmental objectives become central to the decision-making process relating to a particular sector rather than being pursued separately through purely environmental policy instruments. Environmental integration is achieved by changing the ways in which institutions function and altering the resulting sectoral policies.

The rise of EPI in the EU is found in the series of (Environmental Action Programmes (EAPs)) of the EU. As far back as the first EAP (1973–1976) the need for an integrated approach was noted. In 1997 a new

EU Treaty was signed, which included a new integration requirement in Article 6. As a result, the European Council took a new initiative on EPI, and the Commission was asked to produce a strategy to integrate environment into other policy areas. This led to a Commission Communication, *A strategy for integrating environment into EU policies – Partnership for Integration* (COM(98)333)⁵⁸. It set out practical steps for implementing the integration principle within the three EC institutions. The major outcome from this was the “Cardiff Process”, whereby different Council formations covering sectoral policies produced strategies for EPI. This represented the high point of activity on EPI – after a few years the strategies were not followed up and while this process was never officially stopped, EPI as an explicit activity became far less prominent.

In effect, the debate on EPI over the years leading to the Cardiff Process was essentially one of high policy and political discussion with occasional argument about individual policy concerns. The problem was to develop a clear, practical process to perform EPI

58 <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM%3A128075>

– how to analyse policy objectives in an integrated way. The rise of ex-ante Impact Assessment provided this analytical framework and essentially the debate in the EU moved to examination of these methods (how and where to use them). This is the subject of the next section.

However, integration should be expected to deliver results in relation to changes in sectoral policies. There have been positive steps. For example, the Common Agricultural Policy, which has been heavily criticised for its environmental impacts, has not only developed measures to link its financial support mechanisms to farmers with some environmental outcomes, but also has specific funds for farmers to undertake environmental actions. However, even with these positive steps it is still subject to criticism and a major constraint is the political influence of the farming industry in certain Member States. It is worth noting that some EU level policy areas have made more limited progress in environmental integration, such as trade (but this is also a matter for agreement with third countries).

3.5.5. Institutional responses

The importance of EPI may be set out in strategic documents, but it is important that this is reflected in institutional structures and in policy processes. Co-ordination across the Commission is the responsibility of the Secretariat General. This role has grown in importance as legislation has become comprehensive and as major policy challenges (environmental, social and economic) require action in a range of policy fields. The Secretariat General leads on strategic policy development and ensures different Directorates General (DG) of the Commission (responsible for different policy areas) coordinate activities, follow agreed strategic policy initiatives and conduct policy evaluations according to agreed procedures.

DG Environment is organized into six divisions, one of which covers different horizontal issues (such as funding, enforcement, etc.), but also “policy co-ordination”. Within this is a specific Unit “Coordination, Inter-Institutional Relations and Planning”. This leads on relationships with other Directorates General. However, much of the challenge of policy integration is about detail and the individual Units responsible for specific policy areas have specific responsibilities to discuss those details with other parts of the Commission.

With regard to the Council, there is co-ordination within the different formations (policy areas) of the

Council, but the Council is the representation of the Member States and, therefore, it is the processes and structures that Member States put in place which is reflected in the views within the Council. In practice this varies significantly. Some Member States organise detailed cross-ministerial consideration of policy initiatives and some undertake their own impact assessment. However, this is not the case in others.

The European Parliament also structures its work according to major policy areas (its Committees) and, therefore, it has a challenge of integrating policy development. When the Commission publishes a proposed piece of legislation, the Parliament assigns this to the most appropriate Committee (Environment, Agriculture, etc.). Where the proposal has obvious interests for other policy areas, then other Committees will be given a supporting role. Committees scrutinise the proposal and make recommendations for amendments. However, it is the plenary of the Parliament (all Members of the Parliament) which votes on those amendments. Therefore, different interests are brought together in the final decision making. Further, in the support structures in the Parliament at dedicated Impact Assessment service was created in 2012, which draws on expertise across policy areas to support the work of the Committees (further information on this is given below).

Overall, the different EU institutions have recognised the structural responses needed to support policy integration. The outcomes do ensure more cross-sectoral policy consideration, although there is a challenge ensuring the right issues are coordinated and lessons are continually being learned.

3.5.6. Environmental policy evaluation

The EU has developed detailed approaches to ex-ante policy assessment (Impact Assessment - IA) and ex-post policy evaluations. These requirements apply to all policy areas and require analysis of environmental, economic and social consequences. Therefore, they allow for integration of environmental concerns into policy development. However, it is always important to note that there can be a difference between analysis of a policy proposal and the political decisions made during the adoption of the final policy.

The requirements for IA in the EU predate those for ex-post evaluation. The first IAs were undertaken in the 1980s and limited to major spending programmes. From the 1990s onwards they evolved to

cover other policy areas. Since then, they have been evaluated, further guidance issued and more evaluation undertaken.

At this time the EU took a more detailed approach to ex-post evaluations. In the 2000s the Commission was giving greater attention to regulatory burdens and ex-post evaluation of existing legislation. Importantly, it was recognised that simple evaluation of individual items of EU law may not be sufficient. It was also important to evaluate several items of legislation affecting the same area collectively (in so-called “Fitness Checks”). The Commission launched its first Fitness Check analysis in 2011 (published in 2012).

In 2015 the European Commission adopted its “Better regulation for better results - An EU agenda”⁵⁹ (further updated in 2017) and the publication of new integrated “Better Regulation Guidelines”⁶⁰ covering both ex-post evaluations and ex-ante impact assessments. Critically, it was accompanied by a detailed “Toolbox”⁶¹ describing 65 tools⁶² to support evaluations and, for the first time, the approaches to IA and ex-post evaluation were brought together. Not only are there obvious common elements to the two areas of evaluation, ex-post evaluations were being conducted on policies for which IAs had been conducted several years earlier. The Toolbox describes the key requirements of IAs including:

- » IAs must set out the logical reasoning that links the problem, its underlying causes, the objectives and a range of policy options to tackle the problem. They must present the likely impacts of the options, who will be affected by them and how.
- » Stakeholders must be able to provide feedback on the basis of an inception IA.
- » IAs must compare the policy options on the basis of their economic, social and environmental impacts (quantified costs and benefits whenever possible).

59 Communication from the Commission. Better regulation for better results - An EU agenda (COM(2015)215). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52015DC0215>

60 Commission Staff Working Document Better Regulation Guidelines (SWD(2015)111). <https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:52015SC0111>

61 Toolbox complementing SWD(2015)111: Better Regulation Guidelines (see: http://ec.europa.eu/smart-regulation/index_en.htm)

62 Each tool can be found here: https://ec.europa.eu/info/law/law-making-process/planning-and-proposing-law/better-regulation-why-and-how/better-regulation-guidelines-and-toolbox/better-regulation-toolbox_en

- » Certain elements must be included in the final IA report. These include: (i) a description of the environmental, social and economic impacts and an explicit statement if any of these are not considered significant; (ii) a clear description of who will be affected by the initiative and how; (iii) impacts on SMEs following the “SME test” in the Toolbox; (iv) impacts on competitiveness; and (v) a detailed description of the consultations.

An interservice group consisting of representatives of different parts of the Commission must be established to steer the preparation of the IA. The draft IA report must be presented to the Regulatory Scrutiny Board for its approval (see below). The Commission’s Better Regulation Guidelines state that ex-ante and ex-post evaluations shall be consistent with clear principles. Prior to conducting an ex-post evaluation the Commission publishes a Roadmap informing stakeholders of the activities to be undertaken, their timing and opportunities to contribute. A starting point for many evaluations is the development of an “intervention logic” which describes the problems the policy seeks to address and how this is done. This helps focus more detailed evaluation questions.

The other EU law making bodies also have their roles in evaluations. The 2016 Inter-Institutional Agreement on Better Law Making⁶³ provides guidance on the coordination of IA activities amongst the Commission, European Parliament and Council.

The Council has undertaken some IA work, but little on ex-post evaluations. It produces an annual IA report and its IAs take account of the Commission IAs. It is, however, important to note that the Council is the body with representatives of Member State governments. Some of these governments also undertake IAs (and some ex-post evaluation). The IAs at Member State level often explore the potential consequences of a Commission proposal for new legislation and it provides that Member State with more pertinent local detail than an EU-wide assessment would give. Findings from such evaluations would feed into Council deliberations (through the positions of the Member States).

The European Parliament has developed a more systematic approach to ex-ante and ex-post assessment.

63 Interinstitutional Agreement between the European Parliament, the Council of the European Union and the European Commission on Better Law-Making <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32016Q0512%2801%29>

A dedicated Parliament IA service was set up in January 2012 and in 2013 it broadened to include ex-post evaluation. This service examines the quality of each Commission IA accompanying a legal proposal, and, if the Parliament requests it, provides assessments of substantive amendments as well as further IA analysis for anything that it views as inadequate in the Commission IA. The Parliament has also developed further capacities to undertake studies of ex-post evaluation, though these tend to focus on specific issues. In both cases, the assessments undertaken by the Parliament are focused on informing Parliamentarians, so they tend to be short and focused.

All draft IAs and ex-post evaluations from the Commission are provided to the Regulatory Scrutiny Board (RSB) and it must give a favourable opinion for the evaluation to be published. Often revisions are required. The RSB consists of a combination of Commission officials and externally appointed experts. About 40% of IAs require resubmission. Interestingly, the evidence base (e.g. analysis of costs and benefits) is less commonly an issue than a justified and clear statement of the problem being addressed or adequate justification of the options chosen to analyse. The RSB also found problems with estimating economic impacts, including administrative burden, and the need to quantify these wherever possible.

3.6. CONCLUSIONS AND LESSONS LEARNED

This section presents some of the key overall lessons (noting that a number of specific lessons have already been included in the different sections above).

The EU is, of course, a unique entity in its legal structure. A challenge for the EU has been how far it is necessary or desirable to standardise requirements across the entire EU (e.g. to ensure functioning of the internal market or fair competition) and how far to allow different approaches (e.g. to accommodate different environment, social and economic conditions). China has significant diversity across its territory and issues of standardised or different approaches is a relevant consideration in policy formulation. However, one key lesson from the EU on this choice is the challenge of checking compliance with the law. Where there is a standardised approach, it is easier to determine whether compliance has occurred. Where Member States are first required to develop their own approaches to an EU objective, this can add complications to compliance checking.

A unique feature is the legal division of competencies between the adoption of law at EU level and at national level as well as the differences in EU level decision making for different issues and instruments. Thus, while an individual country could (in theory) as easily adopt a CAC instrument and MBI, at EU level the adoption of EU-wide MBIs has been more limited.

A key feature of EU law and policy has been the development of legislation requiring detailed planning for delivery of environmental objectives – air, water, waste, etc. EU law sets the objectives to be achieved. It requires measures to be taken (some specified at EU level) and others to be developed at Member State level (often leaving flexibility as to the type of instrument). It requires implementation of measures. Finally (and importantly), these instruments require monitoring and evaluation of achievement of the objectives and effectiveness of the measures, leading to revision where necessary. These planning instruments are key to the choice and development of instruments and to how their can be integrated in a coherent way.

The EU has a long history of use of CAC instruments. However, there has been an evolution from a wide range of strict operating requirements established at EU level to an EU regime that requires determination of the precise operating requirements to be determined at national level (or on a case by case basis). This evolution reflects, to some extent, the diversity of conditions across the EU.

However, it is also important to note that this approach brings challenges of ensuring compliance with the objectives of the regime. For an industrial operator, the case by case approach will still lead to specific conditions against which their performance can be readily checked. However, the challenge for the EU level is to determine whether the principles have been correctly applied when those conditions were established.

MBIs cover a wide range of different instruments. In the EU they have been adopted to address a range of different actors – producers, retailers, consumers, households. Some of the MBIs adopted in the EU have worked well, while others have been less successful in delivering objectives or changing behaviour. The lessons from their application were set out earlier. For MBIs it is important to consider the full range of different options and what works in different circumstances. A liability regime is an important fall-back when damage occurs. Green public procurement is a major driver where public

spending is large.

The EU has several financial instruments, distributing large sums of money for a range of purposes. Some funds are directed towards environmental outcomes. These have proven to be important in specific cases, such as biodiversity management, support for eco-innovation, etc. The EU has also developed environmental conditionalities to non-environmental spending. Such spending is a powerful driver and ensuring consistency with environmental objectives is an important lesson applicable elsewhere, including for China.

Policy evaluation is an area where considerable effort has been given by the EU to develop detailed and efficient processes. It is important to ensure instruments are doing what they aim to do. It is also a further tool to explore how environmental and other law interacts and, therefore, is an integration mechanism. The EU has a longer history of ex-ante Impact Assessment than ex-post evaluation. A useful lesson on ex-post evaluation from the EU has been not to limit that evaluation to individual instruments, but to evaluate groups of instruments addressing specific issues. How instruments each contribute to objectives is far more efficient than examining each separately.

Over time, different analytical tools have been developed and lessons can be learned from each of these. However, EU experience has shown that lack of data is an impediment to operationalising some tools (e.g. quantifying benefits or capturing all costs). The EU institutions are still learning how best to work with incomplete information. For this reason, the EU's evaluation Toolbox emphasises the need to use common sense and to use the tools in an intelligent rather than mechanical way. Finally, across all evaluations, the EU emphasises the importance of stakeholder engagement – stakeholders have views on the instruments and issues (and may also have useful data). Policy evaluation cannot be simply a desk-based technical exercise.

4. Case study on emission reduction policies in transport

This section focuses on command and control policies and economic incentives in China and Europe that have been put in place to reduce emissions from mobile sources. It sets out the Chinese situation and takes stock of the EU experience in developing and implementing an integrated policy system that combines regulatory instruments and incentives in transport sector in order to provide recommendations for China.

4.1. CHINA'S POLICIES ON EMISSION REDUCTION FROM MOBILE SOURCES

4.1.1. Emissions from mobile sources in China

Status of motor vehicles and non-road mobile Sources

In China in 2018, there were 327 million motor vehicles⁶⁴, which included 240 million passenger cars and trucks (of which 2.6 million were new energy vehicles⁶⁵).

In recent years, the number of non-road mobile sources in the country, which include construction machinery, agricultural machinery, small general machinery, ships, aircraft, railway locomotives etc, has also been on the rise (except for ships). Between 2010 and 2017, the number of pieces of construction machinery increased from 4.3 million to 7.2 million, with an average annual increase of 8.5%, while the total diesel power of agricultural machinery increased from 746 million kilowatts to 768

million kilowatts. At the same time, the number of ships decreased from 178,000 to 145,000, with an average annual decrease of 2.9%, while the number of aircraft takeoffs and landings increased from 5.5 million to 10.2 million, with an average annual increase of 9.2%.

Emissions from motor vehicles and non-road mobile sources

Mobile source pollution has become a major contributor to air pollution in China, especially in large and medium-sized cities such as Beijing, Shanghai, Shenzhen, where mobile sources have contributed a significant share of fine particulate matter (PM_{2.5}). In 2018, the total emissions of four types of pollutants from motor vehicles in China were estimated to be 40.65 million tons, among which carbon monoxide (CO) was 30.9 million tons, hydrocarbons (HC) 3.7 million tons, nitrogen oxides (NO_x) 5.6 million tons, and particulate matter (PM) 442,000 tons. Cars and trucks have been the biggest contributor of air pollution caused by motor vehicles, emitting more than 90% of CO, NO_x and PM and more than 80% of HC.

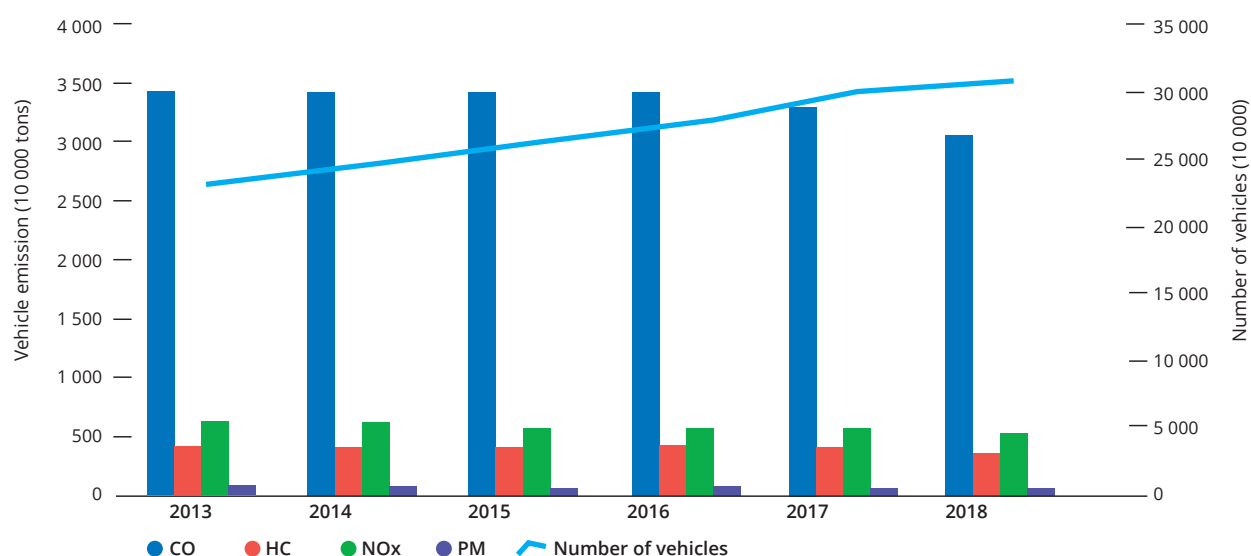
By vehicle type, the emissions of NO_x and PM from trucks (with heavy trucks being the main contributor) were significantly higher than those of buses, whereas CO and HC emissions from buses were significantly higher than those of trucks. By fuel type, NO_x emissions from diesel vehicles were close to 70% of total vehicle emissions, while petrol vehicles emitted a larger portion of CO (over 80%) and HC (more than 70%) of total vehicle emissions. Between 2013 and 2018, the total emissions of the four types of pollutants from motor vehicles has been decreasing. (Refer to Figure 4-1 below).

Meanwhile, the contribution from non-road mobile sources to air pollution is by no means negligible. Non-road mobile sources are becoming an increasingly prominent issue, as the industrial transformation and the toughening control over emissions from coal-powered plants and motor vehicles reduces the proportion of total emissions from these

64 Motor vehicles includes passenger cars, low-speed vehicles (diesel vehicles used for both passenger and freight transport) and motorcycles, but not including trailers or on-road tractors.

65 This includes hybrid electric vehicles (HEVs), pure battery electric vehicles (BEVs), fuel cell electric vehicles (FCEVs), vehicles with hydrogen engines, gas vehicles, alcohol ether vehicle, etc.

Figure 4-1 Downward trend of vehicle pollutant emissions in China*.



* Official data on GHG emissions from mobile sources haven't been released yet.

sources. In 2018, non-road mobile sources emitted 2.6 million tons of sulphur dioxide (SO₂), 762,000 tons of HCs, 5.6 million tons of NO_x and 445,000 tons of PM; emissions of NO_x and PM were close to the levels of motor vehicles. Of these non-road mobile emissions, ships emitted 588,000 tons of SO₂, 89,000 tons of HC, 1.5 million tons of NO_x and 109,000 tons of PM. Data of CO₂ emission from vehicles are not available yet.

emissions of pollutants such as CO, HCs, NO_x and PM. Table 4-1-1 below shows the scope of China's environmental management for new vehicles.

Table 4-1-1 the scope of China's environmental management for new vehicles

Category	Scope
Light-duty Vehicle	Petrol vehicle, diesel vehicle, natural gas vehicles, dual-fuel vehicle, mixed-fuel vehicles
Heavy-duty Vehicle	Petrol vehicle, diesel vehicle, natural gas vehicles
Vehicle Engine	Heavy-duty petrol engine, heavy-duty diesel engine, heavy-duty natural gas engine
Others	Motorcycles, mopeds, motor tricycle

China's emission standards for new vehicles are vehicle/engine-based, and include both the emission limits and the measurement methods for light-duty vehicles, heavy-duty vehicles (engines), motorcycles and low-speed vehicles. Specific standards are not listed in this report.

In June 2018, the Ministry of Ecology and Environment and the General Administration of Market Supervision jointly issued *Limits and Measurement Methods for Emissions from Diesel Fueled Heavy-duty vehicles (CHINA VI)* " (GB17691-2018). In addition, *"Limits and Measurement methods for Pollutant Emission from Light vehicles (China Phase VI)"* (GB18352.6-2016) have been effective since July 1, 2020.

4.1.2. China's regulatory policies on mobile source pollution

China has stepped up the prevention and control of mobile source pollution by continuously tightening emission and fuel standards, along with strengthening environmental monitoring and testing. In addition, measures have been taken to restructure the transportation sector and other policies have been implemented to require the disclosure of environmental information and to set up emission control zones. A mobile source management system that simultaneously addresses pollution from "fuel, road and vehicle" is beginning to take shape.

4.1.2.1 Emission and fuel standards

Vehicle emission standards

China's motor vehicle emission standards are applied to new and in-use vehicles, regulating

In 2018, the *Limits and Measurement Methods of Pollutant Emission from Diesel Vehicles (Free acceleration and loading deceleration)* (GB 2874-2018) and the *Limits and Measurement Methods of Pollutant Emission from Gasoline Vehicles (under two-speed idle conditions and short driving mode conditions)* (GB 18285-2018) were issued and have been effective since May 1, 2019. In the meanwhile, previous local standards were abolished.

Emission standards for non-road mobile sources

Environmental management for new non-road mobile sources in China covers non-road mobile machinery, diesel engines for non-road mobile machinery, small petrol engines for non-road mobile machinery, and marine diesel engines. The environmental standards for new non-road mobile machinery issued that were in place in China at the end of 2020 are shown in Table 4-1-2., which set standards on the emission of CO, HCs, NOX and PM.

Table 4-1-2 Environmental standards for new non-road mobile machinery

Category	Standard ID	Standard Title
Non-road mobile machinery	GB 20891-2014	Limits and measurement methods for exhaust pollutants from diesel engines of non-road mobile machinery (CHINA III, IV)
	GB 26133-2010	Limits and measurement methods for exhaust pollutants from small spark ignition engines of non-road mobile machinery (CHINA I, II)
	GB 36886-2018	Limits and measurement methods for exhaust smoke from non-road mobile machinery equipped with diesel engines
Ship	GB 15097-2016	Limits and measurement methods for exhaust pollutants from marine engines (CHINA I, II)
	GB/T 15097-2008	Measure method for emission pollutant of exhaust gas of marine diesel engines

In accordance with the Action Plan for Diesel Truck Pollution Control, China IV emission standards for non-road mobile machinery were implemented nationwide by the end of 2020; imported second-hand non-road mobile machinery and engines shall meet the current national emission standards for new road mobile machinery.

The Ministry of Ecology and Environment and the General Administration of Market Supervision jointly

issued new standards in 2018 that came into effect on December 1, 2018⁶⁶, which are applicable to the testing of exhaust smoke from off-road diesel mobile machinery and vehicle diesel engine equipment.

Motor vehicle fuel standards

Currently, the environmental management of vehicle fuels in China covers petrol (including automotive petrol and automotive petrol with ethanol or methanol) and diesel (including automotive diesel, diesel used for other purposes and biodiesel), as well as provisions on vapor recovery, etc. The current standards for automotive fuels that were in China are shown in Table 4-1-3.

Table 4-1-3 Standards for automotive fuels in place in China

Type of Fuel	Standard ID
Standards for Gasoline	GB 17930-2016 Gasoline for motor vehicles
	GB 18351-2017 Ethanol gasoline for motor vehicles (E10)
	GB 22030-2017 Blending of ethanol gasoline for motor vehicles
Standards for Diesel	GB 35793-2018 Ethanol gasoline for motor vehicles E85
	GB 19147-2016 Automobile diesel fuels
	GB25199-2017 B5 diesel fuels
Standards for Detergent	GB 19592-2004 Detergent additives for vehicular gasoline
	GB 32859-2016 Detergent additives for diesel fuel
Standard for NOx reduction agent	GB 29518-2013 Diesel engines NOx reduction agent. Aqueous urea solution

⁶⁶ "Limits and Measurement Methods for Exhaust Smoke from Off-road Mobile Diesel Machinery"

Table 4-1-4. Environmental standards for China V and VI vehicle gasoline and date of implementation

Environmental targets	GB17930 Gasoline for motor vehicles CHINA V	GB17930 Gasoline for motor vehicles CHINA VIA	GB17930 Gasoline for motor vehicles CHINA VIB	GB18351 Ethanol gasoline for motor vehicles (E10) CHINA V	GB18351 Ethanol gasoline for motor vehicles (E10) CHINA VIA	GB18351 Ethanol gasoline for motor vehicles (E10) CHINA VIB
Sulphur Content (ppm)	≤10	≤10	≤10	≤10	≤10	≤10
Summer Vapor Pressure (kPa)	40-65	40-65	40-65	40-65	40-65	40-65
Olefins (%)	≤24	≤18	≤15	≤24	≤18	≤15
Manganese Content (mg/L)	≤2	≤2	≤2	≤2	≤2	≤2
Aromatics + Alkenes (%)	—	—	—	—	—	—
Aromatics (%)	≤40	≤35	≤35	≤40	≤35	≤35
Date	2017.1.1	2019.1.1	2023.1.1	2017.1.1	2019.1.1	2023.1.1

Table 4-1-5 Environmental standards for China V and VI vehicle diesel

Environmental Targets	GB19147 Automobile diesel fuels (CHINA V)	GB19147 Automobile diesel fuels (CHINA VI)	GB25199 B5 diesel fuels (CHINA V)	GB25199 B5diesel fuels (CHINA VI)
Sulphur Content (ppm)	≤10	≤10	≤10	≤10
Value of hexadecane	≥51	≥51	≥51	≥51
Density (kg/m ³)	810-850	810-845	810-850	810-845
PAH (%)	≤11	≤7	≤11	≤7
Lubricity, Wear Spot Diameter (m)	≤460	≤460	≤460	≤460
Date	2017.1.1	2019.1.1	2017.1.1	2019.1.1

Regarding automotive diesel standards, the State Administration for Market Regulation and the Standardization Administration issued a notice⁶⁷ in December 2018, marking the integration of the regulation of motor vehicle diesel, ordinary diesel and some marine oils. Environmental standards for China V and VI vehicle diesel and their effective dates are shown in Table 4-1-5.

Fuel standards for non-road mobile sources

As mentioned above, a uniform standard has been set up to regulate automotive diesel oil, ordinary diesel oil and some marine oils, and the standard for

China VI vehicle diesel is applied across the board.

Regarding marine fuels, these are regulated by the standard of "Marine fuel Oils" (GB17411-2015), which has classified distillate marine fuels into three grades based on their sulphur content. In 2018, the first revision of the standard was issued, to which was added the requirement that the sulphur content of marine fuel used in inland waterway shipping should be no greater than 10mg/kg.

4.1.2.2. Promoting ethanol use in motor vehicles

According to the *Renewable Energy Law* and the *Action Plan for the Prevention and Control of Air Pollution*, 15 ministries jointly issued the *Implementation Plan Concerning the Expansion of Ethanol Production*

⁶⁷ Notice on Abolishing the Mandatory National Standard for Ordinary Diesel

and Promotion for Transportation Fuel, (hereinafter referred to as “the Implementation Plan”)⁶⁸. The “Implementation Plan” requires that by 2020, the use of ethanol in automotive applications will be promoted nationwide. By 2025, China will strive to achieve the large-scale production of cellulosic ethanol, to have developed a fully-fledged industry in advanced liquid biofuel technology and equipment and to have built an improved market-oriented operation mechanism.

4.1.2.3. Environmental monitoring and testing

Environmental monitoring for new vehicles

A monitoring system to ensure compliance with environmental requirements has been established. As part of an environmental management system, the emissions of new motor vehicle products that are manufactured, imported and sold by manufacturers are checked against emission standards. The institutions that inspect the compliance of vehicles with new vehicle emission standards are themselves regulated. Since 2017, these inspection institutions have been required to connect with environmental authorities through the internet in order to make inspection data accessible. By the end of 2018, a total of 21 institutions responsible for the emissions inspections of new motor vehicles and new non-road mobile machinery emission have been connected online to share real-time testing video and results.

Environmental monitoring of in-service vehicles

The environmental management of motor vehicles in use is exercised by the competent environmental departments at all administrative levels in accordance with the law. Management systems have been established for regular emission inspections, random environmental checking and the phasing out of old vehicles. Only those vehicles passing the in-service test shall be permitted to be used on roads. A vehicle emissions inspection and control platform connected at the national, provincial and municipal levels has been created. Environmental spot-checking has also been carried out and a joint law enforcement mechanism for environmental departments to detect and collect evidence, and for traffic control departments to implement penalties, has been established. Moreover, inspections of the vehicle emission inspection institutions themselves are also conducted, and environmental departments at all

levels may carry out joint inspections over these institutions throughout the country.

Environmental supervision over non-road mobile sources

The environmental departments of various administrative units also supervise the production of non-road mobile machinery in order to ensure its consistency with environmental standards, and they also conduct spot checks on enterprises and vehicles to ensure that non-road mobile machinery meets the emission requirements before it enters the market. In addition, there is a system to recall non-road mobile machinery that does not meet environmental standards. If a manufacturer or an importer is aware that the air pollutant emissions from their products exceeds the limit or that the design and production were defective or fail to meet the prescribed requirements for the durability of environmental protection, the manufacturer or the importer has to recall the relevant products. For those who fail to do so, the product quality supervision department under the State Council shall, in conjunction with the competent department of environmental protection, demand that the relevant products are recalled. If the non-road mobile machinery is not equipped with pollution control devices or its pollution control devices do not meet the requirements, thus failing to meet emission standards, the subpar devices have to be replaced by machinery that meets the requirements. In addition, China has set relevant regulations and rules on the disclosure of environmental information for non-road mobile machinery and has also established low emission zones for non-road mobile machinery (for more information, see sections 4.1.2.4 and 4.1.2.5).

For ships, in addition to implementing ship exhaust emission standards and fuel sulphur content standards, rules have also been set for the allocation and use of onshore power, the emission monitoring of tailpipe emissions treatment and the control of volatile organic compounds. Environmental supervision now focuses on two aspects: first, ship machinery inspection institutions check whether a ship's engine meets the relevant emission standards; second, the maritime department test the sulphur content of ship fuel samples, as well as checking the ship's certificates, documents and records regarding pollution prevention.

4.1.2.4. Transport restructuring

In September 2018, the General Office of the State Council issued the *Three-Year Action Plan for Advancing Transport Restructuring (2018-2020)*, which, by 2020, explicitly aimed to significantly improve the

68 http://www.gov.cn/xinwen/2017-09/13/content_5224736.htm

Table 4-1-6 Six actions under Three-Year Action Plan for Advancing Transport Restructuring (2018-2020)

6 actions	Measures/Targets
Enhancing railway capacity	The efficiency of existing railway lines will be enhanced and the construction of private railway lines will be accelerated. By 2020, the proportion of industrial and mining enterprises and logistics parks with an annual freight volume of over 1.5 million tons that have access to private railways should be over 80%.
Enhancing waterway capacity	The inland waterway transport network will be strengthened, supported by railway lines to distribute freight from the ports. By the end of 2018, the cargo at major coastal ports around the Bohai Sea, Shandong Province and the Yangtze River Delta and at the coal concentration ports of Tangshan and Huanghua will be transported by railway or waterway; by winter of 2020, ore, coke and other bulk goods from major coastal ports, including Tangshan Port and Huanghua Port, will, in principle, be mainly transported by rail or waterway.
Enhancing Road freight management	The enforcement of the loading of highway freight vehicles will be strengthened in order to prevent overloading. By the end of 2020, the average illegal overloading rate of freight vehicles on expressways in all provinces (autonomous regions and municipalities) will not exceed 0.5%. Freight vehicle models shall be further standardized and the intensive and efficient development of the road freight industry shall be promoted.
Quickening multi-modal transport	The construction of logistics parks that support multimodal transport shall be promoted, and the connection between different modes of transportation shall be strengthened. Pilot multimodal transport projects, such as container transport, ro-ro transport by commodity vehicles, cold chain transportation, express trains for e-commerce logistics, etc, shall be encouraged at the local level.
Greening urban delivery and logistics	The implementation of a demonstration project for urban green freight transportation will be accelerated. Policies to facilitate the passage of new energy vehicles in cities shall be introduced and implemented widely. Rail-road combined transportation of supplies for urban working and living shall be strengthened. A new urban railway logistics model of "railway+ warehousing and logistics" shall be created.
Integrating information resources	The construction of a multimodal transport information platform, accessible to the public, will be accelerated, and logistics information services shall be improved. A mechanism for monitoring and reporting information on the restructuring of the transport sector shall be established.

national freight transport system through significantly increasing the use of waterways and railways to transport bulk commodities. Beijing, Tianjin, Hebei and their surrounding areas will be turned into a demonstration zone for the adjustment of the structure of the transport system. The six major actions that were to be taken in the three-year action plan are shown in Table 4-1-6.

4.1.2.5. Environmental information disclosure

The Law on Prevention and Control of Air pollution stipulates that "motor vehicle manufacturing and import enterprises shall disclose information about the discharge inspection, pollution control technology, and relevant maintenance technology of the motor vehicles they manufactured or imported." In August 2016, the then Ministry of Environmental Protection issued a Notice⁶⁹ that aimed to create a comprehensive, science-based, law-based, and digitalized environmental management system for motor vehicles and non-road mobile machinery. It proved to be effective in promoting public

participation in the area. The provisions related to information disclosure are listed in Table 4-1-7.

Regarding inspections, the Notice requires all environmental departments at the provincial level to set up a mechanism to verify the inspection information of motor vehicles and non-road mobile machinery, to strengthen the supervision and management of environmental information disclosure through on-site inspection and sampling inspection, and to ensure that manufacturers and importers of motor vehicles and non-road mobile machinery disclose information as required. In addition, public participation is encouraged to monitor the environmental information disclosed by the manufacturers and importers of motor vehicles and non-road mobile machinery, and report any problems to the authorities through the environmental complaint platform in accordance with the law. In addition, all environmental departments at the provincial level are required, in a timely manner, to investigate and address any problems brought to their attention.

Those who fail to truthfully, accurately, timely and completely disclose the environmental information about motor vehicles and non-road mobile

69 Notice on Disclosing the Environmental Information on Motor Vehicles and Non-road Mobile Machinery

Table 4-1-7 provisions on information disclosure under Notice on Disclosing the Environmental Information on Motor Vehicles and Non-road Mobile Machinery

Regulated area	Requirements
Who should disclose	Manufacturers and importers of motor vehicles and non-road mobile machinery shall disclose the environmental information regarding their products, including the emission inspection results and pollution control techniques information, and shall be responsible for the authenticity, accuracy, timeliness and integrity of the information disclosed.
What to disclose	Basic information about manufacturers and importers of motor vehicles and non-road mobile machinery; pollution control techniques used for motor vehicles and non-road mobile machinery; emission inspection results of motor vehicles and non-road mobile machinery: type inspection, inspection of production consistency, in-use conformance inspection and ex-factory inspection, including test results, inspection conditions, instruments and equipment, information about the inspection agencies, etc.
When and how	Motor vehicle manufacturers and importers shall disclose the important environmental information in the form of a vehicle list before the products leave the factory or enter the country; the manufacturers and importers of non-road mobile machinery shall attach a stick-on label in a prominent position on the surface of the machinery to disclose the important environmental information before the products leave the factory or enter the country. The manufacturers and importers of motor vehicles and non-road mobile machinery shall disclose the environmental information about motor vehicles and non-road mobile machinery on their official websites before the products leave the factory or enter the country, and upload it to the environmental information disclosure platform of the Ministry of Environmental Protection for inquiry and use by relevant government departments, the public and other enterprises.
Date of implementation	Starting from January 1, 2017, manufacturers and importers of motor vehicle / non-road mobile machinery shall disclose the environmental information of newly manufactured and imported motor vehicle / off-road mobile machinery as required.

machinery in accordance with the Notice shall be subject to penalties in accordance with the Law on the Prevention and Control of Air pollution. The results of the punishment shall be made public in a timely manner and uploaded onto in the environmental information disclosure platform for motor vehicles and non-road mobile machinery.

4.1.2.6. Setting up emission control zones

Low emission zones for non-road mobile machinery

By setting up low emission zones, the use of heavily-polluting non-road mobile machinery is restricted in specific areas in the city. Under Article 61 of the Law on the Prevention and Control of Air Pollution states: "municipal people's governments may, in view of the quality of the ambient environment, delimit and announce the areas where the entry of high-emission non-road mobile machinery is prohibited." By the end of 2018, more than 60 cities had designated emission control zones for non-road mobile machinery. In most cases, the areas designated as low-emission zones are large central areas where non-road mobile machinery that do not meet specific emission standards are prohibited from being used. Most cities have designated one single large area as the low emission zone. In addition, cities have issued relevant supporting measures, such as labeling, record-keeping, public supervision and so on.

Emission control area for marine vessels

In 2015, the Ministry of Transport issued the Implementation Plan for Ship Emission Control Areas to set up control zones in the Pearl River Delta, Yangtze River Delta and Circum-Bohai (Beijing-Tianjin-Hebei) Waters to control emissions of SO₂, NO_x and particulates from marine vessels. In November 2018, the Ministry of Transport issued the Plan for Implementing Air Emission Control Zones for Ships to further expand the scope from the original three areas to the coastal waters across the country. Furthermore, inland waterway control areas have also been set up on the navigable waters of the Yangtze River (from Shuifu in Yunnan to Liuhekou in Jiangsu) and the Xijiang River (from Nanning in Guangxi to Zhaoqing in Guangdong). The Plan also specifies the sulfur content of fuel oil, the emission control requirements of particulate matter and nitrogen oxides, and the requirements for the use of onshore electricity by ships at port. The air emission control zones for ships are set up to reduce emissions and improve the air quality of coastal and inland port cities.

Emission control area for road transport

At present, the low emission zones in China are mostly set up for non-road mobile machinery and ships. Only a few cities have established low emission zones for road traffic, including Hebei Xiongan New Area, where the local government just issued

a circular⁷⁰ to regulate off-road mobile machinery, heavy diesel vehicles and light vehicles. The Huludao Municipal Government also introduced a Notice⁷¹ that requires that from 6:00 to 21:00, petrol vehicles below China I emission standard and diesel vehicles below China III emission standard are denied access to the city's central area.

4.1.2.7. Emission reductions at the local level

Beijing has made remarkable progress in motor vehicle pollution control. Since 1998, Beijing has formulated and implemented strict local standards for emission management for new and in-use vehicles and for the quality of fuel products. In addition, it has adopted comprehensive management measures and has continuously strengthened traffic control and rolled out a series of economic incentives. A "vehicle-fuel-road" integrated urban emission control system for urban motor vehicles has been put in place. At the same time, the city has invested in high-volume public transport to promote green and low-carbon transport.

In relation to emission and fuel standards, Beijing has been leading the country by enacting stricter standards or applying the national standards sooner than the rest of the country. Beijing was the first Chinese city to implement the China I emission standard for light gasoline vehicles in 1999 and took the lead in implementing the Beijing 5 / V emission standard, which is equivalent to the EU stage 5 / V standard in 2013. It has been catching up with the EU and US level in emissions control. Recent legislation⁷² have both been applied in Beijing since May 1, 2019. In terms of fuel standards, Beijing started using unleaded gasoline in 1997 and in 2004 enacted and enforced the second-phase of local standards for automotive fuel, which were stricter than the national standards. Since then, Beijing's oil product standards have been one or two stages ahead of the rest of the country. Over the past 20 years, emissions from transport in Beijing have continued to decline despite a more than three-fold increase in the number of motor vehicles (see figure 4-1-6). Compared with the level of 1998, the emissions of carbon monoxide have declined by 89%, total

hydrocarbons by 64%, nitrogen oxides by 55% and fine particulates (PM_{2.5}) by 81%. The phase-out of old vehicles is the biggest contributor to emission reduction⁷³.

In March 2020, Beijing issued a new Regulation⁷⁴, which laid down rules for the prevention and control, use, inspection and maintenance, regional coordination and legal liabilities in the sector. The Regulation, effective since May 1st 2020, has provided a legal basis and policy guidance for the management of motor vehicles and non-road mobile machinery in Beijing.

4.1.3. China's incentive policies for emission reduction from mobile sources

The incentives for the prevention and control of mobile source pollution in China are mainly economic incentives, including subsidies, tax exemptions, electricity price concessions and so on, which are important to the prevention and control of mobile source air pollution.

4.1.3.1. Incentives for emission reduction from motor vehicles

The "Old-for-New" replacement policy

In 2009, the Ministry of Finance, the Ministry of Commerce and other departments issued a Notice⁷⁵ to encourage the replacement of old vehicles with new ones by increasing subsidies and expanding the coverage of these. According to the measures, the coverage of scrappage subsidies may be extended to minivans, medium-sized taxis and passenger cars under 8 years old, and to medium-and light-duty trucks and medium-sized passenger cars under 12 years old. Owners who scrap "yellow label" vehicles⁷⁶ before the maximum age limit stipulated by the existing scrappage regulations are entitled to subsidies when buying a new car.

70 Circular on Delineating the Low Emission Zone for Pollutants from Mobile Sources in Xiongan New Area

71 Notice on the Establishment of Automotive Emission Control Zone in Huludao

72 "Limits and Measurement Methods of Pollutant Emission from Gasoline Vehicles (under two-speed idle conditions and short driving mode conditions)" (GB 18285-2018) and the "Limits and Measurement Methods of Pollutant Emission from Diesel Vehicles (Free acceleration and loading deceleration)" (GB 2874-2018)

73 A review of 20 Years' Air Pollution Control in Beijing, UNEP

74 Regulation on the Prevention and Control of Emissions from Motor Vehicles and Non-road Mobile Machinery

75 Notice on Printing and Distributing Implementation Measures of Old-for-New Replacement Policy for Automobiles; http://www.gov.cn/zwqk/2009-07/15/content_1366184.htm

76 Yellow label vehicles refer to gasoline vehicles that do not meet the China I emission standard and diesel vehicles that do not meet the national III emission standard.

Subsidy for phasing out and scrapping of diesel vehicles

In 2018, the Ministry of Ecology and Environment issued the Action Plan for the Control of Pollution from Diesel Trucks, which explicitly put forward an action plan to clean up diesel vehicles and “speed up the phase-out and treatment of old vehicles.” In order to speed up the phase-out and scrapping of China III (and older) diesel trucks, as well as old gas vehicles using lean-burning technology, various targets and plans have been developed. Supporting measures such as economic compensation, restrictions, and stronger supervision and law enforcement have been put in place to smooth the process. Those who scrape old trucks and purchase new energy trucks benefit from purchase subsidies granted by the central government. Local governments are encouraged to pilot and establish a subsidy mechanism linking the operation of new energy vehicles to the phase-out of diesel trucks.

Promoting government green procurement of motor vehicles

In 2020, the NDRC and the Ministry of Justice jointly issued the *Opinions on Speeding up Establishing Legal and Policy System for Green Production and Consumption*⁷⁷, which requires purchasing products and services that goes beyond the environmental standards in the process of government procurement. It aims at expanding the application of green products standards in government procurement. State-owned enterprises should take the lead in implementing the green procurement guidelines and establish the green procurement management system. The document also emphasizes the importance of establishing and improving a mechanism to promote green products and new energy vehicles, such as energy-saving household appliances, energy-efficient lighting products, water-saving appliances and green building materials. In addition, it mentions the importance of providing the appropriate support to consumers in purchasing these types of energy-efficient products.

4.1.3.2. Incentive policies for non-road mobile sources

Subsidy for vessels

China has introduced economic incentives to reduce emissions from non-road mobile sources. For example, for old ships, the Ministry of Finance, the

Ministry of Transport, the National Development and Reform Commission, and the Ministry of Industry and Information Technology have implemented two sets of policies since 2010 on the early scrap-page and replacement of old coastal transport ships and single-hull tankers. In February 2014, the four ministries jointly initiated a second set of policies on “dismantling the old to build the new”, effective from January 2013 to December 2015⁷⁸. These raised the level of subsidy, taking into account the type and age of vessels, and granted subsidies based on the standard of 1500 yuan / ton. The subsidies, which were no longer paid in a lump sum amount as stipulated by the first set of policies, were granted in two installments, which generated positive results. In addition, relevant documents and subsidy standards have also been issued at the national level to regulate onshore power use (see Table 4-1-8 for details).

At the local level, Shenzhen issued the *Interim Management Measures for Subsidizing Shore Power Facilities and Low-Sulphur Marine Oil*⁷⁹. Shanghai officially implemented *Measures for the Prevention and Control of Pollution from Ships in Port of Shanghai*⁸⁰, and Management Guidelines for Subsidies of Ships Upgrading and Ship Dismantling.⁸¹

Subsidy for agricultural machinery

On April 4, 2018, Beijing issued *Regulations on the Safety Supervision and Management of Agricultural Machinery in Beijing*⁸², which offers free service to install, maintain and replace pollutant emission control devices for financially subsidized tractors, combine harvesters and individual owners. The municipal agricultural administrative department and its agricultural machinery supervision agency supports the development of new technologies, new processes, and new equipment for energy saving, emission reduction and emission control of agricultural machinery. The aim is to promote the speedy replacement and upgrading of products, and work

77 *Opinions on Speeding up Establishing Legal and Policy System for Green Production and Consumption*; <https://www.ndrc.gov.cn/xxgk/zcfb/tz/202003/P020200317570029922474.pdf>

78 *Management Measures for Central Financial Subsidy Special Fund for the Scrapping and Replacement for Old Transport Ships and Single-hulled Tankers*; http://zizhan.mot.gov.cn/zhezhan/zhengwugonggao/jiaotongbu/guanliguiding/201404/t20140430_1612675.html

79 *Interim Management Measures for Subsidizing Shore Power Facilities and Low-Sulphur Marine Oil*; http://www.sz.gov.cn/zfgb/2014/gb896/content/mpost_4949538.html

80 *Measures for the Prevention and Control of Pollution from Ships in Port of Shanghai*; <http://www.shanghai.gov.cn/nw2/nw2314/nw2319/nw2407/nw33192/u26aw42464.html>

81 http://xxgk.mot.gov.cn/jigou/syj/201607/t20160719_2977645.html

82 *Regulations on the Safety Supervision and Management of Agricultural Machinery in Beijing*; <http://sfj.beijing.gov.cn/sfj/index/483217/517510/index1.html>

towards the elimination and scrapping of heavy-polluting agricultural machinery so as to improve the air quality in Beijing.

4.1.3.3. Incentives for new energy vehicles.

Since 2009, governments at all levels have issued a series of policies to encourage the development of new energy vehicles^{83,84}. The incentives for NEVs mainly include financial subsidies, tax reductions, industry access, electricity pricing, infrastructure construction, bus subsidies, official vehicle procurement and so on. These fiscal policies play a positive role in promoting the innovation and development of NEV industry.

Fiscal subsidies

The conditions for subsidizing new energy vehicles have been set up and the central government has set aside special funds to support the pilot subsidy program for private purchases of NEVs. The conditions for subsidizing new energy passenger vehicles, buses and trucks are shown in Table 4-1-9, 4-1-10 and 4-1-11⁸⁵.

To support the healthy growth of the NEV industry and promote the application and consumption of NEVs, in 2020, the MOF, MIIT, MST and NDRC jointly issued a paper to extend the fiscal subsidies for promoting the use of NEVs to the end of 2022, considering the technological progress, scale effect and other factors.⁸⁶

Tax exemptions

To promote the NEV industry, in addition to purchase subsidies, tax exemptions were also introduced as a key policy. MOF, SAT, and MIIT jointly issued the Announcement about Exempting Vehicle Acquisition Tax for New-Energy Vehicle, which stipulated that NEVs were exempt from vehicle purchase taxes between September 1, 2014 and December 31, 2017. The policy has since been renewed and is still in force today.

Market access

In order to implement the national strategy of developing NEVs, to improve the regulation of the manufacturing activities and to promote the sustainable and healthy growth of the industry, MIIT issued the *Access Management Rules for New Energy Vehicle Production Enterprises and Products* in 2017⁸⁷. The new rules set more stringent requirements for new entrants and strengthened the safety requirements for products. A "halting" system was introduced, under which the manufacturers must immediately halt the production and sales of NEV products should any safety and other serious problems be found in the products. In terms of the access requirement for new entrants, "the applicants for access to NEV manufacturing should be automobile manufacturers that have already obtained access to vehicle production or new automobile production enterprises that have completed the investment procedures; conform to the same category of management rules for access of conventional automobile production enterprises; and have design and development capabilities, production capacity, production conformity assurance, and safety assurance and be able to provide after-sales service and product safety assurance."

Electricity pricing

In 2014, the General Office of the State Council issued the *Guiding Opinions on Accelerating the Promotion and Application of New Energy Vehicles*⁸⁸, which requires that "charging facility operators may collect electricity and charging fees from electric vehicle users; until 2020, government-guided price management will be implemented for EV charging fees. For the electricity used by the commercial centralized charging facilities that directly purchase from the grid enterprises, the electricity price for large industries will apply; for charging stations at non-commercial premises such as residential homes and quarters, the electricity used will be charged according to the locations; for the electricity used by charging facilities installed in government offices, enterprises and public parking lots, the electricity price for ordinary industries and businesses will apply. Charging facilities for electric vehicles are subject to a time-of-use rate. The cost of EV charging facilities supporting grid transformation is included in the transmission and distribution prices of grid enterprises."

83 *Notice on Continuing the Promotion and Application of New Energy Vehicles* issued in 2013; http://www.gov.cn/zwgk/2013-09/17/content_2490108.html

84 *Notice on Preferential Taxation Policies for Energy-Saving NEVs in 2018, the Notice on Supporting the Promotion and Use of New Energy Buses and Notice on Further Improving the Financial Subsidy Policy for the Promotion and Use of New Energy Vehicles* in 2019; http://jjs.mof.gov.cn/zhengwuxinxi/zhengcefaui/201905/t20190508_3251282.html

85 Program of Fiscal Subsidies for Promoting New Energy Vehicles and Technical Specifications for Products (2020); <http://www.gov.cn/zhengce/zhengceku/2020-04/23/5505502/files/f5fc2592b25e4ff3a5ba01770dd5842e.pdf>

86 http://www.gov.cn/zhengce/zhengceku/2020-04/23/content_5505502.htm

87 <http://miit.gov.cn/n1146295/n1652858/n1652930/n3757018/c5466114/content.html>

88 http://www.gov.cn/zhengce/content/2014-07/21/content_8936.html

Table 4-1-8 Economical Incentives for Vessels at the National Level

Competent Authorities	Document	Provision
Ministry of Transport	Implementation Plan of Special Action for Prevention and Control of pollution from Vessels and Ports (2015-2020) ^a	By 2020, onshore power will be used at 90% of the major ports for the berthing of ships and vessels, and 50% of the specialized terminals for containers, passenger ferries and cruise ships will have the capacity to supply shore power to ships. Promote the establishment of the mechanism and incentives for the supply and sales of onshore power for ships, reduce the cost of onshore power use, and guide docking ships to use onshore electricity.
Ministry of Transport	Notice of the General Office of the Ministry of Transport on Using the Central Financial Incentive Funds in 2017 to Support Docking Ships in Applying for the Use of Onshore Power ^b	Onshore power projects, coastal and inland port onshore electricity equipment construction or transformation projects and ship onshore electricity equipment construction or transformation projects completed between January 1 to December 31, 2016 were entitled to rewards. Reward method: the Ministry of Finance and the Ministry of Transport determined the amount of the lump-sum monetary reward based on the amount of money invested in the projects and the social benefits generated: (1) the amount of reward for the completion of the project in 2017 did not exceed 60% of the total investment for the purchase of equipment; (2) the amount of reward for the completion of the project in 2016-2018 was reduced year by year; (3) those finished between 2018-2019 were subject to a separate set of rules.
Ministry of Finance; Ministry of Transport	Management Measures for Subsidizing Inland Waterway Vessels ^c	Ships that meet the requirements of these measures and are dismantled or renovated within the prescribed period are entitled to the subsidy.
Ministry of Finance, Ministry of Transport, National Development and Reform Commission, Ministry of Industry and Information Technology	Management Measures for Central Financial Subsidy Special Fund for the Scrapping and Replacement for Old Transport Ships and Single-hulled Tankers ^d	Shipowners who scrap and replace old transport ships and single-hull tankers ahead of schedule during the period from January 1, 2013 to December 31, 2015 were able to apply for subsidy funds in accordance with the relevant provisions.

a. http://www.gov.cn/gongbao/content/2016/content_5038094.html

b. http://zizhan.mot.gov.cn/st/guangxi/tongzhigonggao/201707/t20170727_2676555.html

c. http://www.gov.cn/foot/2014-04/17/content_2661483.htm

d. http://zizhan.mot.gov.cn/zhuizhan/zhengwugonggao/jiaotongbu/guanliguiding/201404/t20140430_1612675.html

Table 4-1-9 Subsidy Standard for NEV Passenger Vehicles (10,000 CNY)

Type	Electric range R (working condition, km)		
Electric vehicles (EV)	300≤R<400	R≥400	R≥50
	1.62	2.25	n/a
Plug-in hybrid vehicles (extended range electric vehicles included) (PEV)	n/a		0.8

1. Subsidy per EV=Min {Subsidy ER, battery capacity X¥500} x battery energy density multiplier x energy consumption multiplier

2. Vehicles purchased by a non-private parties or commercial vehicles are entitled to compensation of 0.7 times that of vehicles purchased by private parties.

3. The sales price of eligible vehicles should be no more than ¥300,000 (with reference to the receipt or official price, "power change mode" excluded)

Table 4-1-10 Subsidy Standard for NEV Buses (10,000 CNY)

[illegible]

Table 4-1-11 Subsidy Standard for NEV Trucks

Type	Central government base subsidy (CNY/kwh)	Max subsidy by gross vehicle weight subsidies (10,000 CNY/vehicle)		
		N1	N2	N3
Electric trucks	315	1.8	3.5	5
Plug-in hybrid trucks (extended range electric trucks included)	450	--	2	3.15

According to GB/T 15089-2001, N1 trucks refer to trucks with total designed gross weight ≤ 3,500 kg, N2 trucks refer to trucks with designed gross weight over 3,500 kg but ≤ 12,000 kg, N3 refer to trucks with designed gross weight over 12,000 kg.

Infrastructure construction

In October 2015, NDRC, MIIT and the Ministry of Construction jointly issued *the Guidelines for Developing Electric Vehicle Charging Infrastructure (2015–2020)*⁸⁹. These set the overall goal for the development of charging infrastructure during the “13th Five-Year Plan” period, i.e., by 2020, there will be more than 12,000 new centralized charging and switching stations and 4.8 million decentralized charging points to meet the needs of 5 million EVs across China. In 2019, China’s charging infrastructure continued to grow at a rapid pace. With the number of the charging points that were part of the national charging infrastructure reaching 1.2 million, it has certainly contributed to the rapid development of China’s large EV market⁹⁰.

Subsidies for Public Transport

The Ministry of Finance in 2015 issued a *Notice on Improving Fuel Price Subsidies for Urban Bus to Speed up the Promotion and Application of New Energy Vehicles*⁹¹ to support the purchase and operational costs of all types of urban buses, on the premise that the overall level of subsidies to urban bus remained relatively stable. The purpose of the Notice was to balance the cost of traditional buses and NEV buses and gradually give the advantage to NEV buses through adjusting and optimizing the structure of the subsidy. Such a stepwise and category-based measure can help create a policy environment conducive to energy conservation and emission reduction in the urban bus market and the development of the new

energy vehicle industry, while ensuring the smooth and healthy transition of the bus industry.

Subsidy standards for energy-saving and NEV buses (2015-2019)

Unit: 10,000 CNY/bus/year

Types of Buses	Length (L) (meters)		
	6≤L<8	8≤L<10	L≥10
Electric Buses	4	6	8
Plug-in Hybrid Buses (including Extended-Range Electric Buses)	2	3	4
Fuel Cell Buses	6		
Super Capacitor Buses	2		
Non-plug-in Hybrid Buses	2		

Procurement of government fleet

*The Notice on Improving Financial Subsidies for the Promotion and Application of New Energy Vehicles*⁹², jointly issued by the Ministry of Finance, the Ministry of Industry and Information Technology, the Ministry of Science and Technology and the National Development and Reform Commission, encourages to procure new energy vehicles for government use and leasing of new energy vehicles should be preferred.

In addition, favorable fiscal policies have also been issued at the local level. For example, in 2019, the General Office of the Fujian Provincial People’s Government issued a Notice⁹³, which explicitly mentions

89 http://www.gov.cn/zhengce/2015-10/09/content_5076250.html

90 <https://tech.sina.com.cn/roll/2020-02-27/doc-iimxyqvz6090754.shtml>

91 http://www.mof.gov.cn/mofhome/gansu/lanmudaohang/zhengcefaui/201505/t20150521_1236255.html

92 http://www.gov.cn/zhengce/zhengceku/2020-04/23/content_5505502.html

93 *Notice on Several Measures to Further Promote Consumption*

the need to promote the consumption of NEVs. Local governments have lent strong support to promote the use of NEVs in accordance with relevant policies and regulations. Government-funded public parking spaces provide free parking for NEVs for the first 2 hours. The basic electricity charges are waived for operating centralized charging stations that are directly connected to grid enterprises, and the electricity price is half of that applied to local large industries.

4.1.4. China's Policy Integration on emission reduction in transport

4.1.4.1. Comparison between regulatory and incentive policies.

Compared with its incentives, China's regulatory policy is more comprehensive, as a greater effort has been invested in setting up the laws and regulations, emission standards, oil quality regulations; remarkable progress has been made in these areas. The *Action Plan of Air Pollution Prevention and Control* is focused on emissions reduction from mobile sources, laying down standards for new vehicle emission and oil quality and setting up measures for vehicle management and traffic management. Thus, an integrated transport management system that covers "vehicle, fuel and road" has taken shape. Built on what it has achieved so far, China continues to tighten its emission standards. The China VI standards for light vehicles and heavy vehicles were issued, respectively, in 2016 and 2018. Far from merely copying EU emission standards, the China VI standard for light vehicle has incorporated the most advanced control ideas in the world, and is more stringent than the Euro VI standard in terms of technology neutrality, emission limits, evaporative emission controls, on-line diagnosis and so on. For example, the limits for particulate matter (PM) and carbon monoxide (CO) under China VI for light vehicles are 0.003 and 0.5g/km respectively, 40% and 50% lower than those under Euro VI standard. Moreover, China focuses more on the improvement of oil quality, especially by taking comprehensive measures to reduce the sulfur content of diesel. In the meantime, China has brought the standard for automotive diesel in line with that for ordinary diesel, providing a foundation for the rapid transition from China IV to China VI for diesel vehicle emissions.

Steady progress has been made in improving incentives in recent years. An environmental and economic policy tool system, including subsidies, taxes and fees, rewards, prices and other means, has been established initially. Subsidy and rewards policies aim

to eliminate and upgrade older vehicles through economic incentives, and promote the application of new technologies, products and energy sources. However, compared with regulatory policies, China's incentive policies are fewer and improvement is much needed in policy management, supportive measures and policy design.

A combination of regulatory policies and incentives has proven effective in emissions reduction from mobile sources. Taking Beijing as an example, the phasing-out of old vehicles is attributed to the implementation of multiple measures, including zones limited traffic and subsidies for the replacement of old vehicles. According to a study, the cumulative contribution of the vehicle phase-out reduced emissions of CO and THC by 56%, NOx emissions by 59% and PM2.5 emissions by 63% between 1998 and 2017.

4.1.4.2. Challenges in emission reduction in transport sector

Heavy-duty diesel vehicles

At present, the quality of diesel fuel and the level of emissions from diesel vehicles are the main reasons for the failure of a significant reduction in NOx emissions in China. It is difficult to track and monitor excessive emissions from mobile sources, which allows many oversized diesel vehicles to take advantage of the situation.

Off-road mobile machinery

Emissions from off-road machinery are mainly driven by diesel engines. In 2019, the total emissions of nitrogen oxides and particulate matter from these sources were 4.9 million tons and 240,000 tons respectively, with nitrogen oxide emissions close to the level of motor vehicles. However, off-road machinery is characterized by high mobility, irregular workplaces, and irregular active time, which makes supervision more difficult. In addition, with the research and regulation of China's off-road machinery lagging behind that of motor vehicles, relevant regulations and standards are insufficient.

Inadequate incentive policies

Currently, the management of mobile sources in China is still dominated by administrative command and control policies. There is a lack of initiatives and enthusiasm from relevant stakeholders. More importantly, most incentive policies are subsidies, hence they lack diversity, as they do not include other forms of market-based instruments.

4.1.5. Policy recommendations

Improvement of regulatory policies on emission reduction from mobile sources

For diesel trucks, the integrated policy system that covers vehicles, fuel and roads should be continued, and more effort is needed to phase out old vehicles, improve oil quality, restructure the freight industry, strengthen emissions regulation and so on. A whole process of emissions reduction from diesel vehicles (engines) should be worked on, by using road remote sensing, online monitoring, mobility tracing and an effective supervision network. For new energy vehicles, more incentives should be given to electrifying high-emission vehicle fleets (such as buses, taxis, delivery vehicles), optimizing and improving the location of charging infrastructure, so as to improve EV development. For non-road mobile machinery, emission limits should continue to be tightened, old machinery and ships should be phased out, uniform standards should be set for all diesel oils and the use of new energy or clean energy-powered non-road mobile machinery should be encouraged. In addition, the use of onshore electricity by ships should be promoted. For mobile sources, emission standards for CO₂ emissions should be set up.

Use of market-based instruments

The current incentive policies should be further improved, and innovative market-based instruments should be identified. Green government procurement, congestion charges and other incentive policies should be considered. Taxation and pricing tools can be used to continue to promote new energy vehicles and phasing out old vehicles.

4.2. EU EXPERIENCE ON EMISSION REDUCTION POLICIES FOR THE TRANSPORT SECTOR

This section presents the experience in the EU with policies that aim to integrate environmental considerations into transport policy. The focus is on EU level policies, although examples are given of Member State policies where appropriate, e.g. where the competence for the policy area lies with the Member States, such as in relation to vehicle taxation.

An overview of the EU transport sector, and its trends in terms of the number of vehicles, their use and their environmental impact is provided in Annex A.1. In the EU there are also policies on improving the environmental performance of the fuels used in

the transport sector, and to incentivise the use of cleaner fuels, as well as to regulate vehicle waste (including batteries). These are discussed in Annex A.2.

4.2.1. Setting the strategic policy framework

Transport policy, whether ‘command and control’, ‘incentives’ or supporting measures, is not developed in isolation. At various administrative levels, including at the EU level, as well as at the national and local levels, strategies often set the framework for the implementation of a range of different transport policies. These help to ensure that the various policies make up a coherent and consistent framework to deliver the economic and social benefits of transport, while at the same time reducing its adverse environmental, social and economic effects. In addition, strategies help to ensure that transport policies are consistent with the objectives of other policy areas.

The development of such strategies is important for policy integration. It is in these strategies where the ‘integration’ occurs, as these are where the challenges, either relating to transport in general, or to a specific topic in transport, are addressed and the potential measures developed. The following sections cover EU, national and urban transport strategies in the EU.

4.2.1.1. EU transport strategy

Since the early 1990s, every decade or so the European Commission has developed a new transport strategy. The strategy that has governed the development of EU transport policy over the last decade was published in 2011 in the form of a White Paper. Whereas previous EU transport strategies tended to focus on the next decade, the 2011 White Paper took a longer-term perspective, i.e. to 2050. This was due to the concerns that it was aiming to address, amongst which was the need to reduce GHG emissions from the transport sector, and a recognition that the investment decisions that were made in the subsequent decade would contribute to determining the transport system that is in place in 2050.

At the time of the strategy’s publication, the UN-FCCC was calling for developed countries to reduce their economy-wide GHG emissions by at least 80% by 2050 compared to 1990 levels, which the Commission had estimated equated to at least a 60% reduction in GHG emissions from the transport sector. Delivering this level of GHG emissions reduction was at the core of the 2011 White Paper, and the

Box 1: EU policy instruments: Binding or not?

The European Commission publishes a range of different types of policy documents, which have different implications for Member States (see Section 1.1). These include Communications and proposals for Directives and Regulations.

A Communication may be a strategic document. Such a strategic document could be a sector-wide document, such as the 2011 Transport White Paper, or focus on a specific aspect of a broader area. For example, in the last decade the Commission has published Communications setting out an Urban Mobility Strategy and a Low Emission Mobility Strategy. Strategic Communications can set the framework for the development of a particular policy area, as in the case of the 2011 Transport White Paper, or provide an overview of a particular area and then propose a series of actions for different actors to address the issues identified. Such actions can be legislative or non-legislative. However, the Communication itself is not binding. Where a Communication proposes legislative actions that are within the competence of the EU (i.e. EU-level law), the European Commission will need to make additional proposals to initiate the development of the necessary legislation. Non-legislative actions can include recommendations for Member States to take action on the issues for which

they alone have legal competence (see Chapter 1 for an explanation of legal competence in the EU).

As noted in Section 1.1, of the EU institutions, only the Commission has the power to initiate policy. The Commission makes a proposal (which is the end result of an internal process – see Box 2) for either a Directive or a Regulation, which could be to implement an action proposed in a Communication. The final form of the legislation is agreed in discussions between the Council and the Parliament. Once agreed, the Directive or Regulation is adopted and will become EU law after a specified period of time (see Chapter 1 for the legal differences between EU Directives and Regulations).

However, a Directive only becomes binding in each country when the national legislation that implements it comes into effect. A Regulation, on the hand, is binding and directly applicable in all Member States as soon as it is adopted. If a Member State fails to implement a binding requirement, the Commission has the power to initiate enforcement action, which usually involves referring the Member State to the CJEU (see Section 1.1), which then could fine the country concerned.

initiatives that it included, many of which are discussed in Sections 4.2.2 to 4.2.4, below. These included, for example, CO₂ emission standards for vehicles, a strategy for sustainable alternative fuels for transport, including the deployment of the appropriate infrastructure, and various measures to improve the efficiency of the transport system⁹⁴.

The 2011 strategy has been evaluated by the Commission. In late 2019, the Commission published the European Green Deal, which sets out its response to the current environmental challenges that are facing the Union, including climate change. This stated that the Commission would adopt a 'strategy for sustainable and smart mobility' in 2020. The focus

of this would be to put users first and to provide them with mobility that will be more affordable, accessible, healthier and cleaner⁹⁵. This strategy was published in December 2020 and builds on the previous 2011 White Paper by increasing the focus on reducing the environmental impacts of transport in line with the aspirations of the Green Deal, including in relation to transport's emissions⁹⁶.

The EU's transport strategy, whichever form it takes, is not binding on Member States (see Box 1). However, the Member States, and indeed the European Parliament, respond to the publication of such a strategy by the Commission. For example, in

94 COM(2011) 144 White Paper: Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system

95 COM(2019) 649 Communication from the Commission on The European Green Deal

96 COM(2020) 789 Sustainable and Smart Mobility Strategy – putting European transport on track for the future

Box 2: The development of EU legislation

The Commission has developed a set of Better Regulation Guidelines, which inter alia set out how its officers should develop proposals for Directives and Regulations (see Chapter 2 for further details). This includes the development of proposals and the evaluation of policies that are in place, as well as their monitoring and the necessary stakeholder consultation*. A similar process is also applied to most strategic Communications.

The Commission has to prepare an Impact Assessment (IA) to support any proposal for a Directive or a Regulation. (An IA also usually accompanies a Communication, such as a transport strategy.) The IA has to set out the problem, the justification for EU-level action, the objectives of the proposed policy intervention and potential options for its implementation, as well as an assessment of the economic, social and environmental impacts of the different options. The IA is often supported by one or more studies undertaken by external consultants.

The IA also has to set out the monitoring arrangements for the proposed policy, which will be included in the legislation. This usually involves an evaluation, which is undertaken after a specified number of years, while mid-term reviews (e.g. to confirm a longer-term target) are also possible. Such evaluations and reviews are also often supported by studies commissioned from external consultants.

In support of an IA, evaluation or review, the Commission should bring together an Interservice Group (ISG), which involves representatives of other Commission departments (known as Directorate Generals, or DGs). For example, while the development of a piece of transport legislation is usually led by the transport DG, the ISG could be attended by inter alia representatives of the climate, environment and energy departments. The ISG acts as a steering group for both the internal Commission process and also often for any external study. In this way, the targets and concerns of other DGs are integrated into the process.

The views of stakeholders are also sought in the course of an IA, evaluation or review. This can consist of separate, specific meetings with stakeholders and/or with Member States initiated by the Commission. Alternatively, stakeholder engagement, in the form of surveys, interviews and workshops can occur as part of any external studies that are commissioned to support the process. In this way, the Commission draws on the views and expertise of a wide range of stakeholders to support the development, and evaluation, of policy.

An evaluation or review usually results in the Commission proposing an amendment to the piece of legislation, or perhaps even proposing new legislation.

* https://ec.europa.eu/info/law/law-making-process/planning-and-proposing-law/better-regulation-why-and-how/better-regulation-guidelines-and-toolbox_en

response to the publication of the 2011 Transport White Paper, the Council (involving Member States) held a policy debate on the White Paper, prior to which national governments submitted their views on the document. The Parliament prepared its own report on the White Paper in response to its publication. These responses help the Commission to gauge the extent of the support for its proposals.

In addition to the overarching strategy, the Commission also frequently publishes topic-specific strategies or policy frameworks. In order to provide context for the next two sections – on reducing transport's air pollutant emissions (Section 4.2.2)

and on reducing its CO₂ emissions (Section 4.2.3) – the relevant EU policy frameworks are covered below.

The EU's latest **air quality policy framework** was published in 2018⁹⁷, only five years after the previous programme from 2013⁹⁸. This reiterated the EU's approach to improving air quality involving the

97 COM(2018) 330 Communication from the Commission, "A Europe that protects: Clean air for all"

98 COM(2013) 918 Communication from the Commission, "A Clean Air for Europe Programme"

three pillars of air quality standards, emissions reduction targets for the Member States and emissions standards for the most significant sources of pollution, including transport vehicles (see Section 4.2.2.1) and fuels (see Annex A.2.1). The document also set out complementary measures that to put in place, either at the EU level, or within Member States at the national or local levels. EU level measures included expanding the EU policy framework on road user charging (see Section 4.2.4.2), green public procurement (see Section 4.2.4.3) and the deployment of refuelling and recharging infrastructure for alternative transport fuels (see Section 4.2.3.4), as well as the CO₂ standards for road transport vehicles (see Section 4.2.3.1). EU support for national measures was also mentioned, specifically guidance (including best practice and recommendations) on urban vehicle access restrictions, including low emission zones (see Section 4.2.2.2), while underlining that these needed to be implemented as part of Sustainable Urban Mobility Plans (see below).

The EU's most recent strategic document on reducing *passenger car and van CO₂ emissions* was published in 2007⁹⁹, and was effectively the results of the review of an earlier strategy that was published in 1995¹⁰⁰. Both documents covered both supply- and demand-side measures, as well as noting the Commission's support for research to improve the efficiency of vehicles. The supply-side measures are effectively the command-and-control measures, which focus on reducing the CO₂ emissions of the new cars that are put onto the market, while the demand-side measures include incentives and other support measures (see Sections 4.2.3.2 and 4.2.3.3). The Commission has since taken a similar approach to heavy duty vehicles (HDVs), adopting a strategy in 2014¹⁰¹. While the focus of the latter was more on preparing the ground for the supply-side measure, it still made reference to the potential use of incentives to further reduce CO₂ emissions from HDVs.

While the measures themselves will need to be developed separately (for example in the EU, any necessary Directives and Regulations would be developed in accordance with relevant EU processes

– see Box 2), including different measures in a strategy underlines their interaction and the comprehensiveness of their scope, and so supports the integration of 'command and control' and 'incentive' policies.

4.2.1.2. National transport strategies

Many, but by no means all, Member States have a national transport strategy. The extent to which this has been influenced by the EU's Transport White Paper will vary by country. Having said that, the EU-level requirement for Member States to have a transport strategy if they wish to receive financial support from a particular EU fund is likely to have influenced the development of the national strategy in these countries (see below).

In addition to the White Paper having no binding requirements on Member States, the EU also has no competence over the development of national transport strategies, or over the development of national transport infrastructure more generally. However, EU legislation does require that relevant plans, programmes and projects are subject to an environmental assessment. The Strategic Environmental Assessment (SEA) Directive requires that an SEA be undertaken of all plans and programmes relating to transport¹⁰², while the Environmental Impact Assessment (EIA) Directive requires that EIAs are undertaken for most major transport projects¹⁰³. A 2019 evaluation of the SEA Directive concluded that it had generally proved to be beneficial in improving the environmental performance of transport plans and programmes¹⁰⁴.

Other environmental considerations are built into the EU's decision-making process to ensure that projects that support the transition to a low carbon, low emission transport system are funded. One of these is that Member States that want to receive financial support from the EU's regional development funds have to develop a transport master plan that has been subject to an SEA. A review of this requirement concluded that applying an SEA to strategic transport plans had greater potential to deliver the investments that are needed to deliver environmental and climate objectives than applying an SEA at a later stage, as many options were still possible at

99 COM(2007) 19 Communication from the Commission, "Results of the review of the Community strategy to reduce CO₂ emissions from passenger cars and light-commercial vehicles"

100 COM(95) 689 Communication from the Commission, "A Community strategy to reduce CO₂ emissions from passenger cars and improve fuel economy"

101 COM(2014) 285 Communication from the Commission, "Strategy for reducing Heavy-Duty Vehicles' fuel consumption and CO₂ emissions"

102 Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment

103 Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment

104 SWD(2019) 413, 'Evaluation of the Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment', Commission Staff Working Document

such an early stage. It was also noted that it was best if the SEA was integrated into the decision-making process, ideally being carried out in parallel to the development of the strategic plan, so that the plan was able to evolve as the SEA was undertaken. It was also concluded that climate change mitigation measures were best addressed at the high levels of decision-making, such as at the SEA stage¹⁰⁵.

4.2.1.3. Urban transport planning

The integration of transport measures is similarly encouraged at the local level by the EU's guidelines on the development and implementation of **Sustainable Urban Mobility Plans** (SUMP). As with other areas of planning, urban transport planning is not an EU competence. However, there is a perceived demand for EU level support, both in terms of the exchange of good practice between cities and the provision of guidance on a range of issues, particularly in parts of the EU that do not have a well-developed approach to transport planning. In addition, as technology and business models in transport are developing quickly, such guidance helps those local authorities that would not otherwise have the resources or expertise to keep up with the developments. As a result, guidelines on the development and implementation of SUMP have been developed for the European Commission, which were updated in 2019. The second iteration of the SUMP guidance is much more comprehensive than the first, and includes guidance for local authorities on a range of specific topics in order that these may be integrated with other measures in the context of a SUMP.

SUMPs aim to encourage walking, cycling and public transport use where these are more beneficial than car use, e.g. in polluted and congested cities, through the implementation of a wide range of local measures. These include: investing in infrastructure for public transport, cycling and walking; restricting car access and parking; promoting public transport, cycling and walking; promoting and enabling shared mobility (e.g. car sharing, car pooling, bike sharing, etc.); promoting the use of cleaner fuels and vehicles; and supporting sustainable urban logistics. Dedicated 'topic guides' and 'practitioner briefings' have been produced, which cities can refer to when

they are interested in learning about a specific topic¹⁰⁶.

The development of transport strategies is not without its challenges. The SUMP guidelines contain information on the challenges associated with the development of transport strategies, as well as on how these might be overcome. The SUMP concept is based on eight high level principles, which underline the importance of, for example: planning for the sustainable mobility of the entire 'functional city'; cooperating across institutional boundaries; assessing the performance of the mobility system; and defining a long-term vision that covers all transport modes in an integrated manner¹⁰⁷. The process for the development of a SUMP has been refined over the years and now incorporates 12 stages within a broader SUMP planning cycle¹⁰⁸.

4.2.1.4. Summary and conclusions relating to the strategic policy framework

Within the EU and its Member States, there are various strategies and plans that have been developed to set the framework for the development of transport policy, including topic-specific strategies, which help to ensure that different policies are developed in an integrated way. While the EU's transport strategy sets the framework for the development of transport policy by the Commission, national strategies, where these exist, may or may not be developed in a way that is coherent with the EU's strategy. While the SUMP guidelines provide a framework for the development and integration of sustainable transport in urban areas, the extent to which this framework is taken up depends on individual cities, as well as on wider national policy frameworks.

However, the apparent demand for the SUMP guidelines suggests that many cities across the EU are developing urban transport strategies that at least have some common elements. The EU level requirements for there to be SEAs and EIAs of transport plans, programmes and projects also ensures that there is some coherence in terms of the approach taken to considering the environmental performance of transport when such plans, programmes and projects are being developed. Finally, the requirement that certain countries must have a

105 Milieu, TEPR and COWI (2020) "Mapping good practices in strategic environmental assessment for transport plans and programmes", report for the European Commission's DG Environment; see <https://op.europa.eu/en/publication-detail/-/publication/8776efcc-8a8a-11ea-812f-01aa75ed71a1/language-en/format-PDF/source-126920041>

106 <https://www.eltis.org/mobility-plans/sump-guidelines> (accessed 13th January 2021)

107 <https://www.eltis.org/mobility-plans/sump-concept> (accessed 31st March 2020)

108 <https://www.eltis.org/mobility-plans/sump-process> (accessed 31st March 2020)

transport master plan that has been subject to an SEA before they are able to receive financial support from certain EU funds will also help to provide some coherence in the development of such plans in these countries.

4.2.2. Integrating measures to reduce transport's air pollutant emissions

This section focuses on the policies in the EU that aim to reduce transport's air pollutant emissions. Section 4.2.2.1 covers relevant command and control policies, starting with those that deal with the functioning of vehicles and mobile machinery. This is followed in Section 4.2.2.2 by a discussion of the measures that restrict the use of (certain types of) vehicle and mobile machinery.

4.2.2.1. Regulating the air pollutant emissions from vehicles and polluting machinery

In relation to *air pollutant emissions from vehicles*, the current Euro 6 standards set emission limit values for light duty vehicles (cars and vans; see Table 3 in Annex A.3)¹⁰⁹, while the Euro VI standards do the same for heavy duty vehicles (buses, coaches, lorries; see Table 4 in Annex A.3)¹¹⁰. These standards require that the regulated vehicles (or engines) emit no more than the specified limits of certain air pollutants, otherwise they will not be allowed to be put onto the market in the EU. The compliance with these standards is tested in the course of the type approval process, which is regulated at the EU level. This process ensures that all new vehicles that are sold in the EU have to meet minimum standards in terms of *inter alia* their emissions performance. As the name suggests, the current emission standards are the latest in a series of standards, which date back to the early 1990s. The Commission is currently developing more stringent air pollutant emission standards for vehicles that use internal combustion engines¹¹¹.

The EU also has requirements for *market surveillance* for all vehicle types. These set out the activities that need to be carried out by the relevant authorities in the Member States to ensure that the vehicles that are put on the market comply with the requirements of EU legislation. Authorities must undertake regular checks to ensure that vehicles, and their components, comply with the relevant requirements, including with respect to their air pollutant emissions. The checks can include documentary checks, as well as laboratory and on-road tests. A minimum of one test must be undertaken for every 40,000 vehicles registered in a country, each of which has to ensure compliance with a range of EU legislation, including that on air pollutant emissions¹¹².

The EU has also set limit values for air pollutant emissions from smaller motorised road vehicles (such as motorbikes and small three- and four-wheel vehicles)¹¹³ and for engines used *non-road mobile machinery* (NRMM)¹¹⁴. The current NRMM Regulation contains the latest set of emission limit values for NRMM, the first of which was adopted in the late 1990s. The current set of limit values are still being introduced and cover engines that can be used in a wide range of NRMM, including engines to be used in: NRMM intended, or suitable to be moved, by road; mobile machines used for producing electric power; hand-held machinery; all but the smallest inland waterway vessels (and their auxiliary engines); railway vehicles, both locomotives and railcars¹¹⁵; and snowmobiles and all terrain vehicles (including those that can take passengers). The legislation also sets out requirements for market surveillance. This requires that the relevant authorities in the Member States undertake checks of documents and, if appropriate, physical and laboratory checks of engines to ensure that these comply with EU legislation. In addition, separate pieces of legislation set emission limit values for the air pollutant emissions from agricultural and forestry vehicles¹¹⁶ and recreational water vessels¹¹⁷.

109 Regulation (EC) 715/2007 on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information

110 Regulation (EC) No 595/2009 on the type-approval of motor vehicles and engines with respect to emissions from heavy duty vehicles (Euro VI) and on access to vehicle repair and maintenance information

111 COM(2019) 649

112 Regulation (EU) 2018/858 on the approval and market surveillance of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles

113 Regulation (EU) 168/2013 on the approval and market surveillance of two- or three-wheel vehicles and quadricycles

114 Regulation (EU) 2016/1628 on requirements relating to gaseous and particulate pollutant emission limits and type approval for internal combustion engines for non-road mobile machinery

115 A vehicle that can provide the motive power for propelling itself, as well as carrying goods and/or passengers.

116 Regulation (EU) No 167/2013 on the approval and market surveillance of agricultural and forestry vehicles

117 Directive 2013/53/EU on recreational craft and personal watercraft

In addition to ensuring that all new vehicles have to comply with a minimum level of environmental performance and the market surveillance activities, the EU also has a system of ***in-use checks for road transport vehicles***. For all vehicles, requirements for periodic roadworthiness testing are set out. For cars and vans, these tests have to be undertaken for the first time no later than four years after a vehicle's initial registration, and then at least every two years, whereas for heavier vehicles the first test has to be no later than a year after it was first registered and then needs to be undertaken annually. A set of minimum requirements for the content of the tests is set out in the legislation, which includes requirements for the visual inspection of the emissions control equipment and the analysis of the vehicle's exhaust gases (or checking the equivalent reading in an on-board diagnostics system where this is available)¹¹⁸.

EU legislation also sets requirements for the ***technical roadside inspection*** of medium-sized and large passenger and freight vehicles. This sets out guidance on the selection of vehicles to be subject to these tests and requires a detailed technical roadside inspection, which could include the emissions performance of the vehicle, if an initial inspection considers that a more detailed inspection would be appropriate¹¹⁹.

One of the ***challenges that the EU has faced*** in relation to the Euro 6 standards for cars was a discrepancy between the emission limits as measured on the test cycle in the course of the type approval process, and the real-world emission of NO_x, in particular. This became clear in the early 2010s, which led to work being undertaken to develop and implement a real-driving emissions (RDE) test procedure. This test uses portable emissions measurement systems (PEMs) to measure the emissions of NO_x and the number of particles that are emitted when the respective vehicles are used in real-world driving conditions. A car must pass the RDE test, as well as the emissions tests undertaken during type approval, in order for it to be allowed to be sold in the EU. For a car to pass the RDE test, its real-world NO_x emissions must be no more than 43% higher than the respective test cycle emissions limit value, while emissions of the

number of particles must be no more than 50% higher¹²⁰.

An ***additional challenge*** that has arisen in relation to the emission of air pollutants from cars was the use of software by manufacturer VW to manipulate the emissions performance of its cars. The software was able to detect when the car was being tested and so turn on its emissions control system in order to ensure compliance with the type approval tests; the control system was then deactivated when the vehicle was used outside of the laboratory. One of the measures introduced as a result of this was the market surveillance requirements noted above. Of the market surveillance tests that need to be performed, at least 20% must focus on the vehicle's exhaust emissions and be equivalent to the emissions tests that are undertaken in the course of type approval testing. Fines can be imposed on manufacturers whose vehicles do not comply with this legislation¹²¹.

4.2.2.2 Regulating the use of vehicles and polluting machinery

Restrictions on the ***use of vehicles*** can take many forms, from the pedestrianisation of public space and the creation of bus and cycle lanes, all of which support modal shift and restrict car use, to restrictions on the use of a particular type of vehicle in certain areas, e.g. those vehicles with higher emissions. Such urban vehicle access restrictions are encouraged at the EU level, e.g. via the SUMP guidelines (see Annex A.2.3), as a result of *inter alia* their potential environment benefits. However, as a result of the subsidiarity principle (see Section 1), the implementation of these measures is left to individual cities. In addition to introducing access restrictions that aim to encourage modal shift, many cities in the EU have implemented, or are implementing, access restrictions that directly aim to improve the environmental performance of transport by restricting access to more polluting vehicles.

¹¹⁸ Directive 2014/45/EU on periodic roadworthiness tests for motor vehicles and their trailers

¹¹⁹ Directive 2014/47/EU on the technical roadside inspection of the roadworthiness of commercial vehicles circulating in the Union

¹²⁰ Commission Regulation (EU) 2016/427 amending Regulation (EC) No 692/2008 as regards emissions from light passenger and commercial vehicles (Euro 6); Commission Regulation (EU) 2016/646 amending Regulation (EC) No 692/2008 as regards emissions from light passenger and commercial vehicles (Euro 6); Commission Regulation (EU) 2017/1151 supplementing Regulation (EC) No 715/2007; Commission Regulation (EU) 2018/1832 amending Directive 2007/46/EC; ICCT (2017) "Real-driving emissions test procedure for exhaust gas pollutant emissions of cars and light commercial vehicles in Europe"; ICCT (2018) "Changes to the motor vehicle type-approval system in the European Union".

¹²¹ Regulation (EU) 2018/858; European Court of Auditors (2019) "The EU's response to the 'dieselgate' scandal"

The most obvious example of such access restrictions are the various environmental, low emission and **clean air zones** that are being set up in different European countries. The basic element of many of these is the banning of (or charging for) vehicles that do not comply with specified Euro emission standards from entering specified parts of a city. The original environmental zones in Sweden date from 1998 and only applied to lorries and buses. The requirements to enter these zones have been gradually tightened over the years, so that, from a specified date, heavy vehicles that complied with less stringent Euro emissions standards were not allowed to enter the various environmental zones¹²². Since January 2020, Sweden has had two additional classes of low emission zone, the first of which only applies to cars, while the other only allows entry to the least polluting light and heavy vehicles¹²³.

As with the Swedish approach, German environmental zone policy is set out within a national framework. This allows cities to vary the stringency of the environmental zone that they implement depending on their needs. The German system is based on stickers that are attached to the vehicle to indicate its Euro emissions standard and applies to cars, buses and trucks, but not to light commercial vehicles¹²⁴. Many other European countries have similar zones, including Denmark¹²⁵, the Netherlands¹²⁶ and France¹²⁷, which tend to be set up slightly differently. The number of such zones is increasing, largely as a result of the fact that air pollution levels in many European cities breach EU air quality standards. Some zones are going even further, e.g. in central Madrid, its Zero Emission Zone only allows entry to electric and hydrogen vehicles, along with a limited number of other low emission vehicles, e.g. some plug-in hybrid vehicles¹²⁸.

Some cities in Europe are also taking action to reduce emissions from NRMM through the use of **low emission zones for NRMM**. These zones tend to be based on requiring the use of NRMM that meets future EU NRMM emission standards (see Section 4.2.1.1) in the respective cities¹²⁹. The Norwegian capital Oslo has gone further. By actively engaging with the construction industry, the city has established a zero emission standard for construction sites in the city that it now includes in tender documents¹³⁰.

4.2.3. Integrating measures to reduce transport's CO₂ emissions

This section focuses on the policies in the EU that aim to reduce transport's CO₂ emissions. Section 4.2.3.1 covers relevant command and control policies, specifically the which the EU regulates CO₂ emissions from vehicles. This is followed in Section 4.2.3.2 by a discussion of the measures in the EU that incentivise the purchase and use of more efficient vehicles and, in Section 4.2.3.3 on the provision of relevant information to consumers. The section concludes (in Section 4.2.3.4) with a discussion of the measures to ensure the provision of the necessary refuelling and recharging infrastructure for alternative transport fuels.

4.2.3.1. Regulating CO₂ emissions from vehicles

As noted in Section 4.2.1, the European Commission announced its intention to take action to reduce the **CO₂ emissions from cars** in a Communication in 1995¹³¹. This noted that the growth in transport's CO₂ emissions could undermine the Community's CO₂ reduction objectives. Although not explicitly stated, the implication was that the initial focus was to be on cars as these accounted for half of the EU's transport's CO₂ emissions at the time. The initial approach was to set up a series of voluntary agreements with manufacturers, supported by action to differentiate vehicle taxes and the provision of information to consumers (see Sections 4.2.3.2 and 4.2.3.3 below). The voluntary agreements were

122 https://urbanaccessregulations.eu/images/stories/pdf_jan2010/SE_Milj%C3%B6zon_Sverige_ENG.pdf (accessed 13th March 2020)

123 <https://www.government.se/press-releases/2018/04/government-makes-announcement-on-low-emission-zones/> (accessed 13th March 2020)

124 <https://www.umweltbundesamt.de/en/topics/air/particulate-matter-pm10/low-emission-zones-in-germany>; <http://gis.uba.de/website/umweltzonen/index.php?tab=uwz>; <https://www.environmental-badger.co.uk/en.html> (all accessed 13th March 2020)

125 <https://eng.mst.dk/air-noise-waste/air/reducing-traffic-emissions/danish-low-emission-zones/> (accessed 13th March 2020)

126 <https://www.milieuzones.nl/english> (accessed 13th March 2020)

127 <https://www.lez-france.fr/en/general-information.html> (accessed 13th March 2020)

128 <https://www.distintivo-ambiental.es/en/spanish-environmental-zones/madridcentral-zez.html> (accessed 13th March 2020)

129 For example, see: <http://www.sootfreecities.eu/sootfreecities.eu/public/measure/non-road-mobile> (accessed 6th August 2020); <https://cpnonline.co.uk/features/the-march-of-the-low-emission-zone/> (accessed 6th August 2020); <https://www.london.gov.uk/sites/default/files/nrmm-practical-guide.pdf> (accessed 6th August 2020)

130 <https://www.oslo.kommune.no/politics-and-administration/smart-oslo/projects/zero-emission-construction-sites/#gref> (accessed 6th August 2020)

131 COM(95) 689

finalised in the late 1990s, under which manufacturers were to reduce the CO₂ emissions of their new cars. However, by the mid-2000s, it had become clear that the voluntary approach was not working, so the Commission decided to regulate¹³².

The Regulation on the CO₂ emissions from cars came into force in 2009, followed by a Regulation targeting van CO₂ emissions two years later. The Regulation of vans followed that of cars as there was concern that there was a regulatory gap with some cars being registered as vans in some Member States in order to take account of tax or other incentives¹³³. Instead of setting an emission limit value that is applicable to all vehicles (as with the Euro 6 standards), the EU chose to regulate the CO₂ emissions of cars and vans by setting fleet-wide CO₂ emission performance standards, from which manufacturer-specific targets are derived. Manufacturers are fined in the event of non-compliance with their specific targets.

In 2019, new standards were adopted for 2025 and 2030, which also included an incentive mechanism for manufacturers to put more low and zero emission vehicles onto the market (see Table 1)¹³⁴. If a manufacturer exceeds the zero and low emission vehicle benchmark, they are rewarded with a less stringent CO₂ emissions reduction target, with the maximum being a 5% reduction in their target for exceeding the benchmark by 5%. Vehicles with zero tailpipe emissions (i.e. battery electric and fuel cell electric vehicles) count as one vehicle for the purpose of the benchmark, with plug-in hybrid vehicles counting as a proportion of one vehicle, depending on the extent to which their tailpipe CO₂ emissions are lower than the 50 gCO₂/km threshold that is used to define a low emission vehicle.

Table 1: Requirements on manufacturers in relation to reducing CO₂ emissions from cars and vans and the incentive for putting zero and low emission cars and vans on the market under Regulation (EU) 2019/631

	EU fleet wide target from:		Zero and low emission vehicle benchmark from:	
	1 January 2025	1 January 2030	1 January 2025	1 January 2030
Cars	15% reduction compared to 2021 target	37.5% reduction compared to 2021 target	15% of the respective new vehicle fleets	35% of the respective new car fleets
Vans		31% reduction compared to 2021 target		30% of the respective new van fleets

Source: Articles 1(4) to 1(7) of Regulation (EU) 2019/631

The original 2009 and 2011 Regulations set targets until 2020/21. An evaluation of this legislation identified that, while the Regulations had contributed to reducing the CO₂ emissions from new vehicles, one of the main issues was that there was a **discrepancy between test cycle and real-world CO₂ emissions**. This limited the effectiveness of the legislation in practice, as the reduction of CO₂ emissions in the real-world was less than had been expected¹³⁵. This was addressed by changing the test cycle on which a vehicle's CO₂ emissions were measured – from the New European Driving Cycle to the Worldwide Harmonised Test Protocol – which should lead to the test cycle reductions in CO₂ emissions being more representative of real-world emission values. In addition, in the revised legislation that sets the targets for 2025 and 2030, a new provision was included that requires the Commission to monitor real-world CO₂ emissions, while an obligation was put on manufacturers to ensure that the measured CO₂ emissions correspond with in-service CO₂ emissions¹³⁶. These two provisions have been included in an attempt to avoid the discrepancies that emerged in the past between real-world and test cycle emissions.

Since the adoption of the Regulation, a new set of European Commissioners has taken office. One of their first actions was to adopt the European Green

132 Farmer, A. (ed) (2011) "Manual of European Environmental Policy 2011", Routledge

133 COM(2009 593 Proposal for a Regulation setting emission performance standards for new light commercial vehicles as part of the Community's integrated approach to reduce CO₂ emissions from light duty vehicles

134 Regulation (EU) 2019/631 setting CO₂ emission performance standards for new passenger cars and for new light commercial vehicles

135 Ricardo-AEA and TEPR (2015) "Evaluation of Regulations 443/2009 and 510/2011 on CO₂ emissions from light-duty vehicles"

136 Regulation (EU) 2019/631

Deal (see Annex A.2.1), which included *inter alia* their response to the need to reduce GHG emissions. The Green Deal included a commitment to achieving climate neutrality in the EU by 2050, which requires a 90% reduction in transport's CO₂ emissions compared to 1990 levels. One of the measures to which the Green Deal committed the Commission was, by 2021, to review the 2025 and 2030 CO₂ emissions performance standards for cars and vans in order to ensure that these are consistent with the economy-wide net-zero GHG emissions target for 2050¹³⁷. The results of this review are expected to be published in early 2021.

In 2019, the EU began to regulate **CO₂ emissions from heavy duty vehicles** for the first time. A similar approach is taken to that for cars and vans, with CO₂ emissions performance standards being set for 2025 and 2030 (see Table 2). The legislation contains many of the same elements as that for cars and vans, including an incentive mechanism to encourage manufacturers to put zero and low emission vehicles onto the market and fines being levied in the event of non-compliance with the specific targets. As with cars and vans, there is also a requirement on the Commission to monitor real-world CO₂ emissions and an obligation on manufacturers to ensure that measured CO₂ emissions correspond with in-service CO₂ emissions. The main difference compared to the car and van CO₂ Regulation is that the vehicle-specific CO₂ emissions for heavy duty vehicles are determined by simulation, using a tool (VECTO) that has been developed for this purpose, rather than by direct measurement¹³⁸.

The EU also has a strategy for reducing **GHG emissions from maritime transport**¹³⁹. To date, the only legislation that has been forthcoming in this context requires the EU to monitor, report and verify the CO₂ emissions of large ships that call at EU ports¹⁴⁰. The remaining two steps of the strategy are to set GHG reduction targets for the maritime sector and to introduce a market-based mechanism to deliver GHG emissions reductions. In both cases, the EU is supporting the development of the relevant measures at the international level by the International

Maritime Organisation (IMO)¹⁴¹. An amendment to the EU's emissions trading Directive from 2018 states that the Commission should regularly report on the IMO's progress with the development of the relevant measures. In this context, it also underlined that preparatory work on the relevant measures, either at the IMO or EU level, should start from 2023¹⁴². The implication being that, if measures are not forthcoming in the IMO, the EU should take unilateral action.

Table 2: Requirements on manufacturers in relation to reducing CO₂ emissions from selected heavy duty vehicles Regulation (EU) 2019/1242

	EU fleet wide target for...		Zero and low emission vehicle benchmark from:	
	From 2025 onwards	From 2030 onwards	From 2025 onwards	From 2030 onwards
Heavy duty vehicles*	15% reduction compared to reference CO ₂ emissions**	30% reduction compared to reference CO ₂ emissions**	2% of the respective new vehicle fleets	To be decided by a review in 2022

* Not all heavy-duty vehicles are covered at this stage, e.g. coaches and buses are not yet covered, neither are some lorries.
** 'Reference CO₂ emissions' are based on the CO₂ emissions monitoring data reported in the 12 months to 30 June 2020
Source: Articles 1 and 5(3) of Regulation (EU) 2019/1242

4.2.3.2. Incentivising the purchase and use of more efficient vehicles

As noted above, in its 1995 strategy on reducing CO₂ emissions from cars, the Commission recognised the importance of **using vehicle taxation as a means of incentivising** the purchase and use of cars that emitted less CO₂¹⁴³. As a result, it proposed the establishment of an EU-wide framework to support the differentiation of vehicle taxes according to a car's CO₂ emissions. This was supposed to be implemented through Member State actions within an EU-level framework. However, by 2005 few countries had differentiated their taxes according to a vehicle's CO₂ emissions, and so the Commission published a proposal to coordinate the differentiation of Member State vehicle taxes according to cars' CO₂ emissions. However, as this was a taxation measure, it required a unanimous agreement

137 COM(2019) 649
138 Regulation (EU) 2019/1242 setting CO₂ emission performance standards for new heavy-duty vehicles
139 COM(2013) 479 Communication from the Commission on Integrating maritime transport emissions in the EU's greenhouse gas reduction policies
140 Regulation (EU) 2015/757 on the monitoring, reporting and verification of carbon dioxide emissions from maritime transport

141 COM(2013) 479
142 Directive (EU) 2018/410 amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments
143 COM(95) 689

Box 3: Levying taxes and charges to support the purchase and use of zero and low emission vehicles in the Netherlands and Norway

The vehicle tax system in the Netherlands has been gradually adapted over the last decade in favour of cars with lower CO₂ emissions, while diesel cars have been taxed at higher rates than petrol vehicles. Since 2008, cars with low CO₂ emissions have at least been partially exempt from registration taxes and annual circulation taxes. By 2018, battery electric and fuel cell vehicles were exempt from registration taxes, whereas plug-in hybrid cars, as well as those that run on petrol and diesel, were taxed according to their CO₂ emissions.

The Dutch system divides plug-in hybrid, petrol and diesel cars into bands according to their CO₂ emissions; cars are then taxed according to their CO₂ emissions, with each gram of additional CO₂ leading to a higher tax, the rate of increase of which depends on the band. So, an additional gram of CO₂ emissions incurs a higher tax increase in a higher band (that consists of more polluting vehicles) than in a lower band. Battery electric vehicles are also exempt from the annual circulation tax, whereas plug-in hybrids emitting 50 gCO₂/km or less are taxed at half the rate of petrol and diesel cars, at least until 2020.

The way in which the Netherlands taxes its company cars is also dependent on their CO₂ emissions. Company cars are taxed on the basis of a certain percentage of the gross list price of the vehicle, which tends to evolve annually. Between 2010 and 2013, battery electric and plug-in hybrid cars were effectively exempt from company car taxes,

as the taxable percentage of their gross list price was 0%. Since 2014, neither battery electric vehicles nor plug-in hybrid vehicles have been exempt from company car taxes although both initially benefitted from a lower taxable percentage than petrol and diesel cars, with battery electric cars being taxed at a lower level than plug-in hybrids. However, from 2017 the rates applied to plug-in hybrid cars have been the same as those applied to low emitting petrol and diesel cars.

In Norway, since 2001 battery electric and fuel cell electric cars have been exempt from value added tax, which is currently levied at a rate of 25% on the list price of other cars. A car's registration tax is currently based on three components: a car's CO₂ emissions, its NO_x emissions and its weight. Zero and low CO₂-emitting vehicles are effectively offered a tax deduction for that component, while zero emission vehicles pay nothing for the NO_x component of the tax. Previously, electric cars had been completely exempt from registration taxes. In 2018, the annual vehicle tax was replaced by a traffic insurance fee, which is paid as part of the car's insurance. Again, there is no fee for battery electric and fuel cell electric cars. In addition, these types of car had previously been exempt from national road tolls, although since 2018 they are now charged at half the rate of petrol and diesel cars*.

* European Environment Agency (2018) "Vehicle emissions and impacts of taxes and incentives in the evolution of past emissions", Eionet Report – ETC/ACM 2018/1

ICCT (2018) "Using vehicle taxation policy to lower transport emissions: An overview for passenger cars in Europe"

amongst Member States (see Section 1.1), which was not forthcoming¹⁴⁴. Hence, the design and use of taxes to support the purchase and use of cars with low CO₂ emissions has been left to Member States.

Various countries in Europe have set up taxation and incentive systems that encourage the purchase and use of low CO₂ emitting cars. Such national vehicle

taxes are complementary to the EU level CO₂ performance standards for cars (see Section 4.2.1.2); the latter ensures the supply of cleaner vehicles, taxes and incentives help to stimulate demand for these vehicles. In addition, the taxation of so-called "company cars" is relevant, as employees are often given a car as part of a salary package, which is then taxed accordingly. Company car taxes can be set so as to encourage the purchase of low emission cars as company cars. Certain vehicles, such as zero emission vehicles, are also sometimes given exemptions from charges, such as tolls for the use of bridges, parking charges and congestion charges, as an

144 Ricardo-AEA and TEPR (2015)

additional incentive. The way in which companies are taxed in relation to the vehicles that they own is also sometimes based on a vehicle's CO₂ emissions in order to provide an incentive for companies to buy and own cleaner vehicles.

Studies that have investigated the impact of such taxes and incentives have concluded that, where national taxes are sufficiently differentiated according to CO₂ emissions and where incentives are sufficiently large, consumers respond by buying more zero and low emitting vehicles. The most evident examples in this respect are the Netherlands and non-EU Member State Norway, where a mix of tax differentiation and incentives have led to high shares of plug-in hybrid and/or electric cars. For a decade in the Netherlands, the registration, annual circulation taxes and company car taxation have favoured low CO₂ emitting cars, as well as electric and plug-in hybrid cars. Since the 1990s, Norway has exempted electric cars from registration and annual circulation taxes, while electric cars are also partially exempt from tolls and parking charges (see Box 3 for more details)¹⁴⁵. As can be seen from the examples in the Box, the way in which vehicles are taxed, and the level of tax, needs to be regularly altered to take account of the market uptake of different vehicles, developments in their comparative fuel efficiencies and the need to maintain revenues.

In both the Netherlands and Norway, the net impact of these policies is that the level of taxes and charges paid by the owners of cars that have higher CO₂ emissions is significantly more than those paid by owners of lower, or zero, emission cars. In both countries, the level of taxation becomes increasingly steep for cars that emit more than 130 gCO₂/km. Significant tax advantages for the purchase or registration of low emitting vehicles have been identified as being particularly important in ensuring that consumers buy low emission cars in large numbers, although the differentiation of annual circulation and company car taxes is also considered to be important to provide a consistent price signal to the market. As the average CO₂ emissions of the new car fleet, or the fleet as a whole, declines, tax rates will need to be adjusted to ensure that the incentive to buy, own and use a low CO₂ emitting vehicle remains¹⁴⁶.

4.2.3.3. Provision of information to consumers to support environmental objectives

The provision of information to consumers to enable them to make informed decisions about their purchase decisions is another element of the low polluting/low carbon transport policy framework in the EU (as noted in Section 4.2.1). EU legislation, in the form of the Car Labelling Directive, requires that information on the *fuel economy and CO₂ emissions of new cars* is provided to consumers on a label that is attached to, or displayed near, new cars where these are made available for sale or lease. The Directive also requires that this information is included on printed promotional material, as well as in a printed guide that enables consumers to compare models of different manufacturers¹⁴⁷. This Directive is complementary to the CO₂ emissions performance standards and to national car taxes that are differentiated according to a vehicle's CO₂ emissions (see Sections 4.2.3.1 and 4.2.3.2, respectively). Indeed, the Directive was one of three initiatives – the others being the agreements with manufacturers to reduce CO₂ emissions and an EU initiative on car taxation – that the Commission set out in its 1995 Communication on reducing CO₂ emissions from cars¹⁴⁸.

The current Car Labelling Directive is not that detailed on the design of the label, so Member States have been free to design their own label beyond the Directive's minimum requirements. Around half have chosen to implement a colour-coded label that categorises new cars into seven (or more) colour-coded categories. Most of the Member States that have a colour-coded label have based its design on the colour-coded label that has been used in the EU since the 1990s for household appliances, such as washing machines and fridges. This rates products from A (dark green) to G (red). A more recent energy label that is used on larger buildings in the EU follows a similar format. Hence, consumers are familiar with the design of the label and the type of information that it provides¹⁴⁹.

The Car Labelling Directive no longer completely reflects the new car market in the EU. For example, the Directive does not specify how information

145 European Environment Agency (2018) "Vehicle emissions and impacts of taxes and incentives in the evolution of past emissions", Eionet Report – ETC/ACM 2018/1

146 ICCT (2018)

147 Directive 1999/94/EC relating to the availability of consumer information on fuel economy and CO₂ emissions in respect of the marketing of new passenger cars

148 COM(95) 689

149 Regulation (EU) 2017/1369 setting a framework for energy labelling; Ricardo and TEPR (2016) "Evaluation of Directive 1999/94/EC ("the car labelling Directive")", report for the European Commission

relating to battery electric cars and fuel cell electric cars should be presented. In addition, it also does not cover the internet, which is now where EU consumers undertake a lot of research prior to buying a new car. The Car Labelling Directive is currently under review in order to *inter alia* address these challenges.

In the EU, a label also has to be attached to **new tyres** that are sold for use on cars, vans and on some heavier vehicles, including buses. The part of the label that is used to communicate the tyre's energy efficiency class, which is based on tyre's rolling resistance coefficient, uses the same design as the energy label for household appliances (see above). In addition, the label includes a pictogram to indicate a tyre's 'external rolling noise class', and an A to G classification to indicate its 'wet grip class', which is an indication of the tyre's performance in wet conditions. In 2020, a revised Regulation was adopted, which now includes a provision for separate pictograms on the label to indicate the tyre's performance in snow and ice¹⁵⁰.

4.2.3.4. Ensuring sufficient recharging and refuelling infrastructure for alternative fuels

There is also an emerging EU policy framework that aims to ensure that there is sufficient refuelling and recharging infrastructure for alternative fuels, i.e. the fuels and energy sources that are expected to support the transition to a low carbon transport sector. The Alternative Fuels Infrastructure Directive (AFID) requires Member States to ensure that there is sufficient infrastructure for alternative transport fuels, including for vehicles that use electricity and hydrogen. The Directive also requires Member States to assess the need for shore-side electricity supply for vessels in maritime and inland ports and called for its installation unless there was insufficient demand, or the costs outweighed the benefits. Under the AFID, each EU country must develop a national policy framework for the deployment of infrastructure for alternative transport fuels, while the Commission is committed to working with the relevant standardisation bodies to develop common technical specifications where these are needed. The Directive also contains requirements for the provision of information to consumers¹⁵¹.

The Commission's own analysis of the Member States' national policy frameworks concluded that their low level of ambition with respect to the deployment of infrastructure for alternative fuels meant that they would not contribute significantly to reducing CO₂ emissions from transport¹⁵². Automotive industry and environmental groups have together called on the Commission to revise the AFID to include clear targets for Member States to ensure the deployment of sufficient recharging infrastructure to support the uptake of electric vehicles¹⁵³. The Commission is currently reviewing the Directive in order to *inter alia* ensure that it is consistent with the EU's aspiration to deliver a climate neutral economy by 2050, as set out in the Green Deal.

The importance of informing consumers about the **different alternative fuels and energy sources** that are increasingly being used in the transport sector has also been recognised in the AFID (see Section 4.2.1.4). One of the AFID's provisions requires that information is made available to consumers on the fuels that can be used in a vehicle and on the vehicles that can be charged at recharging points of different powers. This information has to be presented where vehicles are bought (e.g. in car showrooms), where they are refuelled or recharged and also in the manuals that come with the vehicles. The provision of the information has to be based on existing standards, where these exist or have been subsequently produced at the European level. Information also has to be provided to enable consumers to compare the unit price of different fuels and to let them know where refuelling and recharging points for alternative fuels are located. For recharging points, information on their real-time accessibility and charging information could also be provided. As noted in Section 4.2.1.4, the Commission is currently reviewing the AFID, which may include strengthening some of these information provisions¹⁵⁴.

150 Regulation (EU) 2020/740 on the labelling of tyres with respect to fuel efficiency and other parameters

151 Directive 2014/94/EU on the deployment of alternative fuels infrastructure

152 SWD(2019) 29, 'Report on the Assessment of the Member States National Policy frameworks for the development of the market as regards alternative fuels in the transport sector and the deployment of relevant infrastructure pursuant to Article 10(2) of Directive 2014/94/EU, Commission Staff Working Document

153 ACEA, Eurelectric and Transport & Environment (2019) 'Joint call to action for the accelerated deployment of smart charging infrastructure for electric vehicles'

154 Directive 2014/94/EU

4.2.4. Complementary measures supporting the reduction of air pollutant and CO₂ emissions

This section covers the EU's approach to a range of complementary measures that indirectly contribute to reducing transport's air pollutant and CO₂ emissions. This includes support for the development of the appropriate infrastructure (Section 4.2.4.1), incentivising the use of more efficient vehicles (Section 4.2.4.2), green public procurement (Section 4.2.4.3) and the provision of information to consumers more generally (Section 4.2.4.4).

4.2.4.1. Developing transport infrastructure that better protects the environment

The way in which the EU supports the development of transport infrastructure takes account of its potential impacts on the environment and its potential to support a low carbon, low emission transport system. The major EU funds that support the development of infrastructure, particularly the Connecting European Facility (CEF), focus on supporting projects for modes that have the potential for better environmental performance, i.e. infrastructure for rail and waterborne transport. In addition, in order to support the transition to low carbon and low emission transport, the funds support the development of electric vehicle re-charging points on the EU's core road network¹⁵⁵.

In order to improve the environmental performance of its transport system, the EU also takes a range of actions to support combined transport and multimodal transport, i.e. freight and passenger transport that uses the most appropriate mode for each part of its journey. The EU has identified a core network of transport infrastructure and aims to ensure that this is multimodal¹⁵⁶. Relevant projects that improve the interconnections between various modes are supported by the CEF¹⁵⁷. The EU also has legislation, the Combined Transport Directive, that supports the transport of freight over long distances using rail or waterborne transport for the main part of the journey; in these cases, road transport is only used for the initial and/or final part of the journey. The Directive allows for less stringent requirements on the parts of multimodal journeys that are undertaken by road compared to cases where the whole

journey is being undertaken by road, and the provision of selected fiscal incentives for the use of combined transport¹⁵⁸.

The Combined Transport Directive has been beneficial, although it has been concluded that there is significant potential for further improvement to make the most of the potential of combined transport in the EU. In particular, the framework conditions for transporting freight using combined transport are still considered to be less advantageous than those for using road transport alone, which makes combined transport less competitive, while the level of financial support through funds such as the CEF are not considered to have been sufficient¹⁵⁹. A proposal in 2017 to revise the Directive could not be agreed by the other EU institutions, so has been withdrawn; a new proposal is anticipated.

The EU also has legislation that aims to facilitate the long-distance transport of freight by rail through the development of 'rail freight corridors'. This legislation aims to develop a European network for competitive rail freight by *inter alia* improving cooperation between the various rail freight stakeholders, coordinating and planning investments, coordinating the provision of information and improving the management of rail freight traffic¹⁶⁰. This legislation was evaluated in 2020.

EU-wide specifications have also been defined that aim to support the development and provision of multimodal travel information services, which cover *inter alia* access to, and the re-use and updating of, static and dynamic travel and traffic data¹⁶¹. The development of such services is also supported financially by the CEF.

4.2.4.2. Incentivising the use of more efficient vehicles

Incentives relating to vehicles and their use tend to be fiscal in nature. In the EU, levying taxes and charges is a Member State competence (see Section 1), so national governments are generally free to

155 Regulation (EU) No 1316/2013 establishing the Connecting Europe Facility; Regulation (EU) No 1303/2013 laying down common provisions on the European Regional Development Fund

156 Regulation (EU) No 1315/2013 on Union guidelines for the development of the trans-European transport network

157 Regulation (EU) No 1316/2013

158 Directive 92/106/EEC on the establishment of common rules for certain types of combined transport of goods between Member States

159 SWD(2017) 362, 'Impact Assessment accompanying COM (2017) 648 Proposal for a Directive on the establishment of common rules for certain types of combined transport of goods between Member States', Commission Staff Working Document

160 Regulation (EU) No 913/2010 concerning a European rail network for competitive freight

161 Commission Delegated Regulation (EU) 2017/1926 supplementing Directive 2010/40/EU with regard to the provision of EU-wide multimodal travel information services

Box 4: Implementing the congestion charge in Stockholm

The political objective of the implementation of the congestion charge in Stockholm was to reduce congestion and to improve the speed of traffic through bottlenecks. This was translated into an objective of reducing the number of vehicles crossing the cordon that set the outer limit of the charging area by 10% to 15%. The appropriate level of the charge was tested using traffic model simulations for the city. In the course of the design process, the focus was on reducing the congestion levels at major bottlenecks.

A number of different variants of the charging scheme were tested by modelling. These included different levels of charges, as well as charging for the use of certain bridges within the city. When selecting the most

appropriate option attention was given to ensuring that users would be able to understand the charge. Hence, while a more complex system in terms of the level and application of the charges might have been more economically efficient according to the modelling, it was considered important that the design was not too complex to help with its understanding and acceptance.

One particular lesson from the modelling exercise was that it was easy to move congestion around the city, rather than reducing it. Hence, it is important to pay a lot of attention to the design of the system to ensure that it addressed the problem, rather than simply moving it to somewhere else*.

* Eliasson, J. (2014)

levy taxes on the purchase, registration and annual circulation of vehicles, or to levy charges on vehicles using particular infrastructure. The exception to this is the so-called Eurovignette Directive, which sets the **framework for the taxation and charging of trucks**. However, in the case of charges, the framework is only applicable *if* a Member State chooses to implement a charge; it does not require the levying of such charges. The aim of the legislation is to ensure that trucks, which often travel across Member State borders, do not face taxes or charges that potentially distort competition.

Environmental elements have been introduced into the Eurovignette Directive over time. The 1999 amendment to the Directive allowed for the differentiation of charges based on the Euro emissions standard of a vehicle. The current version of the Directive sets the minimum levels of tax that can be applied to heavier trucks and sets out the framework within which charges for the use of infrastructure, and any charges linked to air pollution and noise, should be applied. The Directive also sets the maximum charge that might be levied on a vehicle, depending on its Euro emissions standard (see Section 4.2.1.1), with this charge increasing for older, more polluting vehicles. In addition, the way in which the part of any charge that covers the external costs of either traffic-related air pollution or traffic-related noise should be calculated is set out¹⁶².

In May 2017, the Commission proposed that the Eurovignette Directive be expanded to cover the charges that might be levied on all road transport vehicles, so that all vehicles were protected from discriminatory measures. It proposed to phase out allowing the charges applicable to trucks to be varied according to a vehicle's Euro emissions class and instead allow these to be based on a vehicle's CO₂ emissions. At the same time, the Commission proposed reducing the minimum level of tax that could be levied on trucks so as to provide an added incentive to replace such taxes with infrastructure charging for trucks. The European Parliament supported the Commission's proposal, and indeed strengthened it in some places¹⁶³. However, in 2020, Member States were still unable to reach an agreement on the proposed revisions to the Directive¹⁶⁴.

Congestion charges also have the potential to reduce emissions, both of CO₂ and of air pollutants, by incentivising travel at different times and/or encouraging the use of alternative modes of transport. These charges can also be successful in reducing congestion, delivering socio-economic benefits and for raising revenue that can be used for other transport projects. One of the most successful

162 Directive 1999/62/EC on the charging of heavy goods vehicles for the use of certain infrastructure

163 European Parliamentary Research Service (2018) "Revision of the Eurovignette Directive", Briefing

164 <https://www.europarl.europa.eu/legislative-train/theme-resilient-energy-union-with-a-climate-change-policy/file-jd-eurovignette-directive-revision>

schemes, and perhaps the most studied, is the congestion charge implemented in the Swedish capital Stockholm in 2006 (see Box 4). The system was introduced initially as a trial, which helped to demonstrate the benefits of the scheme, before being introduced permanently after a referendum. The trial brought traffic reductions of around 22%, and a reduction in congestion of between 30% and 50%, which was enough to convince the public to support the scheme in the referendum. In the inner city area, the level of airborne pollutants was reduced by between 10% and 14% as a result of the scheme, although there was a smaller effect – a reduction of around 2% to 3% – on CO₂ emissions in the wider metropolitan area. The system is enforced using automatic number plate recognition^{165, 166}.

4.2.4.3. Incentivising the market through green public procurement

Green public procurement (GPP), i.e. public authorities taking account of environmental considerations when they purchase goods, works and services, has a potentially important role to play in increasing the proliferation of less polluting goods and services. For example, in 2018 public expenditure on goods, works and services amounted to around 16% of the EU's GDP, which is a potentially significant buying power that could be used to improve the environmental performance of these activities¹⁶⁷.

EU legislation sets out minimum procurement rules to ensure that the approach to public procurement is consistent across the EU. In addition to these general rules, an EU Directive, the Clean Vehicle Directive (CVD), was revised in 2019 to set targets for the public procurement of 'clean' transport vehicles and transport services. This requires that Member States ensure that the public sector in their respective countries meets specified targets for the purchase of clean vehicles and transport services in order to help to stimulate the market for such vehicles and services. The targets are differentiated by Member State to reflect the respective different levels of economic development. The previous version of the Directive from 2009 had only required that environmental considerations be taken into

account by the public sector when it was procuring vehicles. However, this approach had not delivered much in the way of benefits to the environment, so a target-based approach was included in the revised legislation¹⁶⁸.

In addition to the targets in the new CVD, the Commission has developed – and regularly updates – GPP criteria that public authorities can use when purchasing vehicles or transport services. These are voluntary and complement the CVD, although the areas covered by the GPP criteria are broader than those covered by the CVD, as, for example, the GPP criteria cover noise, the use of more efficient tyres and the use of lubricants that are better for the environment. The development of such criteria benefits public authorities that might not otherwise have the time or expertise to undertake the necessary research to determine which environmental criteria to apply in procurement processes. The criteria are developed by the Commission supported by external experts and engagement with relevant stakeholders.

4.2.4.4. Provision of information to consumers to support environmental objectives

Another way of communicating the environmental performance of a product to consumers is through the use of an **eco-label**. These are given to a product when it is for sale to demonstrate that it meets a 'good' environmental standard. EU legislation sets the framework for the development of pan-EU ecolabels, although the only one of relevance to transport relates to lubricants. As with the GPP criteria, eco-labels cover a broader range of environmental issues than energy labels. For example, the EU eco-label on lubricants includes limiting the potential impact of lubricants on the environment, including their biodegradability¹⁶⁹. In addition to the EU eco-label scheme, there are national schemes in Europe, such as the 'Blue Angel' in Germany, and regional schemes such as the 'Swan' that is used in northern Europe (Sweden, Denmark, Finland, Norway and Iceland), that aim to demonstrate to consumers that a product or service meets a certain environmental standard. The Blue Angel scheme includes a label for 'municipal vehicles and buses', while the Swan has ecolabels for car care products and vehicle washing installations¹⁷⁰.

165 Börjesson, M. (2018) "Assessing the Net Overall Distributive Effect of a Congestion Charge", International Transport Forum Discussion Papers, OECD Publishing, Paris

166 Eliasson, J. (2014) "The Stockholm congestion charges: An Overview", KTH Royal Institute of Technology, CTS Working Paper 2014:7. Stockholm

167 Directive (EU) 2019/1161 amending Directive 2009/33/EC on the promotion of clean and energy efficient road transport vehicles

168 Directive (EU) 2019/1161

169 Commission Decision (EU) 2018/1702 establishing the EU Ecolabel criteria for lubricants

170 JRC (2016) "Revision of the EU Green Public Procurement for Transport - Preliminary report on Task 1: Scope, definitions and legislation"

4.2.5 Conclusions on the EU's approach to integrating command and control measures with incentives to reduce emissions from transport

The regulation of air pollutant emissions in the EU has a long history, dating back 30 years. The relevant EU emission standards have been increasingly part of a more strategic approach as they have been developed in parallel with EU fuel quality legislation. The regulation of CO₂ emissions is much more recent, with the first legislation, which focused on cars, only being adopted in 2009. This was developed in the context of a strategy that also underlined the importance of vehicle taxation and car labelling as demand-side measures. Both sets of measures have been effective to some extent, although in recent years it has been recognised that it is important to complement such standards with real world testing and monitoring, as well as with improved market surveillance.

While EU policy on the taxation of transport fuels has an equally long history, in the last 20 years there has been an increasing focus on using this policy to incentivise cleaner vehicles or fuels to complement the CO₂ emissions standards. Having said that, as noted above, as long ago as 1995, the Commission recognised the importance of using vehicle taxation policy to support measures to reduce the CO₂ emissions from new cars. Arguably the main challenge at the EU level in relation to using incentives to improve the environmental performance of transport has been the need for a unanimous agreement amongst Member States on any Commission proposal to amend tax policy. In addition, proposals by the Commission to amend the way in which transport is taxed and charged tend to be politically controversial.

However, restrictions on the use of vehicles and incentives (often in the form of taxes and/or charges) that have been implemented in Member States demonstrate the potential impact that such measures can have, if implemented appropriately. These are often directly linked to EU standards, e.g. by restricting access to vehicles that do not meet certain Euro emission standards or linking the differentiation of vehicle taxes according to CO₂ emissions. In countries that have a long-term and comprehensive policy of incentivising low and zero emission vehicles, consumers respond by buying these vehicles. This demonstrates the importance of both the standards to improve the CO₂ emissions performance of vehicles, as these ensure that low and zero emission vehicles are put on the market, coupled with incentives to encourage consumers to purchase such vehicles.

EU policy on electric vehicles is still evolving. While the Regulation on the CO₂ emissions performance standards for different vehicles includes an incentive for zero (and low) emission vehicles, EU policy does not yet ensure that sufficient recharging infrastructure is put in place for these vehicles, neither does it regulate the environmental performance of batteries. However, both of these issues may be addressed by ongoing amendments to existing legislation. As noted above, national incentives have, however, demonstrated what can be achieved in terms of incentivising the purchase and use of electric vehicles, as long as there is complementary legislation in place that ensures that these vehicles are put onto the market.

5. Policy Recommendations

5.1. MAINSTREAMING ENVIRONMENT INTO TOP-LEVEL POLICY DESIGN AND THE 14TH FIVE-YEAR-PLAN FOR NATIONAL SOCIAL AND ECONOMIC DEVELOPMENT

- (1) **The Ministry of Ecology and Environment should draft a plan/roadmap for integrating economic and environmental policies during the 14th Five Year Plan period.** The roadmap should identify key points/areas where high quality environmental development can contribute to/drive high-quality economic and social development. It should also cover relevant taxes and subsidy mechanisms.
- (2) **The Ministry of Ecology and Environment should work to establish a coordination mechanism for inter-departmental consultation and collaboration in drafting key economic and environmental policies.** The mechanism should ensure better coordination and cooperation among ministries in drafting and implementing key policies. The environmental department, in this process, should initiate, plan and coordinate such inter-departmental consultation.

5.2. FURTHER INTEGRATING ENVIRONMENT AND ECONOMIC POLICIES TO PROMOTE GREEN AND LOW CARBON ECONOMIC DEVELOPMENT

- (3) **Deploying fiscal and private resources more effectively.** The State Council should coordinate the Ministry of Finance, National Development and Reform Commission, People's Bank of China, State Administration of Taxation, China Banking and Insurance Regulatory Commission, Ministry of Ecology and Environment and other competent ministries to further the greening of fiscal, financial and taxation policies, optimize

the structure of fiscal spending, increase funding from fiscal and private capital to green industries and environmental protection.

- (4) **Improving economic policies for economic, industrial, energy and transport restructuring.** The Ministry of Ecology and Environment should work with relevant ministries to improve the differential electricity and water pricing policies targeting key industries such as iron and steel, chemicals, etc., to encourage green and low-carbon transition. Improve the pricing and subsidy policies to promote new clean energy development and utilization, and promote innovation in new energy infrastructure such as smart grids, energy storage and big data, and clean transportation such as new energy trucks, and the use of shore power for ships.
- (5) **Emphasizing the importance of producer responsibility legislation** in many emerging industries such as plastics, packaging, electronic products, logistics and express delivery, new energy vehicles, etc.

5.3. ACCELERATING THE FORMULATION AND REVISION OF GREEN SOCIAL POLICIES TO INCREASE POLICY COVERAGE AND EFFECTIVENESS

- (6) **MEE should work with other relevant departments to enhance policies that promote green lifestyles and green consumption.** These could include establishing a reward scheme for public green actions, improving the policies that encourage institutions, households and schools to reduce carbon footprints by selecting and rewarding best performance. Publish a green city ranking list to see which city is taking the lead in adopting green lifestyles. Improve green labeling and green certification, relax market access for green and eco-friendly

products and services, and use “Internet+” to promote green consumption.

- (7) **MEE should further improve disclosure and public participation.** Environmental authorities should improve government environmental information disclosure, improve mechanisms for public feedback and environmental monitoring, and let petitions and public reporting play its role, and improve policies which respond to public opposition to proposed developments.
- (8) **MEE should strengthen the incentive policies for environmental NGOs and volunteers** by granting tax reductions, awards, and partner qualifications. Give out subsidies, honorary certification and other incentives to public environmental supervisors (citizens), public river chiefs, and environmental volunteers.

5.4. SUGGESTIONS ON POLICY TOOLS IN GREEN AND LOW CARBON TRANSPORT SECTOR

- (9) **Integrated use of emission standards and taxation policy to promote green transport.** Incorporate CO₂ emissions into the existing motor vehicle emission standard. Amend the vehicle taxation framework, including that relating to both purchase taxes and annual taxes, to base vehicle taxes on a vehicle’s CO₂ emissions. Experience from the EU shows that greenhouse gas emission reduction in the transport sector can be achieved by taxing vehicles based on their CO₂ emissions, along with CO₂ emissions reduction requirements on new vehicles.
- (10) **Considering the setup of low emission zones and congestion charge.** Cities should be encouraged to establish low or zero-emission zones in city centers, in which only vehicles with low or zero emissions are allowed. Encourage cities to set up congestion charging zones, in which fees are charged at peak times (or at other relevant times) for the use of key road sections or for access to certain areas. Encourage cities to procure zero emission vehicles and services that use zero emission vehicles.

5.5. PROMOTING WHOLE-CYCLE ENVIRONMENTAL POLICY EVALUATION

- (11) The environmental departments should carry out ex-ante evaluations, interim evaluations and ex-post evaluations of environmental policies. Prioritizing the implementation of impact assessments for major environmental policies that are of great concern to the public and with significant impacts on industries and companies. Establish a cyclical mechanism for environmental policy assessment. New policies should include provisions indicating when it would be appropriate for them to be evaluated.

5.6. PROMOTING FURTHER COOPERATION BETWEEN THE EU AND CHINA, SUPPORTING AN INTEGRATED POLICY SYSTEM FOR GREEN TRANSITION AND LOW-CARBON DEVELOPMENT

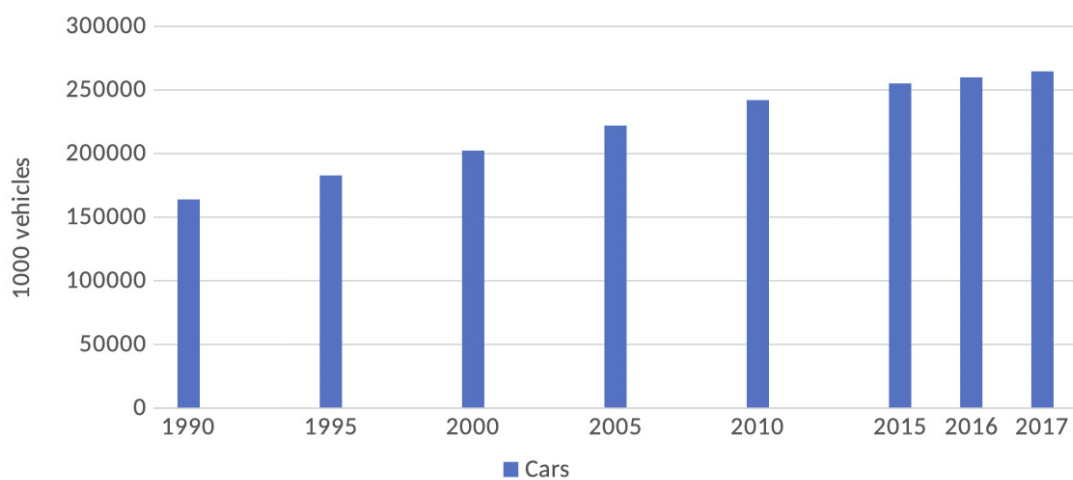
- (12) Make full use of the EU-China cooperation mechanism to enhance dialogue and exchanges between the two sides in green and low-carbon transition. Compare and analyze the common features and crossover areas between China’s green recovery and the European Green Deal. In the meantime, China should work towards a sound legal system to chart the course of China’s green economic recovery and low carbon development.

ANNEX A: COMPLEMENTARY INFORMATION ON THE EU TRANSPORT SECTOR

A.1 EU transport in numbers: Vehicles, their use and environmental impacts

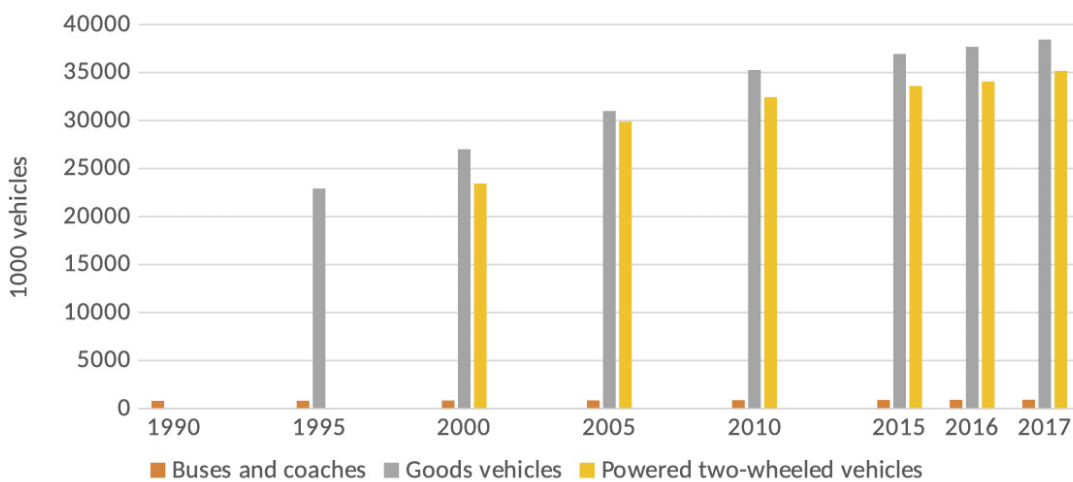
The EU vehicle stock has steadily increased since 1990. In nearly 30 years, the number of cars in the EU Member States has increased by just over 60% (see Figure 1), while since 1995 the number of goods vehicles has increased by two-thirds and the number of powered two-wheeled vehicles has increased by 50% in the last 20 years. However, the number of buses and coaches have not seen as significant an increase, only increasing by just over 15% between 1990 and 2017 (see Figure 2).

Figure 1: The total stock of cars in the EU28¹⁷¹ (1990-2017)



Source: European Commission (2019) "EU Transport in figures: Statistical Pocketbook 2019"

Figure 2: The total stock of other road transport vehicles in the EU28 (1990-2017)

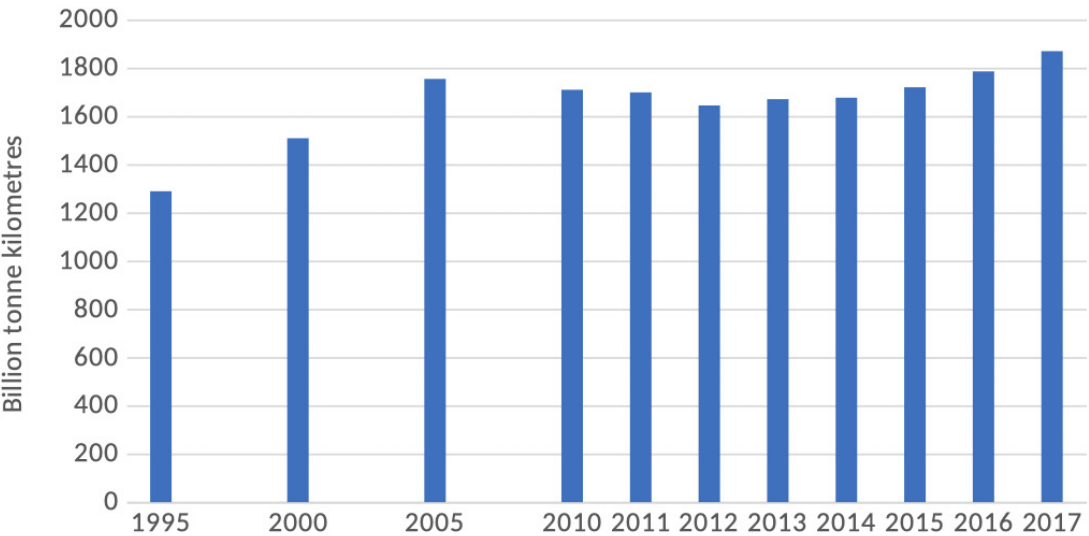


Source: European Commission (2019) "EU Transport in figures: Statistical Pocketbook 2019"

171 The most recent data includes the UK. Hence, the data presented in all of the figures in this sub-section covers the 28 Member States in the EU before the UK's departure.

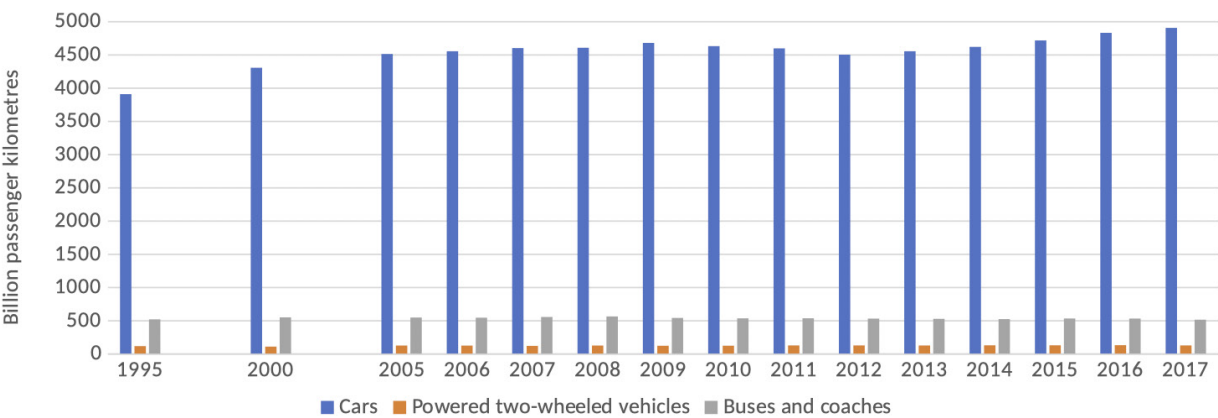
As with the vehicle stock, the use of vehicles over the last 20 to 30 years had also seen an increased trend, although this was interrupted by the financial crisis of the late 2000s. However, in recent years use has been increasing once more. Indeed, by 2017 the use of freight transport and cars was higher than it was before the financial crisis (see Figure 3 and Figure 4).

Figure 3: The use of road freight transport vehicles in the EU28 (1995-2017)



Source: European Commission (2019) “EU Transport in figures: Statistical Pocketbook 2019”

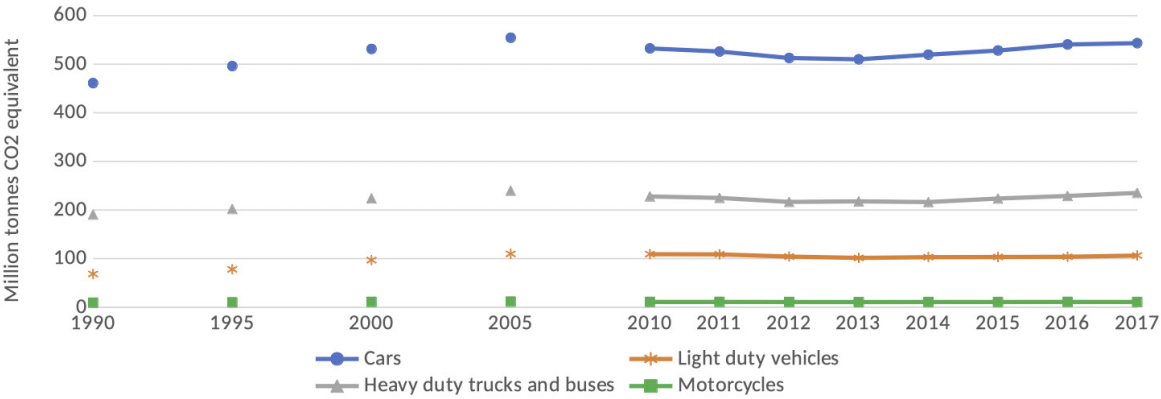
Figure 4: The use of road passenger transport vehicles in the EU28 (1995-2017)



Source: European Commission (2019) “EU Transport in figures: Statistical Pocketbook 2019”

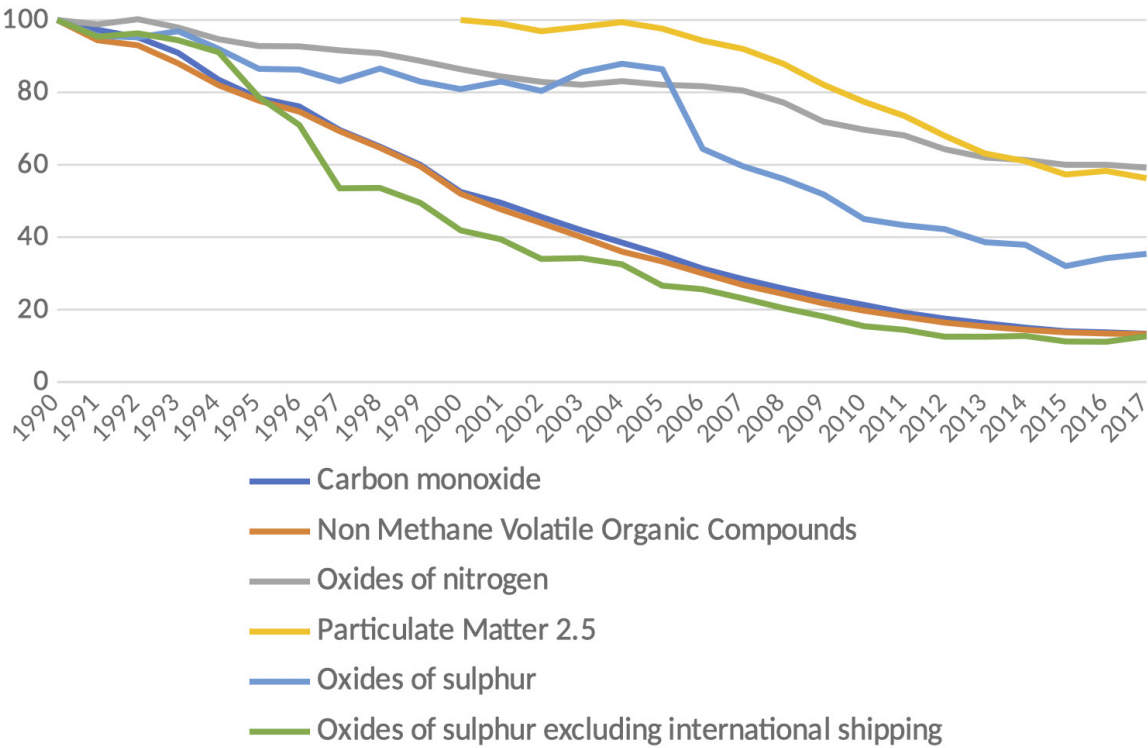
Similarly, a consistent increase in greenhouse gas (GHG) emissions from the EU road transport was interrupted by the financial crisis. However, by 2017 emissions were increasing back towards pre-crisis levels (see Figure 5). While reducing transport’s GHG emissions is proving to be a challenge, emissions of most air pollutants have declined significantly in the last three decades (see Figure 6). The main pollutants for which this is not the case are the oxides of nitrogen (NO_x) and PM_{2.5}, as well emissions of the oxides of sulphur (SO_x) from international shipping.

Figure 5: Greenhouse gas emissions from road transport vehicles in the EU28 by transport mode (1990-2017)



Source: European Commission (2019) “EU Transport in figures: Statistical Pocketbook 2019”

Figure 6: Trends in the emission of air pollutants from transport in the EU28 (1990-2017)



Source: European Environment Agency¹⁷²

172 [https://www.eea.europa.eu/data-and-maps/indicators/transport-emissions-of-air-pollutants-8/transport-emissions-of-air-pollutants-8#:~:text=Between%201990%20and%202017%2C%20the,and%20nitrogen%20oxides%20\(40%20%25\)](https://www.eea.europa.eu/data-and-maps/indicators/transport-emissions-of-air-pollutants-8/transport-emissions-of-air-pollutants-8#:~:text=Between%201990%20and%202017%2C%20the,and%20nitrogen%20oxides%20(40%20%25))

A.2 EU policies on improving the environmental performance of transport fuels, incentivising cleaner fuels and on transport waste

A.2.1 Regulating the environmental performance of transport fuels

EU legislation sets *requirements for the content of various transport fuels* some of which aim to improve the environmental performance of transport. The Fuel Quality Directive (FQD) sets limits on the maximum level of certain polluting substances that can be used in transport fuels, e.g. lead and sulphur, as well as limits on the levels of sulphur that can be present in fuels used in NRMM¹⁷³. EU legislation to regulate the content of transport fuels used in the EU dates from the 1970s when legislation was put in place to regulate the lead content of petrol¹⁷⁴. Over the years, the development of the EU's fuel quality requirements has often been linked with those of the emission standards (see above), as cleaner fuels (e.g. in terms of their sulphur levels) have often been required to allow for the integration of cleaner technologies into vehicles' engines.

The FQD was amended in 2009 to include upper limits on the proportion of biofuels that can be blended into petrol and diesel and also to include a target for the reduction of lifecycle GHG emissions from the fuels covered. This requires that energy suppliers reduce the lifecycle GHG emissions (per unit of energy supplied) of their fuels by at least 6% by the end of 2020 (compared to 2010). In addition, two indicative targets were set, each of 2%, that could be achieved through other means, including carbon capture and storage.

The Renewable Energy Directive (RED) sets a minimum target for the proportion of final energy consumption in transport that should be from renewable sources. This was set at 10% for 2020 and has been increased to 14% for 2030 in the revised RED¹⁷⁵. The RED and the amended FQD are closely linked as both aim to improve the environmental performance of transport fuels. The same set of sustainability criteria were included in both pieces of legislation with the aim of ensuring that the biofuels that could be counted towards meeting the

respective targets of the Directives delivered environmental benefits. The revised RED contains a strengthened set of sustainability criteria.

The implementation of these provisions has *proved to be challenging*. With respect to biofuels, the sustainability criteria did not directly take account of the impacts of indirect land use change (ILUC), the extent of which was only becoming appreciated when the criteria were being developed. ILUC occurs when the production of the feedstocks from which biofuels are produced displaces the production of food crops, which are then grown on land that was not previously used for agriculture, such as grassland or forests; this change of land use can cause additional GHG emissions to be released. The original intention had been to amend the Directives to include ILUC factors for different feedstocks, but it was not possible to agree on these. Hence, in order to limit the potential impacts of ILUC, a cap was put on the proportion of biofuels that can be produced from food crops, while at the same time a target was set for the production of biofuels from wastes and residues¹⁷⁶.

Another EU Directive sets limits on the *sulphur content of certain liquid fuels, including marine fuels*. This places upper limits on the sulphur content of the specified fuels, such as marine gas oil and marine diesel oil, used in maritime applications¹⁷⁷. This Directive effectively implements in the EU the IMO's revised MARPOL Annex VI, which, *inter alia*, required ships in Sulphur Dioxide Emissions Control Areas (SO_x-ECAs) to use fuel with very low levels of sulphur. The Commission's evaluation of the implementation of the Directive revealed that, thanks to good preparation and a good collaboration with industry, compliance with the requirements of the Directive had been high, which had resulted in much lower concentrations of sulphur dioxide (SO₂) in coastal regions, particularly in the EU's SO_x-ECAs¹⁷⁸.

A.2.2 Incentivising cleaner fuels

EU Member States also use incentives to encourage the use of cleaner fuels. The framework for the taxation of transport fuels is set at the EU level in *the Energy Tax Directive*, which includes the minimum

173 Directive 98/70/EC relating to the quality of petrol and diesel fuels; the Directive applies to fuels used in road vehicles and NRMM (see above)

174 Farmer, A. (ed) (2011)

175 Directive 2009/28/EC on the promotion of the use of energy from renewable sources; Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources

176 CE Delft and TEPR (2017), "Decarbonisation of EU transport", report for the European Parliament's Transport Committee

177 Directive (EU) 2016/802 relating to a reduction in the sulphur content of certain liquid fuels

178 COM(2018) 188 'Report from the Commission on implementation and compliance with the sulphur standards for marine fuels set out in Directive (EU) 2016/802'

tax rates that can be applied and the uses, such as public transport, that can benefit from lower fuel tax rates. The legislation also allows Member States to differentiate fuel taxes to support cleaner fuels and fuels made from renewable resources¹⁷⁹.

The framework for the taxation of mineral oils used in transport has been set at the EU level since the early 1990s¹⁸⁰. However, it was only in the revised 2003 Directive that energy prices were explicitly recognised as being an important element of transport and environmental policy¹⁸¹. In 2011, the Commission proposed amending the Directive in relation to the way in which fuels were taxed by basing their taxation on their energy content and CO₂ emissions. However, Member States could not agree on this, so the proposal was withdrawn¹⁸².

In the past, various EU countries *have used incentives* – in terms of lower fuel taxes – to encourage the uptake of cleaner fuels. In particular, fuel taxes were differentiated to speed up the introduction of unleaded petrol and low sulphur petrol and diesel in various EU Member States in order to ensure compliance with the FQD (see Annex A.2.1). This underlines the synergies between regulatory measures and fiscal incentives¹⁸³.

It has become clear that the Energy Tax Directive is not compatible with the need to decarbonise the transport sector and the fuels and energy sources that it uses. For example, while the Directive allows Member States to exempt or reduce taxes for biofuels, as these are produced from renewable resources, it does not differentiate between the different types of biofuels, such as those that are better from an environmental perspective (as distinguished by the RED, for example; see Annex A.2.1). In addition, as the taxation of biofuels is based on volume, the current Directive fails to take account of the lower energy content of biofuels compared to fossil fuels, and so the tax on biofuels could be higher than that on the equivalent volume of fossil fuels. The Directive

also fails to ensure that other potentially low carbon transport fuels, such as hydrogen, are treated preferentially from a tax perspective¹⁸⁴. Towards the end of 2019, the EU's Member States called on the Commission to propose an amendment to the Directive to ensure that it supports the transition to a climate neutral EU.

A.2.3 Regulating vehicle waste, including batteries

While the regulation of emissions is an important element in reducing the environmental impact of vehicles, the regulation of their disposal, including of their batteries, is also important in terms of environmental protection. The EU has been regulating waste vehicles since 2000 through the so-called 'End-of-life' vehicle (ELV) Directive¹⁸⁵. The ELV Directive was developed as a result of a recognition of the amount of vehicles that became waste each year, the importance of these being dismantled and treated to minimise the impact on the environment and the need to avoid distortions in competition within the EU as a result of different approaches being taken in different countries.

The ELV Directive contains provisions on the prevention, collection, treatment, re-use and recovery of ELVs. In relation to prevention, it requires that vehicles are designed to take account of their eventual dismantling, re-use and recovery, and also bans the use of lead, mercury, cadmium and hexavalent chromium in vehicles, apart from in specified cases that are regularly updated to take account of technical progress. Requirements are also set regarding the collection of waste vehicles, e.g. that the relevant systems are set up and that Member States ensure that these are sufficient in number; there are also minimum technical requirements for the treatment of ELVs.

Targets are set for the re-use and/or recycling of vehicles and for their re-use and/or recovery, which includes incineration to generate energy. Since 2015, Member States have had to ensure that a minimum of 85% on average by weight of a vehicle is re-used or recycled, which increases to 95% for re-use and recovery. The latest assessment from the Commission demonstrates that most Member States either meet, or nearly meet, these targets¹⁸⁶.

179 Council Directive 2003/96/EC restructuring the Community framework for the taxation of energy products and electricity

180 Directive 92/81 on the harmonisation of the structures of excise duties on mineral oils; Directive 92/82 on the approximation of the rates of excise duties on mineral oils

181 Council Directive 2003/96/EC

182 SWD(2019) 329, 'Evaluation of the Council Directive 2003/96/EC restructuring the Community framework for the taxation of energy products and electricity', Commission Staff Working Document

183 European Environment Agency (2006) "Market-based instruments for environmental policy in Europe", EEA Technical Report No 8/2005

184 SWD(2019) 329

185 Directive 2000/53/EC on end-of-life vehicles

186 Report on the implementation of Directive 2000/53/EC on end-of-life vehicles, COM(2020) 33

The ELV Directive does not cover what should happen to waste vehicle batteries, including those used in electric vehicles; it only requires that these be removed from waste vehicles. The restrictions on the use of certain substances, as noted above, also apply to batteries, including those used in electric vehicles. There are only two exemptions relating to batteries, the first to allow the use of lead in most car batteries and the second relating to the use of cadmium in batteries for electric vehicles, but only if these are spare parts for vehicles put on the market before 2009¹⁸⁷.

The EU has regulated the content of batteries to some extent, at least in terms of the level of certain dangerous substances that they can contain, since the early 1990s¹⁸⁸. Current requirements relating to waste batteries, including those used in internal combustion-engined vehicles and in electric vehicles, are set out in the Batteries Directive¹⁸⁹. In a similar way to the ELV Directive, the Batteries Directive sets out requirements for the collection (including setting collection targets for Member States), treatment, recycling and disposal of batteries and accumulators. Producers of automotive batteries are required to set up schemes for the collection of waste batteries, while the Directive also states that automotive batteries cannot be disposed of in landfills or in incinerators, other than as suitably treated residues.

The EU is planning to amend and update its batteries legislation in response to, *inter alia*, the anticipated increase in the use of batteries in electric vehicles¹⁹⁰. The process of amending the legislation is ongoing. However, the Commission has set out the issues that will be covered including the sustainability requirements for batteries placed on the EU market. The latter will cover the “responsible sourcing” of raw materials for batteries, limitations on the use of hazardous substances in these batteries and the batteries’ carbon footprint, as well as conditions on their recycled content, reusability and recyclability.

187 Directive 2000/53/EC on end-of-life vehicles, as amended by Commission Directive (EU) 2017/2096

188 Directive 91/157/EEC on batteries and accumulators containing certain dangerous substances

189 Directive 2006/66/EC on batteries and accumulators and waste batteries and accumulators

190 See the Commission's 'Inception Impact Assessment', which can be downloaded from: <https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12399-Modernising-the-EU-s-batteries-legislation>

A.3 EU emission limit values for cars, vans (Euro 6) and heavy duty vehicles (Euro VI)

Table 3: Euro 6 limit values for cars and vans

Reference mass (RM) (kg)		Limit values													
		Mass of carbon monoxide (CO)		Mass of total hydrocarbons (THC)		Mass of non-methane hydrocarbons (NMHC)		Mass of oxides of nitrogen (NO _x)		Combined mass of THC and NO _x		Mass of particulate matter (PM)		Number of particles (P)	
		(mg/km)		(mg/km)		(mg/km)		(mg/km)		(mg/km)		(mg/km)		(number/km)	
Cars and light buses***	All	PI*	CI*	PI	CI	PI	CI	PI	CI	PI	CI	PI**	CI	PI**	CI
		1000	500	100	-	68	-	60	80	-	170	4.5	4.5	6 *10 ¹¹	
Small****, class I vans	RM <= 1305	1000	500	100	-	68	-	60	80	-	170	4.5	4.5	6 *10 ¹¹	
Small, class II vans	1305 < RM <= 1760	1810	630	130	-	90	-	75	105	-	195	4.5	4.5	6 *10 ¹¹	
Small, class III vans	1760 < RM	2270	740	160	-	108	-	82	125	-	215	4.5	4.5	6 *10 ¹¹	
Medium-sized vans*****	All	2270	740	160	-	108	-	82	125	-	215	4.5	4.5	6 *10 ¹¹	

* 'PI' means positive ignition; 'CI' compression ignition

** Only applies to vehicles with direct injection engines

*** Small buses are defined as passenger vehicles with more than 8 seats (in addition to the driver's) having a mass not exceeding 5 tonnes

**** Small vans are defined as commercial vehicles having a mass not exceeding 3.5 tonnes.

***** Medium-sized vans are commercial vehicles that have a mass that exceeds 3.5 tonnes, but which does not exceed 12 tonnes^a

Source: Regulation (EC) 715/2007, Annex I, Table 2 (as amended by Commission Regulation (EU) No 459/2012)

a. These definitions are all from Annex II of Directive 2007/46/EC establishing a framework for the approval of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles

Table 4: Euro VI limit values for buses and heavy commercial vehicles

Limit values								
	CO (mg/kWh)	THC (mg/kWh)	NMHC (mg/kWh)	CH ₄ (mg/kWh)	NO _x (mg/kWh)	NH ₃ (ppm)	PM mass (mg/kWh)	PM number (number/kWh)
WHSC* (CI)	1500	130			400	10	10	8 *10 ¹¹
WHTC** (CI)	4000	160			460	10	10	6 *10 ¹¹
WHTC (PI)	4000		160	500	460	10	10	6 *10 ¹¹

* Worldwide steady state driving cycle

** Worldwide transient driving cycle

Source: Regulation (EC) 595/2009, Annex I (as amended by Commission Regulation (EU) No 133/2014)

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