Policies for reducing pollution and carbon emissions in the industrial sector in Europe and China

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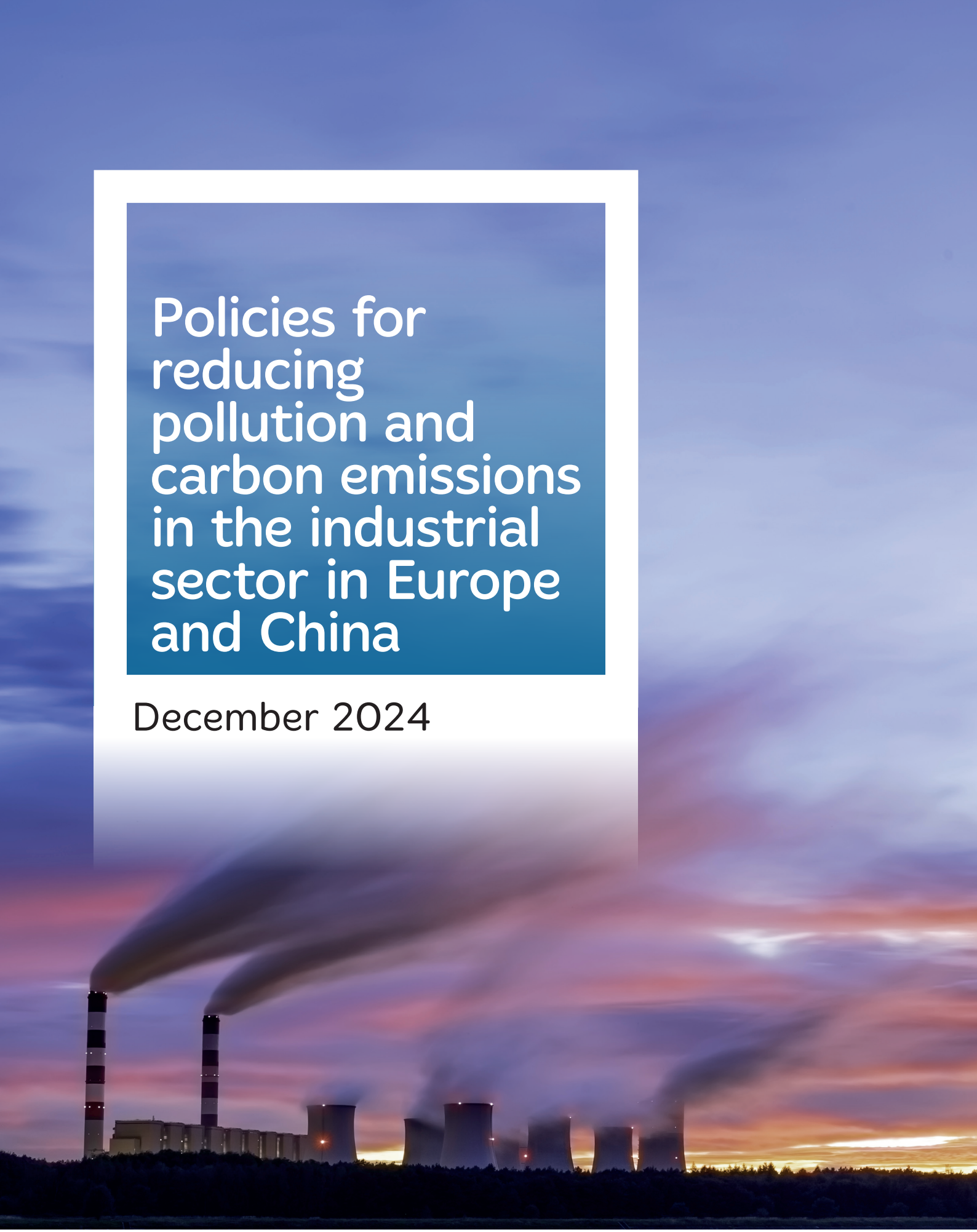

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Policies for reducing pollution and carbon emissions in the industrial sector in Europe and China

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Executive Summary

Identifying synergies in the reduction of air pollution and greenhouse gas emissions is crucial for China in achieving many of its high-level environmental policy objectives, including the 2030/2060 carbon peaking and neutrality targets,[1] the Beautiful China Initiative,[2] and the realisation of an 'ecological civilisation'.

This requires coordinated efforts to address pollution, ecological protection and GHG reduction. Through optimising and innovating in its approach to policy implementation, technological upgrade and management systems for pollution reduction and decarbonisation, China aims to achieve efficient and cost-effective synergies, improving the state of the environment, climate and economy simultaneously. Pursuing such synergies is seen as a strategic imperative for China. It plays a significant role in driving the comprehensive green transition of China's socio-economic development, and modernising ecological and environmental governance.

The European Union has deep experience in developing robust environmental regulatory frameworks and ensuring their enforcement. It serves as a model in setting environmental governance principles and implementing environmental policies and regulations. It has been some time since the EU started to address climate change through integrated environmental governance measures, and it has actively sought synergies in pollution control and GHG emission reduction.

In 2024, the EU revised the Industrial Emission Directive (IED), a cornerstone regulatory tool of the EU in managing pollution from industrial installations. It is also a key directive for the EU in pursuing decarbonisation within its industrial sector. Therefore, the document is a valuable reference for China in developing frameworks to achieve synergy in pollution control and emission reduction.

This paper was developed with reference to the latest revision of the IED. It provides an overview of the revision's context and key contents, with a particular focus on its requirements on synergising pollution control and emission reduction. It then proposes tailored recommendations based on the situation in China. The paper holds that EU practices share many similarities with Chinese approaches to integrating pollution control and emission reduction, and can offer a valuable reference to China in developing relevant frameworks.

Specifically, key takeaways from the IED revisions include the following:

- A source-based method is adopted for coordinating efforts to reduce pollution and carbon emissions;
- BAT helps to identify and apply the most cost-effective technologies for pollution and emission reduction;
- Emissions of non-CO_2 greenhouse gases and pollutants are reduced concurrently;
- An environmental management system addresses all environmental impacts at the same time;
- Synergies between environmental and climate policies have been strengthened.

Building on these insights, the paper proposes four recommendations:

- China should start by identifying priority areas to develop integrated policies that address pollution and carbon reduction simultaneously;
- It is necessary to develop sector-specific BAT guidelines to identify technologies for concurrent pollution control and emission reduction;

1 China aims to reach its carbon emissions peak before 2030 and become "carbon neutral" before 2060. It also refers to these as "dual-carbon" goals.

2 In January 2024, the Communist Party of China Central Committee and the State Council jointly issued an Opinion (in Chinese) on comprehensively developing a "Beautiful China." This concept was first raised at the 18th Party Congress in late 2012 and has since been championed by President Xi Jinping. This new document spells out what it means in much more detail and sets a series of concrete targets for 2027 and 2035.

» China should the expand and strengthen its various pilot programs for exploring innovations in seeking synergies in pollution control and emission reduction;

» China and the EU should continue to carry out further policy exchange and cooperation in this area including, for example, through engagement with the OECD BAT expert group.

1. Policies in the EU for Synergising Air Pollution and Carbon Emission Reduction in Industrial Sectors

1.1 OVERVIEW

In terms of the source-based emission standards system in the EU, the cornerstone instrument is the EU's Industrial Emission Directive (IED), which provides the framework for Best Available Techniques (BATs), and Best Available Techniques References (BREFs).

The Industrial Emissions Directive (Directive 2010/75/EU, referred to as the IED)[3] was first released in 2010. It was a consolidation and upgrading of seven directives on industrial emissions at that time, and has been the key legislation in regulating pollutant discharges from industrial installations in the EU ever since. The aim of the IED is to prevent, or, where that it not practicable, to reduce emissions into air, water and land and to prevent the generation of waste, in order to achieve a "high level of the protection of the environment taken as a whole".[4] The IED allows Member States the flexibility to choose the form and means of implementation in their own national legal systems, but requires all Member States to ensure the environmental performance set in the Directive.[5]

In addressing climate change and environmental degradation, the European Commission announced the EU Green Deal in 2019, as a long-term development strategy. As part of the EU Grean Deal, the European Commission adopted a zero pollution action plan, with the ambition that by 2050 air, water and soil pollution are reduced to levels no longer considered harmful to health and natural ecosystems, that respect the boundaries with which our planet can cope, thereby creating a toxic-free environment. This action plan includes revising measures to address pollution from large industrial installations. As a result, a revised IED came into force in August 2024, the first revision since 2010.[6] The revision looks at both industrial pollutant emission reduction, but also promotes energy, water and resource efficiency, and enables circular economy. The revised IED promotes innovation in new and emerging technologies and fosters decarbonisation.

3 Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution and control) (recast (IED)

4 IED, Art. 1

5 Treaty on the Functioning of the European Union, Art. 288

6 Directive 2024/1785 of the European Parliament and of the Council of 24 April 2024 amending Directive 2010/75/EU of the European Parliament and of the Council on industrial emissions (integrated pollution prevention and control) and Council Directive 1999/31/EC on the landfill of waste (2024 IED)

1.2 MAIN CONTENT OF THE REVISED IED

1.2.1 Scope

The 2010 IED regulates various industrial activities[7], carried out on an industrial scale or above the specified thresholds:

This includes:

- Energy industries: fuel combustion in installations with total rated thermal input of min. 50 MW, mineral oil and gas refining, coke production, coal gasification or liquefaction;
- Metal production and processing: metal ore roasting or sintering, production of pig iron or steel, processing of ferrous and non-ferrous metals, surface treatment of metals or plastic materials;
- Mineral industry: cement, lime and magnesium oxide production, glass manufacture, ceramic products manufacture;
- Chemical industry: production of chemicals on an industrial scale by chemical or biological processing;
- Other industry, including pulp and paper, textiles, or surface treatment with organic solvents;
- Waste management: disposal or recovery of waste, waste landfills and waste incineration or co-incineration;
- Livestock: intensive rearing of poultry and pigs.

The revised IED's scope extends further to the following activities, carried out on an industrial scale or above the specified thresholds:

- Manufacture of batteries;[8]
- Extraction of metal ores, such as cobalt, copper, gold, iron, lithium, on an industrial scale;[9]
- More farms rearing poultry or pigs.

On cattle farming, the revised IED requires the Commission to submit a report by the end of 2026, with an assessment for the need for the EU to comprehensively address emissions, including methane and ammonia emissions, from livestock, in particular for cattle rearing. The report will also evaluate the potential impacts of imported livestock products.

1.2.2 Best available techniques

Best available techniques (BATs) are those "most effective in achieving a high general level of protection of the environment as a whole".[10] The definition of BATs contained in the IED considers a wide range of techniques relevant to IED installations.[11] The availability aspect required the relevant techniques to be "developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages" - irrespective of whether the techniques are used or produced in the EU, as long as they are reasonably accessible to the operator.[12] An ad-hoc technical working group is set up for each sector, which assessed in an extensive and detailed manner the relevant data and latest state of the art techniques. Following the revision, the concept has been adapted for the 'environment as a whole' to explicitly include human health and climate protection.[13] For future BAT conclusions, climate protection considerations will thus be taken into consideration more so than until now.

The BAT reference documents are drawn up based on the so-called 'Sevilla Process' – an information exchange between representatives of Member States, concerned industries, environmental NGOs, the European Chemicals Agency and the Commission.[14] The European Commission has adopted guidance on the practical arrangements of the Sevilla process in Implementing Decision 2012/119/EU[15]. Essentially there are two types of BREFs: Vertical BREFs are more common and relate to particular industrial

7 IED, Annex I
8 2024 IED, Recital 5 and revised Annex I, point 2.7
9 2024 IED, Recital 3 and revised Annex I, point 3.6
10 IED, Art. 3(10)(c)
11 IED, Art. 3(10)
12 IED, Art. 3(10)(b)
13 2024 IED, revised Art. 3(10)(c)
14 IED, Art. 13(1)
15 2012/119/EU: Commission Implementing Decision of 10 February 2012 laying down rules concerning guidance on the collection of data and on the drawing up of BAT reference documents and on their quality assurance referred to in Directive 2010/75/EU of the European Parliament and of the Council on industrial emissions

activities, such as the Large Combustion Plants BREFs or the Iron and Steel Production BREFs. Horizontal BREFs address cross-sectoral issues, relevant to many or even all IED installations, for example on Energy Efficiency. A specific document was also developed for the monitoring of emissions to air and water from installations under the Industrial Emissions Directive, which is referred to as the 'ROM'.[16]

The decision to draw up BREFs or review an existing BREF is taken by the European Commission after consultation of the stakeholders (Member States, industry, environmental NGOs). The process is initiated with a kick-off meeting, followed by one or two formal BREF drafts and a final technical working group meeting. The final BREFs are published by the European Commission and include information on applied techniques, present emission and consumption levels, techniques considered for the determination of BAT, BAT conclusions and any emerging techniques. The BAT conclusions are the legally binding part of BREFs. A list of the current BAT reference documents can be found in Annex I.

1.2.3 Permitting

The IED's main mechanism is permitting: Installations carrying out the industrial activities set out in Annex I of the IED require a permit granted by Member States' authorities, based on conditions set in accordance with the IED. In particular, BAT Conclusions are the reference for setting permit conditions and Emission Limit Values in the permits cannot exceed the emission levels associated with BAT set in BAT Conclusions.

The revised IED requires that permit conditions should include all necessary measures for pollution reduction "in order to ensure a high level of protection of human health and the environment taken as a whole".[17] The conditions should cover: emission limits, waste management measures, emission monitoring requirements, the obligation of reporting (at least once every year), and site remediation. Regular review of the conditions of a permit should be carried out, and should be adjusted in case of any major pollution incidents, any operational safety issues or any new or revised environmental standards. In any circumstances, all permit conditions should be updated within four years after new BAT Conclusions are released. While the set-up of permitting systems currently varies across Member States, based on the revised IED, Member States will have to develop and implement electronic permitting procedures at the latest by 2035.[18]

1.2.4 Emission limit values

Permit conditions shall include emission limit values for polluting substances into air, such as sulphur dioxide, nitrogen oxides, carbon monoxide and dust, as well as into water, such as organohalogen compounds, substances with carcinogenic properties, cyanides and metals.[19] Emission limit values shall be based on the emission levels associated with the best available techniques (BAT) as set out in the relevant BAT conclusions. According to the Commission, before the revised IED, between 75% and 85% of the permits across the EU only adhere to the weakest emission levels (i.e. upper end) of the ranges indicated by the BAT conclusions or exceed these.[20] This has been addressed in the IED revision by clarifying how competent authorities shall use the BAT-associated emission levels to determine emission limit values for installations: As a principle, competent authorities shall set the "strictest achievable emission limit values by applying BAT in the installation, considering the entire range of the emission levels associated with the best available techniques".[21] To this end, the operator shall conduct an assessment of the entire range of BAT-associated emission levels and "the feasibility of meeting the strictest end of the [range], demonstrating the best overall performance that the installation can achieve by applying BAT".[22] By doing so, IED can encourage companies to adopt more advanced technologies and techniques to ensure more effective pollution control and environmental protection. It is also an important pathway for the EU to advance industrial innovation and improve competitiveness.

Derogations allowing less strict emission limit values are limited to very specific cases: where the BAT-associated emission levels would lead to disproportionately higher costs compared to the environmental benefits due to the geographical

16 https://eippcb.jrc.ec.europa.eu/REFERENCE/

17 2024 IED, revised Article 1(2)

18 2024 IED, revised Art. 5(4)

19 IED, Art. 14 and Annex II

20 Commission Staff Working Document, *Impact Assessment Report,* SWD(2022) 111 final, 04.05.2022 (EUR-Lex - 52022SC0111 - EN - EUR-Lex (europa.eu)), 2.1

21 2024 IED, revised Art. 15(3)

22 2024 IED, revised Art. 15(3)

location/local environmental conditions or the technical characteristics of the installation concerned.[23] In the case the installation is also subject to IED Annexes V to VIII, the emission limit values may not exceed those set out in the annexes of the IED. Even if a derogation is to be granted, the competent authority has to ensure that "no significant pollution" is caused and that a "high level of protection of the environment as a whole is achieved".[24] The revised IED also requires an assessment by the operator of the impact of a possible derogation on the concentration of the pollutants concerned in the receiving environment.[25] The importance to consider such cumulative pollution is also stressed by clarifying that derogations may not be granted where they may put "at risk" compliance with environmental quality standards.[26] Information regarding the derogation and the reasons for it will be included by the competent authority in an annex to the permit conditions.[27] Finally, a review of whether derogations granted continue to be justified is required when the relevant permit is reconsidered, and at the very least every 4 years – addressing the practice of long-term or even lifelong derogations.

1.2.5 Environmental performance standards

The revised IED adds environmental performance limit values to the list of minimum permit conditions.[28] Environmental performance is defined as "performance with regard to consumption levels, resource efficiency concerning materials, water and energy resources, the reuse of materials and water, and with regard to waste generation".[29] The environmental performance levels associated with BAT could include consumption levels, resource efficiency levels and reuse levels of materials, water and energy resources, and waste.[30]

The revised IED introduces binding ranges for environmental performance other than emission limit values which may not be exceeded, as laid down in the BAT conclusions.[31] This range constitutes a reference for competent authorities when setting more specific values/levels for an installation. A distinction is made between the use of water on the one hand and the use of other resources or waste generation on the other hand. Competent authorities are explicitly asked to set binding environmental performance limit values for water, within the binding range.[32] For waste and resources other than water, competent authorities shall set indicative environmental performance levels within the binding range, as laid down in BAT conclusions.[33]

1.2.6 Greenhouse gas emissions

The IED covers some of the largest emitters of greenhouse gases (GHG) in the EU, which are also covered by the Emissions Trading Systems (ETS) Directive.[34] Member States cannot set GHG emission limit values for ETS installations except where it is necessary to ensure that no significant local pollution is caused.[35] Evaluation results show that from 2007 to 2017, nearly 40% of GHG emissions in the EU came from IED installations. The promotion of decarbonisation was added as one of the objectives of the IED, which may impact how substantial provisions are interpreted.[36]

IED stipulates that it is possible to set binding requirements on energy efficiency. Energy efficiency – crucial for climate change mitigation in the industry sector - is recognised as one of the criteria for determining best available techniques as well as a general principle governing the operator's basic obligations.[37] For non-ETS installations, it is possible to set binding energy efficiency requirements and standards.[38] However, for combustion units falling under the ETS, Member States may choose not to impose energy efficiency requirements.[39] For the revision of the IED, the Commission had proposed an amendment to make any energy efficiency requirements mandatory for ETS installations – however, this was not adopted by the EU institutions in the

23 IED, Art. 15(4)
24 IED, Art. 15(4)
25 2024 IED, Art. 15(4)
26 2024 IED, Art. 15(5)
27 2024 IED, Art. 15(5)
28 2024 IED, revised Art. 14(2)(aa) and (ba)
29 2024 IED, revised Art. 3(13aa)
30 2024 IED, Recital (27)
31 2024 IED, revised Art. 15(4)
32 2024 IED, revised Art. 15(4)(a)
33 2024 IED, revised Art. 15(4)(b)
34 IED, Art. 9
35 IED, Art. 9(1)
36 2024 IED, revised Art. 1
37 IED, Annex III(9) and IED, Art. 11(f)
38 For example, emission limit values for methane emissions from the combustion of natural gas in a spark-ignited lean-burn gas engine are set in BAT No. 45 II, III of Commission Implementing Decision (EU) 2017/1442, 31/07/2017
39 IED, Art. 9(2)

final text.[40] Thus, while the IED allows for both GHG emissions limit values and energy efficiency standards, in practice, the exclusion of ETS installations led to GHG emission levels seldom included in the BAT reference documents until now, irrespective of whether the relevant installations fall under the ETS. Decarbonisation was however added in the revised IED as one of the criteria to identify BATs.

The ETS Directive[41] contains a review clause aimed at synergies with the IED and the coordination of environmental and climate relevant permits to ensure efficient and speedier execution of EU climate and energy measures.[42] In a similar vein, the revised IED requires a review by 2028 and every 5 years thereafter on the IED-ETS synergies. According to the revision, the report "shall include an assessment of the need for Union action through the establishment or updating of Union-wide minimum requirements for emission limit values and for rules on monitoring and compliance for activities within the scope of the BAT conclusions adopted during the previous five-year period".[43]

1.2.7 Environmental management system

The revised IED introduces the requirement for installation-specific environmental management systems (EMS) with environmental policy objectives (including measures regarding waste, resource, energy and water use) and a chemicals inventory of hazardous substances present in or emitted from the installation, amongst others.[44] The EMS must be audited by an external auditor every three years.[45]

Under the revised IED, operators of energy-intensive installations will be required by 30 June 2030 to include in their EMS a transformation plan on how the installation will be transformed to contribute to a sustainable, clean, circular, resource-efficient and climate-neutral economy by 2050.[46] Other industrial installations will have to implement Transformation Plans within 4 years of publication of BAT Conclusions after 1 January 2030. The transformation plans will only be indicative, but they will form part of the audit conducted of the EMS and their conformity with requirements to be set by the Commission in a delegated act will be assessed.[47]

1.2.8 Other additions in IED revision

1. Enforcement

According to the revised IED, where a breach poses immediate danger to human health or threatens to cause an immediate significant adverse effect on the environment, the operation of the installation shall be suspended without any delay.[48] Where a persistent breach poses a danger to human health or causes a significant adverse effect on the environment, and where necessary action for restoring compliance has not been implement, the operation may be suspended.[49]

2. Penalties

The revised IED sets a minimum level of administrative financial penalties for the most serious infringements at 3% of the industrial operator's annual EU-wide turnover in the financial year preceding the year in which the fine is imposed.[50]

3. Compensation right

The revised IED introduces a right for individuals to claim and obtain compensation from the relevant natural or legal persons for damage to their health incurred as a result of a violation of national measures adopted pursuant to the IED.[51]

4. Access to information and public participation, access to justice

Standing shall not be conditional on prior participation in the permitting phase and the review procedure shall be "fair, equitable, timely and not prohibitively expensive, and shall provide for adequate and effective redress mechanisms, including injunctive relief as appropriate".[52]

40 Commission proposal for a revised IED, Art. 1(7): 'In Article 9, paragraph (2) is deleted.'

41 Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC (ETS Directive)

42 ETS Directive, Art. 8 and 2024 IED, Recital (45)

43 2024 IED, revised Art. 73(1) and Recital (45)

44 2024 IED, revised Art. 14a(1) and (2)

45 2024 IED, revised Art. 14a(4) and Recital (26)

46 2024 IED, revised Art. 27d(1) and Recital (41). Transformation plans will be required for activities listed in points 1, 2, 3, 4, 6.1a, and 6.1 b of Annex I.

47 2024 IED, revised Art. 27d(1)

48 2024 IED, revised Art. 8(3)

49 2024 IED, revised Art. 8(4)

50 2024 IED, revised Art. 79(2). The concept of "most serious infringements" is not defined but recital (51) gives some guidance that infringements "of a high level of gravity due to their nature, extent and repetition, or where these infringements pose a significant risk to health or environment" would be included.

51 2024 IED, revised Art. 79a(1)

52 2024 IED, revised Art. 1(25) and Recital (22)

5. Innovation
Based on the revised IED, the Commission has established an innovation centre for industrial transformation and emissions (INCITE).[53] INCITE was launched on 21 June 2024.[54] The role of INCITE is to collect, analyse and disseminate information on innovative techniques contributing to the minimisation of pollution, decarbonisation, resource efficiency and circular economy.[55] These findings will then be taken into account in the Sevilla process.

1.3 SUMMARY

The key revisions of the IED include the following:

1. Extended scope to cover the following industrial activities carried out on an industrial scale or above the specified thresholds: manufacture of batteries,[56] extraction of ores, such as cobalt, copper, gold, iron, lithium, on an industrial scale.[57]

2. It is clarified that the emission limit value shall be set at the "strictest achievable values by applying BAT in the installation", instead of applying the weakest emission limit value. Meanwhile, consideration of decarbonisation is also included.

3. Environmental performance limit values are added to the list of minimum permit conditions.

4. More emphasis has been placed on energy/resource efficiency and circular economy.

Other provisions of the revised IED also include a new compensation mechanism and updates to the enforcement and penalty mechanisms, as well as the chapters on access to information, public participation and access to justice.

Specifically on synergising pollution control and GHG emission reductions, the following aspects can be found in the IED:

1. The IED implements the "polluter pays" principle and the principle of pollution prevention. Priority therefore is given to intervention at the source of pollution.

2. Both pollution and GHG emissions reductions are considered in setting limits. While the revised IED sets stricter limits for pollutants, decarbonisation is also considered for installations.

3. The revised IED adds environmental performance limit values to the list of minimum permit conditions. It innovatively introduces binding ranges for environmental performance, constituting a reference for competent authorities when setting more specific values/levels for an installation.

4. For non-ETS installations, it is mandatory for Member States to set binding energy efficiency requirements, in line with the BAT Conclusions. However, for IED installations falling under the ETS, Member States may choose not to impose energy efficiency requirements.

5. The revised IED focuses on the synergistic emission reduction of non-carbon dioxide and pollutants, controlling and reducing methane and water and soil pollutant emissions based on the BAT conclusions.

6. BAT references for waste incineration and treatment in particular help to address methane. A report is also due in 2026 will provide assessment of the need for the EU to comprehensively address emissions, including methane and ammonia in livestock breeding, in particular cattle.

7. Environmental Management System (EMS). The revised IED mandates the implementation of installation-specific environmental management systems (EMS). In particular, industrial installations should develop transformation plans detailing how the installation will transform towards zero pollution, climate neutrality and circular economy by 2050. The transformation plans will only be indicative, but they will form part of the audit conducted of the EMS and their conformity with requirements to be set by the Commission in a delegated act will be assessed.[58]

53 2024 IED, revised Art. 27a(1)
54 Take part in the launch of INCITE | Eippcb (europa.eu)
55 2024 IED, revised Art. 27a(2)
56 2024 IED, Recital 5 and revised Annex I, point 2.7
57 2024 IED, Recital 3 and revised Annex I, point 3.6
58 2024 IED, revised Art. 27d(1)

8. Consideration has been given to the synergy between environment and climate. Following the revision, the concept of the 'environment as a whole' in BAT Conclusions has been adapted to explicitly include human health and climate protection. With the concept updated, future BAT conclusions will take more climate protection considerations on top of pollution control requirements.

9. An innovation centre for industrial transformation and emissions (INCITE) is launched by the revised IED. The findings of the centre will be taken into account in supporting green industrial transition.

10. Regular review to check synergies between the IED and the EU ETS Directive. The revised IED requires a review by 2028 and every 5 years thereafter on the IED-ETS synergies. Similarly, the ETS Directive also contains a review clause aimed at enhancing synergies and coordination with the IED to ensure efficient execution of EU environment and climate measures.

2. Policies in China for Synergising Air Pollution and Carbon Emission Reduction in Industrial Sectors

2.1 STRATEGIC DECISIONS AND ARRANGEMENTS

Two of China's most pressing current strategic priorities in building an ecological civilization, are achieving carbon neutrality and fundamental improvement in the environment. Promoting synergies between abatement of pollution and of carbon emissions can support efforts at building an 'ecological civilisation' at the country's new stage of development. This will also help China reach its goal of carbon neutrality on time and effectively promote the building of a 'beautiful China'. At the 2020 Central Economic Work Conference, the 'dual-carbon' strategy to reach carbon neutrality by 2060 and peak its carbon dioxide emissions by 2030 was listed as part of the government's efforts at simultaneous reduction of pollution and carbon emissions. The need for reducing pollution and carbon emissions in key industries and sectors, speeding up the promotion and application of technology that can reduce pollution and carbon, and speeding up the formation of a reward/constraining mechanism for pollution and carbon reduction were put forward at the 2021 Central Economic Work Conference, the 29th and 36th collective study sessions of the Political Bureau of the Central Committee, and the Central Financial and Economic Commission's ninth meeting. During the 29th Study Session of the Political Bureau of the CPC Central Committee, in order to support the overall green transformation of socio-economic development, General Secretary Xi Jinping emphasised the necessity of "using the synergised reduction of carbon emissions and pollution as a lever to accelerate the restructuring of industry, the energy mix, transportation, and land use." "Synergistic promotion of decarbonisation, pollution reduction, green expansion and growth" was further underlined in the report of the 20th CPC National Congress. Promoting the synergy of lowering pollution and carbon emissions will remain one of China's major goals for the foreseeable future.

2.2 POLICY REVIEW

Long-term research and practice in energy saving, emission reduction, and pollution prevention forms the basis of China's policies on synergising the reduction of carbon emissions and pollution. A number of goals for energy conservation and emission reduction, environmental protection projects, and the elimination of outdated production capacity were set forth in the *11th Five-Year Plan for National Economic and Social Developmen*t (2006-2010), which included energy conservation and emission reduction as a binding indicator for the first time. Carbon emission and main pollutant assessment goals were laid forth in the Outline of the *12th Five-Year Plan for National Economic and Social Development* (2011-2015).

Despite well-defined goals for reducing emissions of both greenhouse gases and pollutants, so far very few policies have been put in place to achieve these dual objectives simultaneously, and even fewer have highlighted the importance of this synergy. The *Opinions on Accelerating the Improvement of the Environmental Protection Science and Technology Standard System* implemented in 2012 proposed to "strengthen the research and development of key

technologies for the synergistic control of different pollutants and greenhouse gases, and realise the synergy between energy conservation and consumption reduction, pollutant emission reduction and greenhouse gas control". A 2015 proposal to "actively promote the synergistic control of air pollutants and greenhouse gases in the key sectors such as thermal power, iron and steel, cement, etc." was made in the *Opinions on the Implementation of Environmental Policies for the National Key Functional Areas* by the former Ministry of Environmental Protection and the National Development and Reform Commission. While the current regulations may not have set out to reduce pollution and carbon emissions specifically, they do have the desired effect of improving the groundwork for future initiatives in this area.

The implementation of the *Law on Prevention and Control of Air Pollution* starting from 1 January 2016 was a significant milestone: it is the first time that a national law in China has emphasised the need for coordinated management of greenhouse gas emissions and conventional pollutants. Afterwards, the State began to accelerate the synergistic effect of controlling conventional pollutants and reducing GHG emissions. National laws, policy documents, and departmental rules began to prioritise synergistic control as a goal and principle, leading to adjustments in the institutional mechanism. For instance, the State Council has released two important plans: the *13th Five-Year Plan for Controlling GHG Emissions* and the *Three-Year Action Plan for Winning the Battle for Blue Skies*. These plans have a common objective and requirements, which is the coordinated control of GHGs and atmospheric pollutants. Relevant authorities started integrating the combined reduction of pollutants and GHGs into the guiding principles or basic objectives of relevant policy documents. For instance, the Ministry of Ecology and Environment (MEE) issued the *Comprehensive Treatment Programme for Volatile Organic Compounds in Key Industries*[59] in 2019 and the *Technical Guidelines for Pollutant Removal from Pollution Treatment Facilities of Industrial Enterprises for Collaborative Control of GHG Accounting (Trial)*[60] in 2017.

59 MEE Notice, issued June 26, 2019 (Atmospheric Environment, document number 53): https://www.mee.gov.cn/xxgk2018/xxgk/xxgk03/201907/t20190703_708395.html

60 MEE Notice, issued September 4, 2017 (Science and Technology, document number 73): https://www.mee.gov.cn/gkml/hbb/bgt/201709/t20170913_421402.htm

It was during the 75th UN General Debate in September 2020 when General Secretary Xi Jinping made the announcement that China aimed to reach carbon neutrality by 2060 and peak its carbon dioxide emissions by 2030. In January 2021, the *Guiding Opinions on Coordinating and Strengthening Work Related to Climate Change and Environmental Protection* were released. This document aimed to establish a comprehensive and efficient system for strategic planning, policies and regulations, institutional framework, pilot projects, and international cooperation. Its goal was to facilitate unified planning, coordination, and implementation of efforts related to climate change and environmental protection. Subsequently, China introduced a "1+N" policy system for carbon peaking and carbon neutrality, which accelerated the formation of synergistic policies for pollution reduction and carbon emissions reduction. "1" refers to the *Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy* and the *Action Plan for Carbon Dioxide Peaking Before 2030*, successively issued by the central government as the top-level design documents to promote carbon peaking and carbon neutrality. "N" refers to a series of implementation plans for key areas, guidance for key industries, and supporting safeguard measures issued by the state and relevant ministries.

A key part of the "1+N" policy system is the *Implementation Plan for Synergising the Reduction of Pollution and Carbon Emissions*, issued in June 2022 by the MEE in collaboration with six other ministries. Aiming for unified planning, deployment, promotion, and evaluation, the plan outlines the entire strategy for reducing pollution and carbon emissions and emphasises the need of promoting both simultaneously.

In the meantime, China has been continuously enhancing its integrated system to mitigate pollution and carbon emissions in industrial sectors and parks. In May 2021, the *Guiding Opinions on the Strengthening of the Prevention and Control of Environmental Pollution at Source from Energy-Intensive Construction Projects with High Emissions* were released as part of its system harmonisation efforts. This Guiding Opinion is built upon the comprehensive environmental management framework that encompasses regional environmental impact assessment (EIA), planning EIA, project EIA, pollutant discharge permits, supervision and law enforcement, and supervision and accountability. In July 2021, the *Work Programme on Promoting Carbon Emission Reduction via Environmental Impact Assessment and Pollutant Discharge*

Permitting was released, aiming to maximise the effectiveness of the environmental impact assessment and pollutant discharge permit system in controlling sources and managing processes. The programme also seeks to facilitate the coordinated planning, organisation, and execution of environmental protection efforts and climate change initiatives.

The *Announcement on Piloting Carbon Emissions Environmental Impact Assessments in Construction Projects in Key Sectors* issued in July 2021 highlights the significance of conducting carbon emission assessment pilot programs, with the focus on carbon emissions in key industries including power generation, iron and steel, building materials, non-ferrous metals, petrochemicals, and chemicals. An announcement was made in October 2021 on piloting carbon emission assessment in planning EIAs for industrial parks, testing technical methodologies and a pathway towards carbon emission assessment in planning EIAs for industrial parks. It aims to promote the establishment of a mechanism for integrating climate change factors into environmental management.

In November 2021, the *Guiding Opinions on the Implementation of the 'Three Lines and One List'*[61] *for Ecological Zoning Control (Trial)* was released. The objective of this document was to identify technical approaches and management strategies for applying ecological, environmental and resource utilisation limits in zoning control. The document also aimed to facilitate the coordinated control of pollution and carbon emission reduction. The *Implementation Plan for Environmental Impact Assessment and Pollutant Discharge Permit for the 14th Five-Year Plan* was issued in April 2022. The plan aims to enhance the source prevention system, specifically the environmental impact assessment system, and establish a framework for regulating stationary pollution sources centred around the discharge permit system. This initiative seeks to drive continuous improvement in ecological and environmental quality and foster high-quality economic development.

Monitoring and Assessment. The *Pilot Programme on Carbon Monitoring and Assessment* was released in September 2021. In order to develop a comprehensive carbon monitoring and assessment system, a pilot monitoring project was conducted in five key sectors and eleven major companies. These sectors include thermal power, iron and steel, oil and gas extraction, coal mining, and waste treatment. The selected companies for this project include the National Energy Group, China Baowu Steel Group, China National Petroleum Corporation (CNPC), China Petroleum Corporation (CNPC), and China Petrochemical Corporation (SINOPEC). In January 2024, the *Technical Guidelines for the Preparation of Integrated Emission Inventories of Air Pollutants and GHGs (Trial)* were released with the objective of improving the accounting system of integrated emission inventories of air pollutants and GHGs.

Standard System. In February 2024, the *Guidelines for Developing a Standard System for Peaking Carbon Emissions and Achieving Carbon Neutrality in the Industrial Sector* were released. These guidelines outlined the framework for the "dual-carbon" standard system in the industrial sector. They also emphasised the importance of aligning with existing standards for industrial energy conservation and comprehensive utilisation, as well as the standard system of green manufacturing. The goal is to leverage these standards to push the sectors to hit carbon emission peaking and achieve carbon neutrality. This entails expediting the development of standards, consistently enhancing the standard system, and facilitating the transition of the industrial sector to a low-carbon and zero-carbon development model.

Technology application. The *Recommended Catalogue of Energy-Saving Technologies and Equipment in Industry and IT Sectors (2022 Edition)* was published in December 2022 by the Ministry of Industry and Information Technology, advocating for the use of energy-saving and efficiency-enhancing technology in the areas of efficient use of renewable energy sources, optimisation of industrial park energy systems, and cascade utilisation. The *Catalogue of Low-Carbon Technologies Promoted by the State as the Priority (4th Batch)* that was also released in December 2022 by the MEE, covered 35 technologies in six separate categories, including energy saving and efficiency improvements, non-fossil energy, combustion and raw material substitution, technical process and other non-carbon dioxide, carbon sinks, carbon capture, utilisation, and sequestration. The *Guidance Catalogue for Green and Low-Carbon Transformation Industries (2024 Edition)* and the *List of Demonstration Projects of Green and Low-Carbon Advanced Technologies (First Batch)* were issued in February and March 2024, respectively, by the National Development and Reform Commission. These documents aim to expedite the green transformation, and promote the demonstrations and applications of green low-carbon technologies.

61 The phrase 'Three Lines and One List' refers to: ecological red line, environmental quality bottom line, upper limit on resource utilisation, and a list of prohibited technology and practices by industry.

Pilot Programs. The *Notice on Reaching Carbon Emission Peak and Carbon Neutrality in National Eco-Industrial Demonstration Parks* was issued in August 2021. This notice emphasises the significance of hitting the "double-carbon" targets in the development of eco-industrial demonstration parks. It encourages industrial optimisation, technological innovation, and platform construction and awareness raising based on the principles of green and low carbon development, coordinating reduction of pollution and carbon emissions, fostering new low-carbon industries, and maximising the positive impact of sustainable practices. The aim is to build "feature industrial parks" or "theme industrial parks". These parks will serve as the foundation for developing a comprehensive plan and approach to hit emissions peaking and achieve carbon neutrality. The goal is to create eco-industrial demonstration parks that will lead the way in achieving emissions peaking by 2030 and carbon neutrality by 2060, gradually and systematically. In July 2023, the *Pilot Work Programme on Collaborative Innovation for Pollution and Carbon Emission Reduction in Cities and Industrial Parks* was released to coordinate relevant pilot projects. In October 2023, the *National Pilot Programme on Peaking Carbon Emissions* was launched to select 100 cities and parks across the country for the pilot programme. The aim is to explore how different cities and parks with varying resource endowments and development bases approach emissions peak. On 27th December 2023, the *Opinions on Comprehensively Promoting the Building of a Beautiful China* highlighted the importance of conducting collaborative innovation pilots to reduce pollution and carbon emissions. It emphasized that industrial parks play a crucial role in this endeavour.

Market Mechanisms. In 2011, several provinces and municipalities across China, including Beijing, Tianjin, Shanghai, Chongqing, Hubei, Guangdong, and Shenzhen, began setting up carbon emissions trading pilots. These pilots cover over 20 industries, such as electricity, steel, and cement. Local trading began in June 2013 in Shenzhen. In February, 2021, the *Measures for the Administration of Carbon Emissions Trading (Trial)* came in to force, and as of July 2021, the national carbon emissions trading market was officially launched, with two compliance cycles since completed. In January 2024, the *Interim Regulations on the Administration of Carbon Emissions Trading* were issued, subsequently coming into effect on 1 May 2024. These regulations provide a solid legal foundation for the functioning and management of the national carbon emissions trading market. In October 2023, the *Measures for the Administration of Voluntary Emission Reduction Trading (Trial) of Greenhouse Gases* were issued. These measures established a comprehensive management system for the voluntary emission reduction trading market, clearly defining the rights and responsibilities of all parties involved and integrating the compliance carbon emission trading market with the voluntary emission reduction trading market. These measures officially came into effect on 19 October of the same year. Furthermore, China has actively pushed for research in key supporting management systems and technical specifications. This includes the development of project development guidelines, validation and verification rules, registration and trading rules, methodologies, and more. The MEE has developed and published four initial methodologies for voluntary GHG emission reduction projects, including carbon sinks for afforestation, grid-connected solar thermal power generation, grid-connected offshore wind power generation, and mangrove forestation. China has also facilitated the creation and release of management systems and technical specifications to support the guidelines for designing and implementing voluntary emission reduction projects. This includes registration rules and trading and settlement rules. In January 2024, China's voluntary greenhouse gas emission reduction trading market was officially re-launched.

2.3 ACHIEVEMENTS AND CHALLENGES

Currently, China's governance is characterised by collaboration between departments and coordination at both the national and local levels. The country has chosen and developed several prime examples with strong promotional and demonstration potential, which have been shared publicly. As a result, the combined efforts to reduce pollution and carbon emissions are starting to bear fruit. The intensity of carbon emissions decreased by about 34.4 percent between 2013 and 2023, whereas emissions of sulphur dioxide (SO_2) and nitrogen oxides (NOx) fell by 85% and 60%, respectively, in China. This signifies that China's approach to environmental and climate governance has shifted significantly, and the country is actively working to find synergies in reducing pollution and carbon emissions. New practices are being developed at a rapid pace.

When it comes to management, implementation, and technical pathways, China's system for reducing pollution and carbon emissions is far from perfect, and has many issues and obstacles. To begin,

top-down planning to cut pollution and carbon emissions has been carried out. To optimise the finer points, localised policy innovation and implementation optimisation are required. Secondly, there is a lack of unified administrative normative documents, rules, and regulations for the industrial sector, and there is a lack of coordination in the management of air, water, soil, solid waste, greenhouse gases, and other pollutants. Thirdly, regarding technical guidelines, China has established workable protocols for preventing and controlling air and water pollution in the electronics and foundry industries, as well as for other sectors like industrial boilers and tanneries. However, it has not yet developed the best available technical guidelines for minimising pollution and carbon emissions concurrently in industrial settings. Fourthly, there are currently no new techniques or technologies for reducing carbon emissions or managing compound pollution in an integrated manner, and the process of building a technological innovation system to do so is in its early stages.

3. Conclusions and Recommendations

3.1 CONCLUSIONS

Given that IED facilities are responsible for roughly 40% of the EU's GHG emissions from 2007–2017, including decarbonisation considerations in the updated IED is an appropriate step for synergistic environmental and climate governance. It also aligns with China's endeavour to coordinate efforts to lower pollution and carbon emissions. The updated IED creates a strong link between zero pollution, climate neutrality, and circular economy, which has provided a good reference for China in synergising the efforts to cut carbon emissions and pollution, particularly in the following domains:

1) A source-based method is adopted for coordinating efforts to reduce pollution and carbon emissions. Decarbonisation and pollution prevention at source is a priority for the IED. Other goals include advocating an efficient use of energy and resources, fostering technological innovations, and encouraging the best industrial companies to invest so that that the combined effects of technology and capital can be fully leveraged. It is also an essential part of the European Union's strategy to achieve better climate and environmental protection, industrial innovation, and enterprise competitiveness – in essence, it aims to transform climate and environmental challenges into opportunities for industry.

2) BAT helps to identify and apply the most cost-effective technologies for pollution and emission reduction. Best available techniques (BAT) conclusions are the reference for setting emission standards and permit conditions in the EU, which guarantees a high degree of overall environmental protection by taking into account the technology's accessibility, economics, and environmental and climate impacts. However, BAT is not static; it is improved over time in response to technological advances and the needs for environmental and climate protection. The publication and update of BAT Conclusions ensure that permits are issued on a sound scientific basis, and enable companies to choose BAT with confidence, thus facilitating smoother implementation of policies contributing to pollution and carbon emissions reductions.

3) Emissions of non-CO_2 greenhouse gases and pollutants are reduced concurrently. During the revision of the IED, the EU tightened its regulations on the combined reduction of non-CO_2 greenhouse gases and pollutants in agriculture and waste treatment. In particular, the revised IED requires the Commission to submit a report by 2026 that will provide solutions for addressing methane and ammonia in livestock farming. Synergistic efforts can both help to mitigate the negative effects of nitrogen pollution on the environment (air, water, and soil), and support a key step towards meeting the crucial goal of climate neutrality by 2050. The many advantages that may be achieved via reducing emissions of both methane and pollutants simultaneously can inform China's approach to this concerted effort.

4) An environmental management system addresses all environmental impacts at the same time. The updated IED mandates that industrial installations implement environmental management systems. These systems comprise anticipated objectives, emission reduction strategies, innovative technology, and effectiveness assessment and reflect synergies in lowering pollution and carbon emissions across all links. Achieving synergistic reductions in greenhouse gas emissions and addressing all environmental challenges needs transformation plans to be developed by companies in critical sectors. The approaches above may provide a point of reference for China in designing its management measures.

5) Synergies between environmental and climate policies have been strengthened. In the revised IED and the EU ETS Directive, the EU has included the review clause to assess possible synergies of the interplay between the two, aiming at strengthening the synergistic effect between environmental and climate policies and to promote the joint swift and effective implementation of these policies. Given the interconnected nature of environmental and climate policies, it is crucial to evaluate and maximise their synergies while advocating for mutual reinforcement and thorough integration. This will help to foster the synergies that exist between reducing pollution and carbon emissions.

3.2 RECOMMENDATIONS

China is eager to learn about the EU's policies and experiences in cutting pollution and carbon emissions in industry, and adapt them to China's domestic circumstances. This will help bring about greater efficiency and effectiveness in efforts to reduce pollution and carbon emissions. Specific recommendations are as follows.

1) China should start by identifying priority areas for pollution and carbon reduction and then develop policies that achieve synergies between the two.

To achieve a high level of protection for the environment as a whole, it is necessary to evaluate and maximise the combined impacts of applicable laws and policies on climate change and pollution. Based on scientific knowledge of the interconnected nature of pollution control and climate governance, reducing emissions of various pollutants and greenhouse gases—including those in air, water, soil, solid waste, and greenhouse gases—must be a priority in developing strategies for cutting carbon emissions and pollution in the industrial sector.

2) It is important to develop sector-specific guidelines on BAT for reducing pollution and carbon synergies. In light of the current state of technology, the costs and benefits of emission reduction, and the potential effects on health, the environment, and the climate, it is imperative that we move swiftly to assess new and collaborative technologies and establish guidelines for best available technology for reducing carbon emissions, increasing efficiency in key industries, and preventing and mitigating the harmful effects of greenhouse gas emissions on these fronts in a sustainable, cost-effect and efficient manner.

3) China should expand and strengthen the pilot programs on exploring innovations in seeking synergies in pollution control and emission reduction.

It is important to gather relevant case-studies, thoroughly investigate experiences and practices that incorporate synergistic emission reduction of multi-pollutants and greenhouse gases, and promote the transformation of the results of collaborative innovation in pollution reduction and carbon reduction in the pilot work. Efforts should be coordinated in methane waste treatment and animal husbandry to reduce emissions of greenhouse gases like carbon dioxide, nitrous oxide, and methane, and to treat pollutants like wastewater, odours, and waste residue.

4) China and the EU should continue to work together on pollution and carbon emission reduction strategies. Greater efforts can be made to discuss China's carbon-pollution synergy policies at bilateral and multilateral meetings. Bilateral efforts can be made to facilitate the flow of information on joint innovative approaches and technologies in China and the EU to lessen environmental impact and greenhouse gas emissions via seminars, exchange visits, and other relevant activities. Specifically, China may benefit from engaging with the OECD BAT expert group. For several years, this group has been exchanging practices on BAT-based policies to address industrial pollution and published a number of recommendations and reports. China could gain insights by participating actively in this exchange of information.

ANNEX 1: BAT REFERENCE DOCUMENTS[62]

Name	Adopted/ Published Document	Status
Production of Chlor-alkali	BREF BATC (12.2013)	Published
Ceramic Manufacturing Industry	BREF (08.2007)	Review started
Production of Cement, Lime and Magnesium Oxide	BREF BATC (04.2013)	Published
Common Waste Water and Waste Gas Treatment/Management Systems in the Chemical Sector	BREF BATC (06.2016)	Published
Economics and Cross-media Effects	REF (07.2006)	Document formally adopted
Emissions from Storage	BREF (07.2006)	Document formally adopted
Energy Efficiency	BREF (02.2009)	Document formally adopted
Food, Drink and Milk Industries	BREF BATC (12.2019)	Published
Ferrous Metals Processing Industry	BREF BATC (11.2022)	Published
Manufacture of Glass	BREF BATC (03.2012)	Published
Industrial Cooling Systems	BREF (12.2001)	Document formally adopted
Intensive Rearing of Poultry or Pigs	BREF BATC (02.2017)	Published
Iron and Steel Production	BREF BATC (03.2012)	Published
Large Combustion Plants	BREF BATC (12.2021)	Published
Large Volume Inorganic Chemicals		Drawing up started
Large Volume Inorganic Chemicals – Ammonia, Acids and Fertilisers	BREF (08.2007)	Document formally adopted
Production of Chlor-alkali	BREF BATC (12.2013)	Published
Ceramic Manufacturing Industry	BREF (08.2007)	Review started
Production of Cement, Lime and Magnesium Oxide	BREF BATC (04.2013)	Published
Common Waste Water and Waste Gas Treatment/Management Systems in the Chemical Sector	BREF BATC (06.2016)	Published
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Food, Drink and Milk Industries	BREF BATC (12.2019)	Published
Ferrous Metals Processing Industry	BREF BATC (11.2022)	Published
Manufacture of Glass	BREF BATC (03.2012)	Published

62 https://eippcb.jrc.ec.europa.eu/reference/

Name	Adopted/ Published Document	Status
Industrial Cooling Systems	BREF (12.2001)	Document formally adopted
Intensive Rearing of Poultry or Pigs	BREF BATC (02.2017)	Published
Iron and Steel Production	BREF BATC (03.2012)	Published
Large Combustion Plants	BREF BATC (12.2021)	Published
Large Volume Inorganic Chemicals		Drawing up started
Large Volume Inorganic Chemicals – Ammonia, Acids and Fertilisers	BREF (08.2007)	Document formally adopted
Large Volume Inorganic Chemicals – Solids and Others Industry	BREF (08.2007)	Document formally adopted
Production of Large Volume Organic Chemicals	BREF BATC (12.2017)	Published
Mining (extraction) of ores		Drawing up started
Non-ferrous Metals Industries	BREF BATC (06.2016)	Published
Manufacture of Organic Fine Chemicals	BREF (08.2006)	Document formally adopted
Production of Polymers	BREF (08.2007)	Document formally adopted
Production of Pulp, Paper and Board	BREF BATC (09.2014)	Published
Refining of Mineral Oil and Gas	BREF BATC (10.2014)	Published
Monitoring of Emissions to Air and Water from IED Installations	REF (07.2018)	Published
Slaughterhouses, Animal By-products and/or Edible Co-products Industries	BREF BATC (12.2023)	Published
Smitheries and Foundries Industry	BREF (05.2005)	Final Draft
Production of Speciality Inorganic Chemicals	BREF (08.2007)	Document formally adopted
Surface Treatment Of Metals and Plastics	BREF (08.2006)	Review started
Surface Treatment Using Organic Solvents including Wood and Wood Products Preservation with Chemicals	BREF BATC (06.2020)	Published
Tanning of Hides and Skins	BREF BATC (02.2013)	Published
Textiles Industry	BREF (01.2023) BATC (12.2022)	Published
Wood-based Panels Production	BREF BATC (11.2015)	Published
Common Waste Gas Management and Treatment Systems in the Chemical Sector	BREF (01.2023) BATC (12.2022)	Published
Waste Incineration	BREF BATC (12.2019)	Published
Waste Treatment	BREF BATC (08.2018)	Published

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