DO NOT CITE OR QUOTE WITHOUT PERMISSION OF THE AUTHORS

1 Introduction

1. The CAP is a composite indicator that aims to assess countries' climate action as comprehensively as possible to support countries' efforts to advance towards net-zero greenhouse gas (GHG) emissions by 2050. In line with the definition of the Sustainable Development Goal (SDG) 13 related to climate change mitigation, climate action is defined here as government efforts to reduce GHG emissions, including national[1] and international climate policies and improving education and institutional capacity with respect to climate mitigation (UNDP, 2021[2]). The major objectives and purposes of the CAP include:

a) Measure governments' climate action as comprehensively as possible across a wide range of policy areas and instruments, including market-based and non-market-based instruments;
b) Enable to quantify and track progress of countries' climate action based on objective data;
c) Lay out a modular and stepwise approach, covering national sectoral, national cross-sectoral and international climate action. Different modules will be available at different points in time;
d) Identify climate action or policy areas that are more or less ambitious within countries;
e) Enable statistical and econometric analyses to evaluate the effectiveness of climate policy. The empirical analyses would allow to draw policy recommendations for climate policy making.

2. The CAP includes a broad range of government policies or actions. For now, the index focusses entirely on climate mitigation as data on adaptation is still under development. Most of the sub-indicators cover climate policy instruments, including taxes, subsidies, regulations or public expenditure for research, development and demonstration. The CAP goes, however, beyond climate policy instruments. For example, it also includes short-term and long-term targets (e.g. net-zero targets), climate governance (e.g. the existence of an independent climate advisory body), climate reporting (e.g. transparency and completeness of mandatory UNFCCC submissions), international public climate finance (e.g. climate-related official development assistance), and climate education. All of these actions are key to reach the goals of the Paris Agreement (IPCC, 2018[3]).

3. This paper presents a first draft of the conceptual framework and the methodology of the CAP. The development of the CAP is a work in-progress and will be further improved in the coming months. In addition, proposed sub-indicators may be adjusted or new ones added as new data are collected.

4. The remainder of this paper is structured as follows. Section 2 introduces the conceptual framework of the CAP. It provides a brief overview of the structure and the key building blocks of the CAP (Section 2.1). The section also presents information on each of the CAP's building blocks, discusses the rationale of each component, provides the data source and indicates the availability (Section 2.2). Section 3 introduces the methodology of the CAP, including on scoring (Section 3.1), aggregating and weighting (Section 3.2) and the treatment of missing values (Section 3.3). Section 4 presents some caveats and limitations of composite indicators in general (Section 4.1). It also presents a list of climate action or policy indicators that are not included in the CAP and provides reasons for their exclusion (Section 4.2). Section 5 provides some preliminary results of the CAP with indicators for which data was available by December 2021. The Section sheds light on overall trends (Section 5.1) as well as comparisons with other

[1] The CAP also includes sub-national carbon pricing schemes. Covering other sub-national climate actions would be too demanding in terms of data collection efforts and are, thus, excluded.

environmental policy indicators (Section 5.2) and environmental outcomes (Section 5.3). Section 6 carries out a number of sensitivity and robustness checks.

2 The conceptual framework

2.1. Overview of climate actions and policies measurement and indicators

5. The CAP is a composite indicator in the IPAC Dashboard and complementary to other IPAC Dashboard indicators.[2] Composite indicators have the advantage of being more comprehensive than alternative approaches such as single quantitative indicators (e.g. some IPAC dashboard indicators) or perception-based indicators (e.g. expert surveys). Composite indicators aggregate information from various climate actions and policies, which allows to reflect the multidimensionality of governments' climate action (Albrizio et al., 2014[4]) (Almássy, 2018[5]). Moreover, composite indicators simplify complex information and facilitate comparison of the overall climate action within and across countries (Almássy, 2018[5]). Compared to perception-based indicators, composite indicators are typically based on objective data.[3] In recent years, several environmental or climate-related composite indicators have been developed (Box 1). Due to increased data availability across a wider set of countries and policies, this indicator type has become increasingly popular (Galeotti, Salini and Verdolini, 2020[6]). Composite indicators have, however, also some limitations (see Section 4.1).

6. Conceptually, the CAP builds on the OECD Environmental Policy Stringency (EPS) index. The EPS focusses on policy instruments on a number of environmental policies related to air pollution and climate change (Botta and Koźluk, 2014[7]). Using data from the IEA, the OECD, the EEA, and National Communications to the UNFCCC, the EPS evaluates the stringency of environmental policies in OECD Member countries and Key partners. The country scores of the EPS are available on an annual basis since 1990. An update of the EPS will be available in 2022.[4]

7. Similar to the EPS, the CAP focusses solely on climate change policies and actions, which are based on, and embodied in national and international laws and institutions. The CAP does not feature indicators based on direct or indirect outcomes or perceptions, both of which are the result of policy action. For example, the CAP would include countries' public R&D expenditures on low-carbon technologies, but not the number of patents filed by countries' inventors, which are an intermediate outcome of public policies. Moreover, climate actions and policies of the private sector are not within the scope of the CAP. Also in accordance with the EPS, the CAP measures the scope and ambition of policies and actions that countries have adopted to mitigate climate change, but does not take into account its enforcement.

---

[2] Since the CAP aims to cover countries' climate policies and actions landscape, there could be some overlap with some IPAC Dashboard indicators, notably the 'response' indicators. However, the CAP is designed to be complementary to IPAC Dashboard indicators. For example, the CAP includes countries' nominal rates of carbon pricing (and pricing of other GHG) across sectors whereas the IPAC Dashboard indicator on carbon pricing reports the share of CO_2 emissions priced for different benchmark prices.

[3] Country scores of solely perception-based indicators may diverge depending on who is consulted, as it is unclear whether all consulted experts use the same criteria to quantify how effective policies are (Compston and Bailey, 2013[65]). Such divergence is mitigated in the case of composite indicators.

[4] The most recent update of the EPS stems from 2021 and includes 13 sub-indicators, which are divided into non-market based instruments, market-based instruments and technology support policies (Dechezleprêtre et al., 2021[42]).

Box 1. The CAP compared to existing environmental or climate-related composite indices

Table 1 shows selected composite indicators focusing on environmental or climate policy along their respective characteristics. The EPI (Wendling et al., 2020[8]), the CCPI (Burck et al., 2020[9]) and the GFI (MIT, 2021[10]) all assess a significant number of climate-related indicators. The EPI also has a large country coverage of 180 countries and a long time series starting from 2001, though only available biennially. Its 32 subcomponents are grouped into 11 categories, of which 40% are environmental health indicators and 60% are ecosystem viability indicators. It thus mainly aims at assessing the state of the environment based on output variables. The CCPI focusses on climate mitigation, containing output-based indicators (80% of the 14 indicators), in addition to perception-based indicators (20% of the 14 indicators). The CCPI also takes a modular approach, covering four topics: Climate Policy, Energy Use, Renewable Energy and GHG Emissions. The climate policy module is based expert surveys and evaluates, amongst other things, the progress towards countries' NDCs. Similarly, the recently released GFI mainly covers output-based indicators (73% of the 18 indicators) in addition to some qualitatitve assessments on climate policies (27% of the 18 indicators). Its climate policy module, which constitutes the largest of five modules, contains information regarding countries' policy commitment toward climate targets, carbon finance programs, sustainable agriculture and the use of covid stimulus for a green recovery.

The OECD's EPS (Botta and Koźluk, 2014[7]) and EBRD's CLIMI (EBRD, 2011[10]) focus on *de jure* policy rather than output-based or perception-based indicators. The CLIMI consists of similar building blocks as the CAP: i) international cooperation, ii) domestic climate framework, iii) sectoral, fiscal or regulatory measures or targets and iv) cross-sectoral fiscal or regulatory measures. However, the CLIMI only analyses policies from 2010. In comparison, the CAP is envisioned to be a panel dataset with data going back at least to 2010 and, where possible, to 1990. This enables to track countries' progress over time and to carry out empirical analyses to evaluate the effectiveness of climate policies.

Table 1. Key characteristics of environmental and climate policy composite indicators

Name	Institution	# climate-related indicators	Approach	Thematic coverage	Time coverage	Country coverage
Environmental Performance Index (EPI)	Yale and Columbia University	13 out of 32	State of the environment	Environmental pressures (e.g. air quality, climate change)	From 2001, biennial	180 countries
Climate Change Performance Index (CCPI)	German Watch	14 out of 14	80% output-based 20% perception-based	GHG emissions, renewable energy use, climate policy	From 2005, annual	57 countries + EU
Climate Laws Institutions and Measures Index (CLIMI)	EBRD	11 out of 11	Adopted policies and measures	International as well as national cross-sectoral and sectoral policies	2010, only one year	95 countries
Environmental Policy Stringency Index (EPS)***	OECD	8 out of 15	Policy instruments	Selected economic sectors (power, mobility)	From 1990, annual	OECD + key partners + Russia
The Green Future Index (GFI)	MIT	11 out of 18	73% Output-based and 27% policy instruments	Clean innovation, energy, emissions, society and climate policy	From 2021	76 countries and territories
Climate Actions and Policies (CAP) Index	OECD	>50 out of >50	Climate policies and actions	International as well as national cross-sectoral and sectoral policies	From at least 2010, annual	51 IPAC countries + EU27

Note: *** The characteristics of the EPS described in this table are based on the version from 2016. An update of the EPS will be published in 2022.
Source: Authors

8. Compared to the EPS, the CAP focusses exclusively on climate actions and policies. The CAP expands the climate part of the EPS, reflecting a much greater depth and breadth of countries' climate policies. The CAP goes beyond climate policy instruments, also capturing climate action in other areas (e.g. climate education). Besides cross-sectoral and international climate policies, the CAP covers the major emitting sectors, including power generation, industry, transport, buildings, agriculture, and waste. For these sectors, the CAP follows the methodology of the EPS and distinguishes between non-market-based (e.g. energy efficiency or emission standards, bans) and market-based instruments (e.g. carbon pricing, subsidies for low-carbon technologies such as renewable electricity). The CAP also includes some policies on GHG other than carbon dioxide (CO_2), including methane and nitrous oxide.[5] The CAP will cover all 51 IPAC countries[6] and the EU.

9. The CAP covers a wide range of policies across its three building blocks: international climate policy, national cross-sectoral policy and national sector-specific climate policy (Figure 1). Each building block consists of a number of modules (e.g. targets in national cross-sectional policies and actions). Each module encompasses a number of components (e.g. net-zero targets and NDC in targets) and each component can consist of a number of sub-indicators (e.g. year, legal status and coverage of net-zero targets).

10. The CAP comprises more than 50 sub-indicators related to climate mitigation. As such, the CAP is the most comprehensive climate-related composite indicator currently available (Table 1 in Box 1). Actions and policies included in the CAP are based on an extensive stock-taking exercise that builds on previous and on-going OECD work and in-house policy databases or directories, including the OECD Policy Instruments for the Environment (OECD, 2021[11]) database, the IEA Policies and Measures (IEA, 2021[12]) database and the ITF Transport Climate Action Directory (ITF, 2021[13]). Results of this stock-taking exercise feed into the work of the OECD Inclusive Framework on Carbon Pricing (IFCP) and are expected to be presented shortly. Sub-indicators are chosen based on their proven effectiveness of reducing GHG emissions and data availability. In fact, all sub-indicators in the CAP have demonstrated to contribute to reducing GHG emission (Section 2.2). Data on all sub-indicators, components and modules will be made publicly available, enabling researchers and analysts to use those indicators, which are best suited for answering their respective research question. The CAP is planned to be updated every year with a timeliness gap of at least one year.

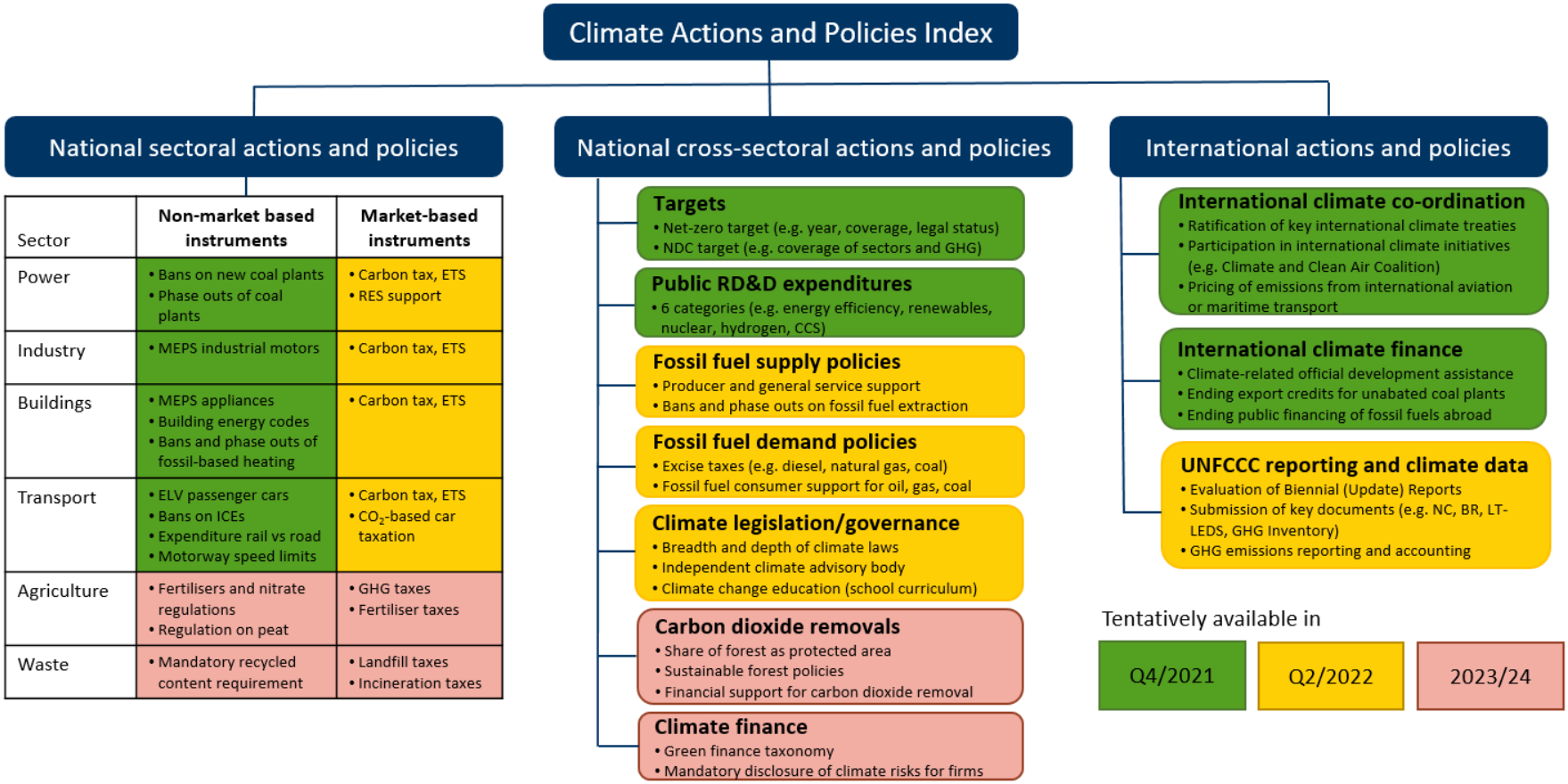
11. The CAP uses a variety of data sources, both in-house and external. It builds on data collected by the OECD's Environment Directorate and is complemented with data from other OECD work as well as from OECD partner agencies (IEA, ITF, NEA). The CAP also draws on external data providers, including the United Nations Statistical Division (UNSD), other UN bodies (e.g. FAO) as well as from think tanks such as REN21 or ICCT (see Annex A for more details).

---

[5] Non-CO_2 GHG emissions are included in the evaluation of ETS and GHG Inventories. A stand-alone methane policy indicator may be developed in 2022 subject to data availability.

[6] The IPAC countries include the following countries: Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Chile, China, Colombia, Costa Rica, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Malta, Mexico, Netherlands, New Zealand, Norway, Peru, Poland, Portugal, Romania, Russian Federation, Saudi Arabia, Slovak Republic, Slovenia, South Africa, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States.

Figure 1. The Climate Actions and Policies Index: Conceptual framework and building blocks



Note: Policies in modules expected to be available in 2023/2024 (i.e. agriculture and waste sectors, CO_2 removals and avoidance, and climate finance) are only indicative. These policies are still under discussion and will be further developed through 2023.
Abbreviations are MEPS: Minimum energy performance standard, ELV: Emission limit value, ICE: internal combustion engine, ETS, Emissions trading system, RES: Renewable energy sources, NC: National Communication, BR: Biennial Report, LT-LEDS: Long-term low-emissions development strategy.
Source: Authors

2.2. The building blocks of the CAP

12. This section provides more details on the proposed modules and components of the CAP. It presents the components, the measurement or sub-indicators, the rationale, the data source, and the expected availability for each building block. Annex A provides additional information on the sub-indicators, including a detailed description of the underlying raw data, the type of variable (e.g. dummy, categorical, continuous), as well as information on country and time coverage, timeliness, and scoring.

2.2.1. Building block I: International actions and policies

13. This block consists of a broad set of international climate policies grouped into three modules: UNFCCC reporting and GHG emissions reporting, international climate co-ordination, and international public climate finance. Since climate change is a global challenge, international climate policy and climate co-ordination is vital to reach the goals of the Paris Agreement. International co-ordination can address several challenges, including unevenly distributed emissions sources, heterogeneous mitigation costs and heterogeneous climate impacts (IPCC, 2014[11]). Table 2 presents the components, the measurement or sub-indicators, the rationale, the data source, and the availability of this building block.

14. Providing climate data and international reporting under the UNFCCC, including the evaluation of the Biennial Reports (BRs) or Biennial Update Reports (BURs) as well as submissions of other UNFCCC documents (e.g. National Communications, GHG Inventories) ensure that data is available to measure progress and to identify drivers of emissions. Hence, transparency and completeness of the UNFCCC reporting are a prerequisite to tailor effective mitigation strategies (Yamin and Depledge, 2004[12]). In fact, information from the BRs and BURs has been used to compare climate policy stringency of countries (Beugin et al., 2016[13]). The CAP accounts for the fact that (mandatory) reporting requirements differ across Annex I, Annex II, non-Annex I countries by normalising the score depending on the country group, following the approach of (Weikmans, Asselt and Roberts, 2019[14]). For the compliance with reporting to the UNFCCC, the CAP also distinguishes between whether the documents have been submitted on time or with delays. The number of submissions and its timeliness often serve as a basis for assessing countries climate ambition as regular reporting enhances transparency (Baettig, Brander and Imboden, 2008[15]) (Bernauer and Böhmelt, 2013[16]). In addition, the CAP also includes information on the coverage and the frequency of GHG Inventories and GHG data following the System of Environmental Economic Accounting, both of which increase transparency of GHG emissions, sources and removals.

15. International co-ordination is crucial to achieve the common climate goal of the Paris Agreement. Ratification of major international climate agreements (e.g. Kyoto, Paris) is key for establishing a common understanding of the global climate problem (Bernauer and Böhmelt, 2013[16]). Participation in international co-operative initiatives is used as a proxy for countries' efforts to multilateral climate co-operation. This indicator is based on the initiatives listed on the UNFCCC global climate action portal (NAZCA) that was launched in 2014 (UNFCCC, 2021[17]).[7] This module also includes information on emissions pricing from international aviation and maritime transport. These sectors account for almost 5% of global GHG emissions (Lee and Fahey, 2020[23]). Measures to reduce GHG emissions from these sectors are outside the scope of the UNFCCC process, but are addressed by the International Maritime Organisation (IMO) and the International Civil Aviation Organization (ICAO) (IMO, 2020[19]).

16. International climate finance is one module in which countries can directly support other countries' efforts to mitigate or adapt to climate change. Some countries (e.g. Finland, New Zealand) explicitly

[7] Basing the initiatives on the NAZCA portal reduces concerns of arbitrariness related to the selection of initiatives included in the CAP. Note that only initiatives where at least one national government (along other sub-national governments or corporate actors) is member are taken into account.

mention that international climate finance has substantial leverage, reducing emissions abroad (MFAT, 2021[20]) (Finnish Government, 2019[21]). Climate-related official development assistance (ODA) is one of the key channels through which developed countries can provide public climate finance to developing countries.[8] Ending export credit support for new unabated coal power plants, i.e. power plants that are not equipped with carbon capture utilisation and storage (CCUS) technologies (OECD, 2021[22]), is expected to increase the financing costs of coal power plants, discouraging investments in new coal plants. Similarly, ending public finance for fossil fuel developments abroad is expected to decrease the number of fossil fuel projects.

Table 2. International climate policy: Detailed description on indicators

Component	Sub-indicators/measurement	Rationale	Source	Availability
UNFCCC reporting and climate data				
Evaluation of Biennial Reports and Biennial Update Reports	Score on the assessment of the UNFCCC technical expert review on the transparency and completeness of BRs and BURs	Transparency and completeness of Biennial (Update) Reports is a prerequisite for climate action because it ensures that relevant data is available to measure progress and to identify the drivers of emissions.	UNFCCC	Q4/2021
Reporting to UNFCCC	Number and timeliness of submissions of key mandatory and voluntary documents to the UNFCCC (e.g. BR, NC, LT-LEDS, GHG Inventory)	Submission of documents to the UNFCCC is a prerequisite for climate action because it fills information gaps and helps identify drivers of emissions as well as strategies to climate mitigation.	UNFCCC	Q4/2021
GHG emissions reporting and accounting	• Coverage and frequency of **GHG Inventories** • Coverage and frequency of publication of GHG data in line with the **System of Environmental Economic Accounting** (SEEA)	Tracking GHG emissions is key for enhancing transparency and addressing climate change effectively. Environmental accounting enables countries to analyse and track total emissions, emissions sources, and emission removals, all of which are key to inform policy and track progress towards targets.	UNFCCC, SEEA	Q4/2021
International climate co-ordination				
Ratification of international agreements	Number of ratified major international agreements (UNFCCC framework convention, the Kyoto protocol and the Paris agreement).	Major international agreements are key to tackling climate change as they provide a common understanding of the problem, and its solutions while laying out common targets. Ratification of those agreements shows commitment to the stated goals.	UNFCCC, UNTC	Q4/2021
Participation in international climate initiatives	Number of memberships in international climate initiatives listed in the Global climate action portal of the UNFCCC	Participation in international climate activities is a good proxy for international co-operation, which is needed to reach climate goals.	UNFCCC	Q4/2021
Pricing of emissions from international aviation and maritime transport	• **Carbon price** on CO_2 emissions from international aviation (e.g. through ETS) • **Carbon price** on CO_2 emissions from international maritime transport	Emissions from international aviation and maritime transport cannot easily be attributed to specific countries and, thus, require international co-operation. Pricing those emissions is a cost-effective means to reduce emissions.	Ongoing OECD data collection	Q4/2021
International climate finance				
International climate mitigation-related official development assistance	Share of provided international climate mitigation-related official development assistance on GDP	Climate mitigation-related official development assistance is one of the key international public climate finance channels to help developing countries mitigate or adapt to climate change.	OECD	Q4/2021
Ending export credits for new unabated coal power plants	Year when export credits for new unabated coal power plants are planned to cease	Ending export credit support for new unabated coal power plants is expected to increase coal plants' financing costs, discouraging investments in new unabated coal plants.	Ongoing OECD data collection	Q2/2022
Ending public finance for fossil	Year when public finance for fossil fuel infrastructure is planned to cease	Ending public finance for fossil fuel infrastructure abroad is expected to reduce investments in	Ongoing OECD	Q2/2022

[8] See Section 3.3 for how the CAP treats missing data and data for recipients countries. Also note that international ODA is deflated by GDP to account for the size of the countries.

Component	Sub-indicators/measurement	Rationale	Source	Availability
fuel infrastructure abroad		fossil fuel infrastructure.	data collection	

Note: Abbreviations refer to NC: National Communication, BR: Biennial Report, LT-LEDS: Long-term low-emissions development strategy
Source: Authors

2.2.2. Building block II: Cross-cutting national climate actions and policies

17. This building block consists of seven modules spanning cross-sectoral national climate policies, including targets (NDCs and net-zero), public research development and demonstration, fossil fuel supply and demand policies, climate legislation and governance, CO_2 removals, and climate finance (Table 3). These are overarching policy areas to mitigate or remove domestic GHG emissions that cannot be easily attributed to a specific sector.

18. NDCs and net-zero targets are key short-term and long-term targets to support the goals of the Paris Agreement (Article 4.1). There are still significant gaps between long-term targets and short-term targets as well as between targets and action (Falduto and Rocha, 2020[22]). However, long-term targets and pathways about how to achieve them (e.g. through long-term low emissions development strategies) are key anchors against which short-term climate action can be evaluated and potentially legally challenged (IDDRI, 2021[23]) (Grantham Research Institute, 2021[24]). Targets can also be seen as proxies for the level of ambition for mitigation set by governments. More importantly, short-term and long-term targets shape consumers' and producers' expectations, affecting their decisions already today. Net-zero targets or NDCs differ across countries with respect to many dimensions such as coverage of sectors and GHGs. Hence, the CAP evaluates the scope (e.g. coverage of sectors and GHGs), the type of target (e.g. absolute reduction target or emission intensity target), the legal status (e.g. in law or in policy document) or the target year (only for net-zero targets). The CAP would assign higher scores for targets with broader coverage, more binding legal status, etc. To that extent the CAP is complementary to the IPAC dashboard indicators, which measure the distance to NDCs and net-zero targets.

19. Continuous improvement of key energy technologies through innovation is important for the transition towards net-zero energy systems.[9] Early-stage technology development requires more targeted policies than deployment of more mature technological solutions (Johnstone, Haščič and Popp, 2009[25]) (Haščič and Johnstone, 2011[26]). The CAP distinguishes between six different energy categories for public research, development and demonstration (RD&D) budget, including energy efficiency, renewable energy, nuclear, CCS, hydrogen and fuel cells, and power and storage technologies, all of which are critical in the technology mix towards net-zero (IEA, 2021[27]). The distinction between different energy technologies provides a more granular picture of countries' energy innovation landscape. Data on public RD&D budgets for carbon removal technologies such as direct air capture is not available (Section 4.2).

20. Fossil fuel supply side policies shape investments and extraction of fossil fuels, including coal, oil, and natural gas. In fact, fossil fuel producer support (e.g. reductions in royalties) and general support services (e.g. government spending on fossil fuel infrastructure such as gas pipelines) remain substantial in some countries (OECD & IEA, 2021[28]). Following the OECD Inventory of Support Measures for Fossil Fuels, the CAP distinguishes between producer support and general support services, both of which benefit fossil fuel production and increases emissions.[10] The CAP also includes bans or phase outs of

[9] See section 2.2.3 for why RD&D expenditure is not included in the building block national sectoral climate policies.

[10] The OECD Inventory of Support Measures for Fossil Fuels provides a comprehensive picture of governments' support measures for fossil fuels. It does, however, not distinguish between inefficient and efficient support measures.

fossil fuel extraction. These policies are effective in avoiding GHG emissions, but are not in place in most countries (Green and Denniss, 2018[29]).

21. Fossil fuel demand policies (e.g. carbon pricing) are key to reduces fossil fuel consumption and CO_2 emissions in a cost-effective manner (Baumol and Oates, 1988[30]). The CAP explicitly distinguishes between direct carbon pricing instruments such as carbon taxes and ETS (see section 2.2.3) and indirect instruments such as fuel excise taxes.[11] The index provides information on 5 excise tax rates: diesel, gasoline, coal, natural gas, and kerosene. The CAP uses nominal rates on fuel excise taxes, making it complementary to the IPAC dashboard indicator on the net effective carbon rate (ECR). Disaggregating the ECR (which is the sum of carbon tax, ETS and fuel excise taxes) into its components provides a more granular picture of countries' carbon pricing policies. In addition, evaluating nominal rates instead of average ECRs that are weighted by country-specific consumption shares of energy products, ensures that a change in the sub-indicator is solely driven by a change in policy and not by a change in the underlying energy consumption basket.[12] To account for tax exemptions, the CAP includes the consumer support estimate on fossil fuels from the OECD Inventory, which includes the vast majority of tax exemptions. The OECD consumer support estimate is normalised by the consumption of the respective fuel and can, thus, be interpreted as average support per unit fuel consumed.[13]

22. Climate legislation and governance are key for effective climate mitigation and enhancing the legitimacy of policy making. As of 2021, there are more than 2,300 laws on climate change globally (Grantham Research Institute, 2021[31]). Recent evidence suggests that each new climate law is associated with a reduction of countries' GHG intensity by 0.78% within the first three years and by 1.79% beyond three years (Eskander and Fankhauser, 2020[32]). Drawing on the LSE Climate Change Laws of the World database, the CAP would include the number of national climate laws. In order to better compare the coverage of laws, each law is weighted by the number of sectors and policy instruments covered. Independent expert advisory bodies were found to enhance the legitimacy of the policymaking process while helping strengthen public trust and political support for climate action (Averchenkova and Lazaro, 2020[33]). Education in climate change was also found to support climate action by raising awareness and creating knowledge, enabling people to take climate action (Anderson, 2012[34]).

23. Carbon dioxide removals will be needed to some degree to reach the goals of the Paris Agreement according to most IPCC scenarios consistent with limiting global warming to 1.5°C (IPCC, 2018[3]). The magnitude of carbon dioxide removals depends on the GHG emission trajectory in the coming decades. Carbon dioxide removals, including environmental sinks (e.g. afforestation, reforestation), bioenergy carbon capture and storage (BECCS), or direct air capture (DAC) differ with respect to the permanence of storage and the trade-offs with other sustainable development goals, including biodiversity (Jeudy-Hugo, Lo Re and Falduto, 2021[35]). The CAP includes both policies to enhance environmental sinks such as forest protection based on the definition of International Union for Conservation of Nature (IUCN) and policies on sustainable forest management, as well as subsidies for technological solutions such as BECCS or DAC.

---

[11] While fuel excise taxes are usually not levied on climate or environmental grounds, they are included in the CAP because the tax base is directly related to CO_2 emissions. By putting a price on CO2 emissions, fuel taxes work in a similar way as carbon taxes. Note, however, that non-climate policies are not included if there is a non-linear relationship between the policy and the effect on GHG emissions (see Table 7 for more details).

[12] While data on effective carbon rates (ECRs) is only available for 2012, 2015, 2018 and 2021, nominal rates for fuel excise taxes, carbon taxes and ETSs are available from 1990, which significantly enhances the sample size which is key for prospective empirical applications. In addition, using country-specific energy consumption to calculate ECRs is subject to endogeneity problems in empirical applications.

[13] See the detailed description in Table A.2 of Annex A for the caveats related to using the OECD fossil fuel support Inventory.

24. Climate finance policies and regulations can help channel private investments into low-carbon technology. Investments in low-carbon technologies need to multiply within the next decades to align with the goals of the Paris Agreement (IEA, 2021[27]). Providing information on assets' environmental sustainability (including climate mitigation) and the risks associated with climate impacts and prospective climate policy can help investors make better informed decisions. This would support aligning private investment flows with net-zero targets (Piebalgs and Jones, 2021[36]).

Table 3. Cross-sectoral climate policy indicators: Detailed description

Component	Sub-indicator/ measurement	Rationale	Source	Availability
Targets				
NDCs	• **Coverage** of NDCs (sectors, GHGs) of NDCs • **Type** (e.g. absolute reduction target)	NDCs are key short-term targets to support the goals of the Paris agreement. Yet, NDCs differ in terms of coverage and type. The NDC is more demanding and more transparent the broader the coverage of NDCs and the more stringent the type.	UNFCCC	Q2/2022
Net-zero target	• **Year** in which country plans to achieve net-zero • **Legal status** of the net-zero target (categorical). • **Coverage** of net-zero target (e.g. all GHG, all domestic sectors)	To limit global warming to 1.5°C, global GHG emissions must reach net-zero by 2050. The earlier countries are planning to reach net-zero, the higher the chance to limit global warming in line with the 1.5°C target. The legal status of net-zero targets has implications on the credibility and on potential litigation actions from civil society if countries are not on track in meeting their targets. The scope of net-zero targets is key for its effectiveness.	ECIU, (Climate Watch, 2021[37])	Q2/2022
Public Research, Development and Demonstration expenditures				
Public Research, Development and Demonstration expenditure	• Spending on public RD&D related to **energy efficiency** in % of national GDP • RD&D for **renewables** • RD&D for **nuclear** • RD&D for **hydrogen** • RD&D for **power and storage** • RD&D for **CCS**	Public RD&D expenditures in low-carbon technologies (e.g. renewables, nuclear, CCS) is crucial for innovation and adoption of new technologies to limit global warming to 1.5°C. Other non-fossil energy technologies (e.g. energy efficiency, hydrogen, fuel cells, smart grids) are key technologies to decarbonise hard-to-abate sectors (e.g. steel, cement) or key enablers for the shift towards zero-carbon energy systems.	IEA	Q4/2021
Fossil fuel supply policies				
Governments' producer and general service support	Sum of governments' producer support and general service support to fossil fuels in % of national GDP.	Governments' fossil fuel support encourages the use of fossil fuels, contributing to the lock-in of carbon-intensive production and consumption styles. The volume of government support for fossil fuels remains substantial. The consumer support estimate is included under 'Fossil fuel demand policies'.	OECD	Q2/2022
Bans on fossil fuel extraction	• **Year** when ban becomes effective **Legal status** of ban (e.g. pledge, in law)	Fossil fuels are the major contributor to GHG emissions. According to IEA's net zero 2050 scenario, from 2021 there need to be no new oil and gas fields for development and no new coal mines or mine extensions.	Ongoing OECD data collection	Q2/2022
Phase out of fossil fuel extraction	• **Year** when extraction is planned to be phased out **Legal status** of phase out	Fossil fuels are the major contributor to GHG emissions. To limit global warming to 1.5°C, it is estimated that 90% of proven coal reserves and around 60% of proven gas and oil reserves must not be extracted (Welsby et al., 2021[38]).	Ongoing OECD data collection	Q2/2022
Fossil fuel demand policies				
Fossil fuel excise taxes	• Level of **diesel** tax in EUR/tCO_2e • Level of **gasoline** tax • Level of **coal** tax • Level of **natural gas** tax • Level of **kerosene** tax	Fossil fuel excise taxes indirectly put a price on energy-related carbon emissions which helps reduce fossil fuel consumption and, thus, CO_2 emissions in a cost-effective way.	OECD	Q2/2022
Governments' fossil fuel consumer support	• Per unit consumer support for **oil** • Support for **natural gas** • Support for **coal**	Fossil fuel support for consumers (e.g. tax exemptions) encourages consumption of fossil fuels, leading to an increase of CO_2 emissions.	OECD	Q2/2022
Climate legislation and governance				

Component	Sub-indicator/ measurement	Rationale	Source	Availability
Breadth and depth of climate laws	Number of sectors and policy instruments covered by climate laws	The breadth and depth of climate laws is a proxy for overall domestic mitigation action.	LSE	Q2/2022
Independent expert advisory body	Existence of independent expert advisory body (yes/no)	The existence of an independent advisory body on climate change has proved effective to monitor governments' progress towards climate targets, to propose policy instruments to reach targets or to propose short-term, mid-term and long-term targets (Averchenkova and Lazaro, 2020[33])	Ongoing OECD data collection	Q2/2022
Climate change education	Score measuring the extent of climate education mainstreamed in, e.g., curricula	Integrating climate change and sustainable development in the curriculum of students and teachers raises awareness and creates knowledge. This can empower people to take action against climate change while improving the understanding of public climate policy.	UN SDG	Q2/2022
Carbon dioxide removals and avoidance				
Policies on Sustainable Forest Management	Number of policies to support sustainable forest management on a national level	According to the UN Global Forest Goals (United Nations, 2019[39]) SFM, including protection, restoration, afforestation and reforestation contributes substantially to reverse the loss of forest cover worldwide.	FAO	Q2/2022
Forest protection	Share of tree-covered land (forests) designated as protected area based on IUCN definition	Forests are able to store substantial amounts of carbon. Designating forests as protected areas reduces the commercial use of forests and, thus, increases the forests' potential to store carbon.	Ongoing OECD data collection	Q2/2022
Financial incentives for carbon dioxide removals through technological means	Subsidy level for carbon dioxide removals through technological means (BECCS, DAC)	Carbon dioxide removals through technological means (e.g. bioenergy carbon capture and storage, direct air capture) are key to limit global warming to 1.5°C according to most IPCC scenarios. Direct air capture alone could remove 1Gt CO_2e in 2050 according to IEA's net-zero 2050 scenario.	OECD, IEA	2023/2024
Climate Finance				
Climate finance policies and regulations	Number of climate finance policies and regulations in place	Climate finance policies and regulations can help channel private investments into low-carbon technology. Climate finance policies include, i.a., the existence of a green finance taxonomy, mandatory disclosure of climate risks for listed firms, or the evaluation of climate risks the financial sector is exposed to	Climate transparency and OECD	2023/2024

Note: 1. Examples of potential instruments for climate finance and carbon dioxide removals and avoidance to be considered. Instruments will be further developed through 2023.
Source: Authors

2.2.3. Building block III: National sectoral climate actions and policies

25. This building block includes indicators on climate policies in the major emitting sectors (power, industry, transport, buildings, agriculture, waste). These sectors jointly account for more than 90% of GHG emissions (Our World in Data, 2021[40]). Sector-specific policies complement cross-sectoral policies. In fact, approximately 70% of emissions reduction from climate strategies and policies in countries' 4th Biennial Reports (submitted in 2020) can be attributed to sectoral measures (UNFCCC, 2020[41]). In addition, a sector-by-sector approach allows for a more granular assessment of the environmental and economic effects of climate policies. Note that sector-specific policies on carbon removal (e.g. BECCS, afforestation) are included in Building block II (Section 2.2.2).

26. Following the EPS, the CAP distinguishes between market-based and non-market based policies. Including the category 'technology support policies' (following the updated version of the EPS (Dechezleprêtre et al., 2021[42])) was, however, not feasible. This is because attributing the RD&D technology categories in the IEA database to specific economic sectors is not possible. For example, RD&D on hydrogen technologies could be attributed to most energy sectors, including electricity, industry, or transport. Public RD&D expenditures are, thus, included under cross-sectoral policies (Section 2.2.2).

Non market-based policies

27. Bans and phase-outs of carbon-intensive technologies (e.g. coal in power production, conventional passenger cars, oil heating) send a clear policy signal and provide certainty for investors, firms and households to switch to low-carbon alternatives (Meckling and Nahm, 2019[43]). IEA's net-zero 2050 scenario clearly states that in order to reach net-zero by 2050, there is no need for the development of new oil or gas fields as well as coal mines and mine extensions from 2021 (IEA, 2021[44]). Hence, banning or phasing out of fossil fuel consuming equipment by governments can be art of a policy mix to ensure that there is no appetite for new developments. The CAP evaluates both the year in which the ban or phase out becomes effective and the legal status (e.g. announcement, in law, achieved). This is because a more binding legal status (e.g. enshrining bans and phase-outs in law) increases the credibility and the accountability of these actions.

28. Building codes and mandatory minimum energy performance standards (MEPS) in the end-use sectors help increase the adoption of energy efficient assets (e.g. buildings, electric motors) and equipment (e.g. passenger cars, appliances) (Schleich, Durand and Brugger, 2021[44]). For example, appliance efficiency policies have helped more than halve the energy consumption of major appliances in countries with the longest-running programmes (IEA, 2021[45]). Where data is available, the CAP evaluates the performance requirements of the MEPS. In all other areas, the CAP uses the number of assets or appliances that are covered by a MEPS.

29. Other non-market based instruments covered in the CAP include speed limits on motorways, the share of public expenditure in infrastructure investment for rail (versus road) and mandatory energy performance labels for appliances. All of these policies are expected to deliver GHG emissions savings (see Rationale in Table 4, (Schleich, Durand and Brugger, 2021[44])).

Table 4. Sectoral climate policies: Non market-based instruments

Components	Sub-indicators/ Measurement	Rationale	Source	Availability
		Power		
Phase out of unabated coal-fired power plants	• **Year** when unabated coal plants are planned to be phased out • **Legal status** of phase out	Coal-fired power plants are the single most important contributor to global GHG emissions. According to IEA's net-zero 2050 scenario, all unabated coal power plants need to be phased out by 2040 globally and much earlier in developed economies	Ongoing OECD data collection	Q4/2021
Ban on the construction of new unabated coal-fired power plants	• **Year** when ban becomes effective • **Legal status** of ban (e.g. pledge, in law)	Coal-fired power plants are the single most important contributor to global GHG emissions. According to IEA's net-zero 2050 scenario, the last unabated coal power plant would be completed in 2025 and no unabated coal power plant will go online in developed economies from 2020	Ongoing OECD data collection	Q4/2021
		Transport		
Ban on sales of new conventional passenger cars	• **Year** when ban becomes effective • **Legal status** of ban (e.g. pledge, in law)	Fossil-based passenger cars are the major source of transport-related GHG emissions. According to IEA's net-zero 2050 scenario sales of new conventional passenger cars requires to halt in 2035 globally	Ongoing OECD data collection	Q4/2021
Emission limit values for new passenger cars	Emission limit value in place (yes/no)	Emission limit values or minimum energy performance standards of passenger cars can improve the fuel efficiency of cars, leading to lower GHG emissions.	IEA	Q4/2021
Share of rail versus road public expenditure	Share of central government's expenditure on new investments in rail infrastructure divided by road infrastructure	Public investments in rail infrastructure provides alternatives to private car journeys whereas investments in road infrastructure foster car dependency, which is at the heart of increasing mobility and growing emissions. In addition, rail transport has substantially lower GHG emissions per passenger kilometre compared to cars, notably in non-urban areas (IEA, 2020[46]).	ITF	Q4/2021
Speed limits on motorways	National speed limits on motorways	Speed limits on motorway are one of the most effective ways to reduce road transport emissions immediately. According	ITF	Q4/2021

Components	Sub-indicators/ Measurement	Rationale	Source	Availability
		to the European Environmental Agency, reducing the speed limit from 120 km/h to 110 km/h would reduce fuel consumption and GHG emissions of passenger cars by 12-18% (EEA, 2020[47]).		
Industry				
Minimum energy performance standards for electric motors	Level of the minimum energy performance standards of industrial motors	Minimum energy performance standards for electric motors are key to limit industry's energy demand. According to IEA's net-zero 2050 scenario, all new electric motors need to be best in class from 2035.	IEA	Q4/2021
Buildings				
Ban on fossil fuel heating systems	• **Year** when ban becomes effective • **Legal status** of ban (e.g. pledge, in law)	Using fossil fuels for heating substantially contributes to building-related GHG emissions. Banning fossil fuel use for heating in new buildings and/or in major building renovations would provide clear policy signals for low-emission heating technologies (e.g. heat pumps, district heating).	Ongoing OECD data collection	Q2/2022
Phase out of fossil fuel heating systems	• **Year** when fossil fuel heating is planned to be phased out • **Legal status** of phase out	Using fossil fuels for heating substantially contributes to building-related GHG emissions. Phasing out fossil fuel use for heating in existing buildings would accelerate the uptake of alternative heating technologies (e.g. heat pumps, district heating where available).	Ongoing OECD data collection	Q2/2022
Building energy codes	Mandatory or voluntary building energy code for new buildings in place (yes/no)	Mandatory or voluntary building energy codes are key to curb energy demand by mainstreaming energy efficient buildings. According to IEA's net-zero 2050 scenario, all new buildings need to be zero-carbon ready from 2030.	IEA	Q4/2021
Minimum energy performance standards of appliances	Number of minimum energy performance standards in place for new domestic appliances (e.g. lighting, refrigerator)	Minimum energy performance standards in the buildings sectors are key to curb energy demand by mainstreaming energy efficient electrical equipment. According to IEA's net-zero 2050 scenario most new appliances and cooling systems need to be best in class from 2035.	IEA	Q4/2021
Mandatory energy labels for appliances	Number of mandatory energy labels for buildings and appliances	Energy labels provide information on appliances' energy performance, enabling consumers to make better-informed decisions. This helps mainstream more energy efficient products.	IEA	Q4/2021
Agriculture[1]				
Regulation on nitrates	Presence and potential coverage and stringency of nitrates regulation	Nitrates regulation restrict the amount of nitrogen amount to be applied to land, including from mineral fertilizers that generate nitrous oxide emissions and nitrates from animal manure (which can emit methane) to limit water pollution.	OECD	2023/2024
Ban on peatland cultivation or peat extraction	Score comprising the year and the legal status of the ban	Peatland is a soil carbon sink. Peatland cultivation, extraction or other degradation releases the carbon stocked in soils, contributing to global climate change.	OECD	2023/2024
Waste[1]				
Mandatory recycled content requirements	Minimum share of recycled content in new products	Recycled content requirements require producers of some goods to use a specific share of secondary materials in new products. This reduces the need for primary materials and, thus, reduces primary material extraction and related energy consumption and emissions.	OECD	2023/2024

Note: 1. Examples of potential instruments in the agricultural and waste sector to be considered. More instruments could be added based on ongoing OECD data collection.
Source: Authors

Market-based instruments

30. Market-based instruments include direct carbon pricing instruments (carbon taxes, emissions trading schemes)[14], other taxes related to GHG emissions (e.g. fertiliser taxes, CO_2-based car taxation), and subsides for low-carbon technologies for renewable electricity generation (Table 5). Carbon pricing can mitigate GHG emissions in a cost-effective way (Baumol and Oates, 1988[30]). Following the approach outlined in Section 2.2.2, the CAP uses the permit price level of ETSs or the nominal tax rate of carbon

[14] Indirect carbon pricing instruments such as fuel excise taxes are included in Section 2.2.2.

taxes - i.e. a tax whose tax-base is CO_2 emission, regardless of how the measure is labelled for public communication (OECD, 2021[55]). As such the CAP is complementary to and does not duplicate the IPAC dashboard indicator on the net effective carbon rate. Using nominal rates on carbon prices also provides a more granular picture of countries carbon pricing landscape covering all instruments. To provide information on the coverage of emissions, the CAP evaluates the price level of the carbon tax or the ETS in each of the sectors. In addition, the CAP also evaluates the coverage of GHG emissions beyond carbon dioxide (e.g. methane, nitrogen oxide) for both ETS and carbon taxes (which cover in some countries, F-gases or H-gases). For the agricultural and the waste sector, the CAP is expected to include information on taxes on fertiliser use, landfilling and incineration.

31. The CAP also includes economic instruments beyond carbon pricing, including financial support for renewables in the electricity sector. As countries use different instruments to support renewables, the CAP captures the most common approaches, including Feed-in-Tariffs (FiTs), auctions and tradeable renewable energy certificates. For FiTs and auctions, the CAP includes support for utility-scale solar photovoltaic and wind (onshore and offshore) based on information about the price level and the duration of the support. In addition, the level of the support price is scaled by the levelised cost of electricity (LCOE) to reflect falling technology costs, following the approach of the EPS (Dechezleprêtre et al., 2021[42]). Subsidies for low-carbon technologies in other sectors are not included due to data availability (Section 4.1).

Table 5. Sectoral climate policies: Market-based instruments

Sub-Indicator	Sub-indicator/ Measurement	Rationale	Source	Availability
		For each sector		
Carbon tax	• **Tax rate** of carbon tax • **Number of GHG** covered by carbon tax (e.g. CO_2, methane)	Carbon pricing is the most cost-effective mitigation policy to reduce CO_2 emissions	OECD	Q4/2021
Emissions trading scheme coverage of GHG	• **Average annual price level** of emissions trading scheme • **Number of GHG** covered by emissions trading scheme (e.g. CO_2, methane)	Carbon pricing is the most cost-effective mitigation policy to reduce CO_2 emissions. Pricing of GHG emissions provides incentives to reduce GHG emissions, including short-lived climate pollutants and other non-CO_2 GHG emissions	OECD, ICAP	Q4/2021
		Electricity		
Feed-in-tariff for solar PV	• Ratio between the **level of solar's feed-in-tariff** (FiT) and its levelised cost of electricity (LCOE) generation • **Duration of support** in years	Financial support for renewables is necessary to accelerate renewables deployment. FiT provide certainty for investors, channelling private funds into renewables. Scaling by LCOE ensures that the level of policy support takes falling technology costs into account	OECD	Q4/2021
Feed-in-Tariffs for wind	• Ratio between the **level of wind's feed-in-tariff** (FiT) and its LCOE • **Duration of support** in years	Financial support for renewables is necessary to accelerate renewables deployment. FiT provide certainty for investors, channelling private funds into renewables.	OECD	Q4/2021
Auctions for solar PV	• Ratio between the **level of solar's bid price** and its LCOE • **Duration of support** in years	Financial support for renewables is necessary to accelerate renewables deployment. Auctions provide certainty for investors, channelling private funds into renewables.	OECD, IEA	2023/2024
Auctions for wind	• Ratio between the **level of wind's bid price** and its LCOE • **Duration of support** in years	Financial support for renewables is necessary to accelerate renewables deployment. Auctions provide certainty for investors, channelling private funds into renewables.	OECD, IEA	2023/2024
Tradeable Renewable energy certificates	Share of renewable electricity obligation on total electricity generation	Renewable energy obligations and tradeable certificates provide an extra revenue source for renewable energy developers, which can accelerate the deployment of renewables.	OECD	Q4/2021
		Transport		
CO_2-based car taxation	Rate of registration tax or annual vehicle tax based on vehicles' CO_2 emissions	CO_2-based vehicle taxes provide incentives for car owners to choose less emitting or more energy efficient cars.	OECD	2023/2024
		Agriculture[1]		
Taxes on synthetic nitrogen fertilisers	Tax rate of fertiliser tax	Applying nitrogen fertilisers can lead to nitrous oxide losses into the atmosphere to add to GHG levels and ozone depletion. Taxing those fertilisers would reduce fertiliser use and, thus, GHG emissions.	OECD	2023/2024
		Waste[1]		
Landfilling taxes	Tax rate of landfill taxes	Waste in landfills usually create methane emissions, which are usually not captured. Landfill taxes discourage waste discharge in landfills, providing incentives for more sustainable waste treatments	OECD	2023/2024
Incineration taxes	Tax rate of incineration taxes	Incinerating waste generates GHG emissions. Taxing waste incineration provides incentives for waste reduction or prevention, and to recycle, reuse or repair goods at the end of their lifetime.	OECD	2023/2024

Note: 1. Example of potential instruments in the agriculture and waste sector to be considered.
Source: Authors

3 Methodology

3.1. Scoring

32. Scoring is necessary in order to map very different dimensions of climate actions and policies into one common dimension. Scoring of each sub-indicator is based on the in-sample distribution across all countries and years. This follows the approach of the EPS (Botta and Koźluk, 2014[7]) and is a frequently employed technique for constructing composite indicators (OECD and JRC European Commission, 2008[48]). For each sub-indicator, *the scores and respective thresholds apply to all countries and for all years*, which ensures that countries' scores can change only if there is a change in a policy.[15]

33. For each sub-indicator, the values are allocated into 11 bins and a score between 0 and 10 is assigned as follows:

- A score of 0 is assigned if a policy or action is not in place.
- All other scores are assigned according to the in-sample distribution across all years and countries, so that the percentiles constitute the thresholds between the scores. More precisely, a score of 10 is assigned if the value of the policy instrument is at or above the 90th percentile after excluding all observations where the policy instrument is not in place.[16] A score of 9 is assigned if the value falls between the 80th and 90th percentile and so on. Finally, a score of 1 is assigned if the value of the policy instrument is below the 10th percentile, but is in place.
- For binary or categorical variables, a score of 10 is assigned to the highest value of the policy instrument. All other values of categorical variables are linearly mapped into the space from 1-10.[17] The tables in Annex A provide the thresholds for all sub-indicators.

34. The major advantage of this approach is that it is less arbitrary compared to approaches that assign scores based on subjective values or other plausible, but non-distribution inherent thresholds. Basing the thresholds of bins on the in-sample distribution also means that there is a lot of variability of scores both across and within countries. This allows for more granular tracking of countries' policy progress and more granular cross-country comparisons, which is particularly relevant for policy instruments where many countries have stringencies in the same range. In this case, countries may get a higher score even if the increase of the underlying policy instrument is relatively small.

35. The use of the in-sample distribution to assign scores can have some disadvantages. For instance, adding new countries and years to the sample may require a re-attribution of bin thresholds and therefore lead to a reattribution of scores (Botta and Koźluk, 2014[7]). To address this concern, the bin thresholds will remain fixed for the coming years based on the data that was collected until 2022. An update of bin thresholds and reattribution of scores will be carried out less frequently, e.g. every five years. In addition, basing the scores on the in-sample distribution does not imply that high scores are necessarily compatible

[15] It is important to note that scoring based on the in-sample distribution of countries is necessary to provide an anchor that serves to track countries' progress on policies. Tracking country progress without this empirical benchmark would require establishing another, potentially subjective benchmark.

[16] First excluding the observations, where an instrument is not in place, and then performing the normalisation is advisable, as this avoids having extreme values that dominate the aggregation (Talukder, Hipel and vanLoon, 2017[66]).

[17] For example, the values from 1-5 of a categorical variable would get the scores 2, 4, 6, 8, and 10 respectively.

with policies aligned to reach net-zero. Assigning scores for sub-indicators based on compatibility with net-zero is very challenging and beyond the scope of this paper.

3.2. Aggregation and weighting

36. There are many different approaches for aggregating the scores of the sub-indicators into a composite index value (OECD and JRC European Commission, 2008[48]). For constructing the CAP composite index value, this requires to assign weights to the building blocks (e.g. national cross-sectoral policies and actions), the modules of the building blocks (e.g. targets), the components within modules (e.g. net-zero target) and the sub-indicators within the component (e.g. year or legal status of net-zero target).

37. Four general principles are followed to assign weights for the calculation of the CAP composite index value:

- Weights are the same for all countries.
- Use weights grounded in empirical data where possible. For example, the weights for each sector in the building block national sectoral policies could be based on the sector's share on *global* (not country-specific) GHG emissions in 2020. Weights could also be derived from modelled scenarios (e.g. IEA's NZ2050 scenario) to derive the relative importance of the different RD&D components in the cross-sectoral national policies building block.
- Where the use of empirical data or scenarios is not possible, *equal weights* would be assigned to all sub-indicators within components, to all components within each module and to all modules within each building block.[18] For the sectoral policies and actions, equal weights will be also assigned between market-based and non-market based policies in each sector.
- The weights of building blocks are based on *the number of modules* included in each building block. This essentially means that each module receives the same weight regardless of its position within the conceptual framework (Figure 1). More precisely, with its current structure, the building block national sectoral policies would receive a weight of 6/16 = 0.38, national cross-sectoral policies of 7/16= 0.44 and international policies of 3/16 = 0.18.

38. Table 8 in Section 5 illustrates how the CAP assigns weights to the building blocks, modules, components and sub-indicators. More precisely, the final weight of each sub-indicator is calculated by linear aggregation using the formula *Final weight of the Sub-indicator = Weight Building block*Weight Module*Weight Component*Weight Sub-indicator*.[19]

39. The equal weighting assumption (OECD and JRC European Commission, 2008[48]) does not make any judgement call on the relative importance of various climate actions and policies. All indicators in the CAP are effective in reducing GHG emissions as discussed in Section 2. Some climate actions and policies may be more or less effective than others, but this is likely to vary across countries. Future empirical work is needed to shed more light on this (Section □).

[18] For example, the 'year', the 'coverage' and the 'legal status' of the component net-zero targets get the same weight. The component 'Net-zero targets' receives the same weight as 'NDCs' and the module 'Targets' receives the same weight as 'Public RD&D expenditure'.

[19] Note that the Building Block Sectoral Policies and Actions additionally distinguishes between market-based instruments (MBI) and non-market based instruments (NMBI). Hence, the weights for this Building Block are assigned by *Final weight of the Sub-indicator = Weight Building Block*Weight Module*Weight (N)MBI*Weight Component*Weight Sub-indicator*.

40. Sensitivity checks will be conducted to test alternative assumptions on weights (Section 6). For transparency, the CAP's weights and scores of all its components and sub-indicators will be made publicly available, following the approach of the EPS (Botta and Koźluk, 2014[7]). This will enable countries, academics and practitioners to calculate a composite index value based on their preferred weights.

3.3. Missing values

41. For some sub-indicators, data is not available for some countries, years or country-years. These data points are shown as 'missing' when the data of CAP sub-indicators are published and an explanation for the missing data is provided (e.g. data not collected or not reported).

42. All missing values receive a score of zero for the calculation of the overall value of the CAP. As a general rule, the CAP does not impute values for missing data where this would be possible. This is a conventional way to deal with missing data (Gachau et al., 2021[49]). In addition, this approach rewards countries with solid reporting efforts. There are, however, two exceptions from this general rule:

- Indicators for which data for some countries or years *cannot* exist. For example, countries that are on the ODA recipients list usually cannot provide ODA to other countries; hence, these countries receive a weight of zero for the ODA sub-indicator. The two remaining components in the module international finance would, thus, each receive a weight of 0.5, following the equal weighting assumption within each module (see Section 3.2). Annex A provides more information on sub-indicators for which this rule applies.
- Missing data in *t-1*. In each annual update, the CAP aims to provide data for the previous year to capture an up-to-date picture of countries' climate actions and policies. For some sub-indicators, however, data will not be available in such a timely manner. For those, the CAP imputes the missing data in *t-1* based on previous observations. More details on this nowcasting procedure will be provided in the next version of this paper.

43. A number of robustness checks will be carried out to assess the sensitivity of the CAP to alternative assumptions about missing data (Section 6). This includes, i.a., imputation of missing values where possible or the use of zero weights (and respective adjustment of weights for remaining indicators) instead of zero scores for indicators with missing data. More details on potential robustness checks are outlined in Section 6. Note that the construction of the CAP is still work in-progress, and the methodology of treating missing values could further evolve, in part in response to the on-going sensitivity and robustness checks.

4 Caveats and limitations

44. This section presents some of the caveats and limitations of the CAP. First, Section 4.1 provides a non-exhaustive list of the most important caveats of composite indicators in general and explains how the CAP attempts to address those. Second, Section 4.2 lists a number of policies that are currently not included and provides a reason for their exclusion.

4.1. Caveats of composite indicators

45. Composite indicators face a number of caveats and challenges that need to be taken into account for the interpretation of the results. Table 6 provides a non-exhaustive list of these challenges (see (Botta and Koźluk, 2014[7]) and (OECD and JRC European Commission, 2008[48]) for more details) and explains how the CAP attempts to address them.

Table 6. Caveats of composite indicators and related methodological choices of the CAP

Caveats of composite indicators	Related methodological choice of the CAP
Composite indicators may disguise low levels of policy action in some areas, increasing the difficulty of identifying proper remedial action.	The modular structure of the CAP allows to disaggregate the overall value into its components (Figure 4 in Section 5) so that policy areas with low levels of policy action can easily be identified. In addition, all data on sub-indicators of the CAP are publicly available to increase transparency.
Composite indicators may suffer from subjective decisions on the weights of their sub-indicators.	After an extensive stock-taking exercise, the CAP includes the major modules for effective climate mitigation strategies subject to data constraints (Figure 1). All modules have proven to be effective in terms of reducing GHG emissions (Section 2.2). In the absence of evidence on the relative importance of each of the modules, the CAP assigns equal weights to all modules regardless of their position within the conceptual framework (Section 3.2).
Composite indicators may not be able to reflect important national circumstances	Some climate policies and actions may indeed be more or less effective depending on national circumstances. Thus, future empirical work is needed to shed more light on the effectiveness of policies in different national contexts (Section).
Composite indicators may be biased by missing policy dimensions due to data constraints, which may lead to inappropriate policy conclusion	This paper lists the most important policies that are currently not included to increase transparency (Section 4.2). Missing data may not necessarily lead to biases (Section 4.2). The robustness checks provide some insights on how missing policy sub-indicators might affect the results of the CAP (Section 6). Still, it is important to keep the CAP's data limitations in mind when interpreting the results and formulating policy recommendations.

Source: Authors

4.2. Climate actions currently not included

46. The CAP will be the most comprehensive composite indicator on governments' climate action to-date. However, there are a number of climate actions and policies that are currently not captured by the CAP. Table 7 presents a list of the most relevant policies and provides reasons why these are not included in the CAP. The major reason for not including the indicators is data availability. This includes, i.a., market-based instruments that support low-carbon technologies or energy efficiency in the buildings (e.g. subsidies for renovations), transport (e.g. subsidies for electric vehicles) and industry (e.g. subsidies for electric industrial motors or energy efficiency more broadly) sector. In these sectors, there is not yet an international database on government support programmes. In addition, most government programmes

are time-limited and highly complex, making it difficult to track policy action and compare action across countries.

47. Not capturing some climate actions and policies due to data constraints does not necessarily lead to biased results. In fact, the CAP would only be biased if countries' policy approaches systematically differ between measurable/quantifiable and non-measurable/non-quantifiable government actions and policies. There is, however, no reason to believe that this is the case. While this is impossible to test empirically, the sensitivity and robustness checks shed some light on the effects of deliberately omitting observable policies from the CAP, which can help evaluate the extent of possible bias (Section 6).

Table 7. Climate actions and policies not currently covered

Indicator	Rationale	Reason for not being included
Cross-sectoral national climate policies		
Non-climate policies (e.g. air pollution standards)	Air pollution standards (e.g. emission limit values for cars or power plants) could also reduce GHG emissions, e.g. when power plants close down.	The relationship between air pollution standards and GHG emissions is highly non-linear. While very stringent air pollution standards could indeed lead to ceasing fossil fuel combustion, less stringent standards may actually increase GHG emissions. This is because standards can incentivise the installation of pollution abatement equipment (e.g. catalytic converters or scrubbers), which typically increases energy consumption and, thus, GHG emissions. Hence, the CAP only includes non-climate policies for which a linear relationship between the policy and GHG emissions can be assumed (e.g. fossil fuel excise taxes).
Climate adaptation	As global temperatures increase, policies to adapt to climate change inevitably become more important in all countries.	Internationally comparable data on climate adaptation is not available, but is about to be collected by several actors. For example, the OECD is undertaking a stock-take of approaches to measure progress on adaptation as a first step to understand the state of play of country efforts over the course of 2022. Once data is available, this item could be included in the CAP.
Green budgeting	Governments budget, notably the expense side, has large impact on climate mitigation (e.g. through infrastructure investment or green public procurement)	Data on government expenditure on climate change is so far limited to a few EU countries. The OECD has developed country surveys on emerging green budgeting practices since 2020. Based on the surveys, the OECD is currently developing a composite indicator on green budgeting for OECD countries. Once more data on this becomes available, this item could be included in the CAP.
Internal carbon price	Internal carbon prices, based on the social cost of carbon or other metrics, are used for governments' project appraisal or public procurement. Internal carbon prices can channel governments' investments and purchases towards low-carbon alternatives	There is no internationally comparable data on internal carbon prices. Data on the level of internal carbon prices for OECD countries was collected in the past (see e.g. (Smith and Braathen, 2015[50]) and (OECD, 2018[51])), but has not been collected ever since.
'Soft' policies	Soft policies such as voluntary agreements between governments and industrial sectors or business associations can help reduce energy consumption and/or GHG emissions (Kozluk and Garsous, 2016[52])	There is no internationally comparable database on soft policies. The OECD PINE database and the IEA Policies and Measures database include a non-exhaustive and incomplete list of different types of soft policies. However, it is difficult to quantify those approaches and summarize them in ways that are internationally comparable, though some scholars have tried to do so (Costantini, Crespi and Palma, 2017[53]). Importantly, there is evidence of a lack of effectiveness of soft policies (Kube et al., 2019[62]).
Taxes on fossil fuel extraction	Fossil fuel supply taxes would reduce the incentives of developers to explore and extract fossil fuels. This would reduce the supply of fossil fuels and, thus, GHG emissions.	There is no international comparable database on fossil fuel supply taxes. Data collection is difficult because countries use a number of different instruments to effectively price fossil fuel extraction, including taxes on extraction, income, profits, or revenue or property income such as royalties and dividends (e.g. from state-owned enterprises) (Elgouacem et al., 2020[54]).
Public RD&D for carbon dioxide removal technologies	Emissions removals from technology (as opposed to NBS) are estimated to account for a large part of emission removals in the future, but technology costs are currently high.	There is no publicly available data on public RD&D expenditure for removal technologies such as direct air capture. IEA has data on CCS, but this encompasses mostly CCS in combination with fossil fuels or industrial processes.
Sectoral national climate policy		

Indicator	Rationale	Reason for not being included
Efficiency standards for fossil-based power plants	Policies to increase the (carbon) efficiency of fossil-based power plants (e.g. switch from subcritical to supercritical coal plants or combined heat and power plants) would reduce GHG emissions in the short-run. However, these policies would usually not be sufficient to align GHG emissions with net-zero targets.	There is no publicly available data on market-based or non-market based instruments to increase the efficiency of fossil-based power plants. IEA's International Centre for Sustainable Carbon collects information on emissions standards for new and existing coal power plants (ICSC, 2021[55]). However, most of the standards apply to air pollutants such as sulphur or nitrous dioxide.
Policies on power system transformation	Policies on power system transformation include policies that aim to increase power system flexibility (e.g. through batteries, interconnectors, demand-side response, etc.). These policies help enhance power system decarbonisation by enabling higher shares of variable renewables such as wind and solar PV.	There is no publicly available data on policies for power system transformation. Long-term power system plans exist, but it is difficult to extract quantitative data from them and harmonise the data to make it comparable across countries.
Sustainable mobility	Shifting to more sustainable modes of transport and reducing car dependency is one of the key climate strategies to reduce road transport's GHG emissions (OECD, 2021[56]).	There is no international comparable data on policies to promote sustainable mobility. The CAP includes central governments' investment in rail (versus road). However, this does not capture investments in other sustainable modes (e.g. walking or cycling). In fact, most government actions to promote sustainable modes of transport are carried out at the sub-national level (e.g. urban planning, road and urban space allocation, investments in walking, cycling and public transport infrastructure). Future work in co-operation with CFE and/or ITF could develop policy indicators to promote sustainable modes of transport.
Promotion of biofuels (e.g. biofuel mandates)	Biofuels in transport, buildings or industry could reduce GHG emissions by substituting fossil fuels.	Data on public support for biofuels (e.g. biofuel mandates) would be available. However, these policies are excluded because they risk increasing emissions from direct and indirect land use change if the feedstock does not comply with strong sustainability criteria (Havlík et al., 2011[57]) (Qin et al., 2015[58]).
Financial support for low-carbon vehicles	Low-carbon vehicles (e.g. EVs) emit less CO_2 emissions then ICE vehicles in most countries and can, thus, reduce transport-related emissions.	There is no international comparable database on financial support for EVs or other low-carbon vehicles. Most government schemes are time-limited and change frequently, which hampers data collection.
Financial support for major buildings renovations	Major renovations are key to limit energy demand and GHG emissions in the building sector, notably in developed countries	There is no international database on government support programs for major renovations. Most government programs are time-limited and highly complex, making it difficult to track policy action and compare action across countries.

Source: Authors

5 Preliminary results

48. This section shows some preliminary results of the CAP. It is based on all 42 (out of >50) sub-indicators for which data was available by December 2021. These indicators are listed in Table 8. Note that these 42 sub-indicators slightly deviate from those marked as available by Q4-2021 (i.e. the green modules) in the framework proposed in Figure 1. The intention was to use as many indicators as possible for the first version of the results to provide a better picture of general trends and potential uses of the CAP.

49. This section is organised as follows. Section 5.1 shows the development of the index over time for different country groups as well as per building block and module. It also shows how the CAP can be used to track a country's progress on climate actions and policies, using the example of France. Section 5.2 compares the CAP with other indicators that are widely used to measure environmental or climate policies, including the OECD EPS and energy prices. Section 5.3 dives into the relationship between the CAP and environmental outcome indicators (e.g. GHG intensity) to provide some first insights on the effectiveness of the elements in the CAP to reduce emissions.

50. Table 8 shows all indicators included in this version of the CAP along with the assigned weights to all sub-indicators following the proposed weighting scheme in Section 3.2. Note that the numbers in this weighting scheme will change for the next version of the CAP when more sub-indicators will be included. In fact, most indicators will receive a lower weight than those assigned in the current version. For instance, the sub-indicator *Evaluation of Biennial (Update) Reports* receives currently a weight of 10%. Yet, this will decrease to 3.33% once more components are integrated. This will ultimately affect the relative contribution of all components as well as the overall CAP country scores. Note also that the weights for the sectors in this building block are based on *global* CO_2 emissions (IEA, 2021[59])).

Table 8. Preliminary list of indicators and weighting scheme of the CAP

Level 1		Level 2		Level 3		Level 4		Level 5		
Building block	**Weight Building Block**	**Module**	**Weight Module**		**Weight NMBI/MBI**	**Component**	**Weight Component**	**Sub-indicator**	**Weight Sub-indicator**	**Final weight**
National sectoral actions and policies	40%	Electricity	45%	MBI	50%	Feed-in-tariff for solar PV	50%	Price	50%	2.25%
								Duration	50%	2.25%
						Feed-in-Tariffs for wind	50%	Price	50%	2.25%
								Duration	50%	2.25%
				NMBI	50%	Ban new coal power plant	50%	Due date	50%	2.25%
								Status	50%	2.25%
						Phase out coal power	50%	Due date	50%	2.25%
								Status	50%	2.25%
		Industry	20%	NMBI		Minimum energy performance standards for electric motors	100%		100%	8%
		Building	9%	NMBI		Minimum energy performance standards of appliances	20%		100%	0.72%
						Building energy codes	20%		100%	0.72%
						Ban on fossil fuel heating systems	20%	Due date	50%	0.36%
								Status	50%	0.36%
						Phase out of fossil fuel heating systems	20%	Due date	50%	0.36%
								Status	50%	0.36%
						Mandatory energy labels for appliances	20%		100%	0.72%
		Transport	26%	NMBI		Emission limit values for new passenger cars	25%		100%	2.6%
						Share of rail versus road public expenditure	25%		100%	2.6%
						Speed limits on motorways	25%	City	50%	1.3%
							25%	Motorway	50%	1.3%
						Ban on sales of new conventional passenger cars	25%	Due date	50%	1.3%
							25%	Status	50%	1.3%
National cross-sectoral	30%	Public Research, Development and Demonstration expenditure	33.33%	NA	NA	Energy efficiency	16.67%		100%	1.67%
						CCS	16.67%		100%	1.67%
						Renewable energy	16.67%		100%	1.67%
						Nuclear	16.67%		100%	1.67%
						Hydrogen	16.67%		100%	1.67%
						Storage and power	16.67%		100%	1.67%
		Fossil fuel demand policies	33.33%	NA	NA	Fossil fuel excise tax	100%	Diesel	50%	5%
							100%	Gasoline	50%	5%

actions and policies		Fossil fuel supply policies	33.33%	NA	NA	Bans on fossil fuel extraction	50%	Due date	50%	2.5%
							50%	Status	50%	2.5%
						Phase out of fossil fuel extraction	50%	Due date	50%	2.5%
							50%	Status	50%	2.5%
International actions and policies	30%	International climate co-ordination	33.33%	NA	NA	Ratification of international agreements	33.33%		100%	3.33%
						Participation in international climate initiatives (e.g. Climate and Clean Air Coalition)	33.33%		100%	3.33%
						Pricing of emissions from international aviation or maritime transport	33.33%	Pricing of aviation	50%	1.67%
							33.33%	Pricing maritime	50%	1.67%
		International climate finance	33.33%	NA	NA	International climate mitigation-related official development assistance	33.33%		100%	3.33%
						Ending export credits for new unabated coal plants	33.33%		100%	3.33%
						Ending public financing of fossil fuels abroad	33.33%		100%	3.33%
		UNFCCC reporting and climate data	33.33%			Evaluation of Biennial (Update) Reports	100%		100%	10%

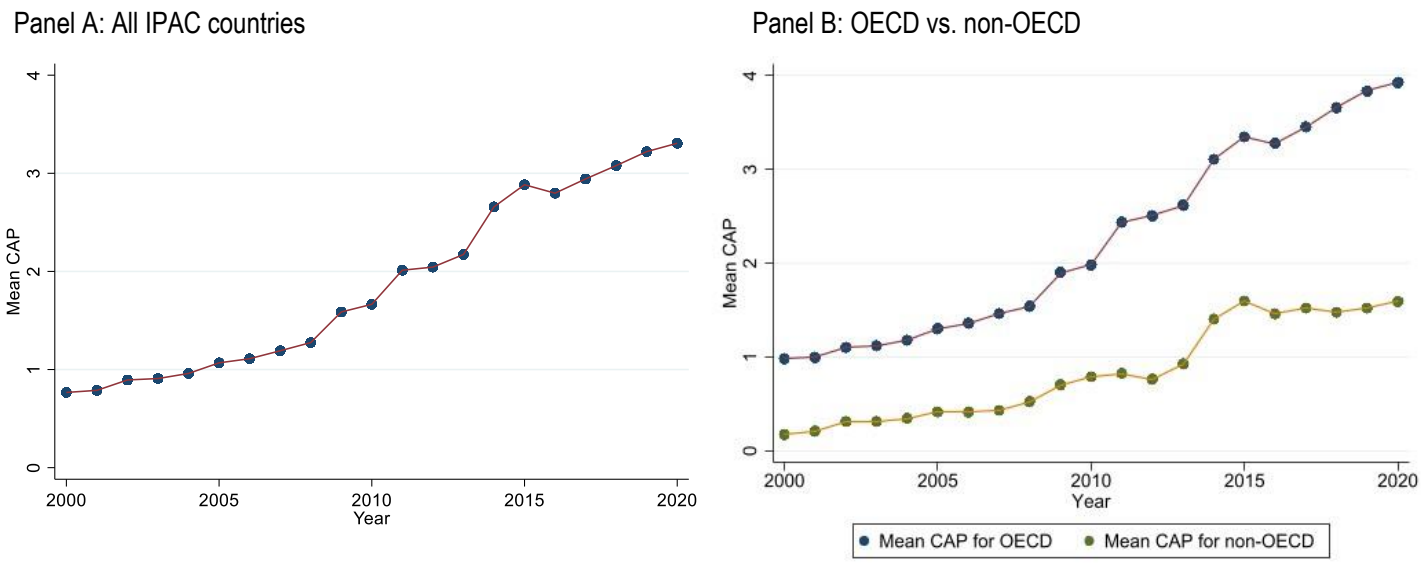
Note: Abbreviations: MBI: Market-based instruments; NMBI: Non-market based instruments and NA: Not applicable. Level 3 only exists for the Building block *National sectoral actions and policies*.
Source: Authors

5.1. Overall trends, decomposition and tracking progress

51. IPAC countries made progress in terms of their climate actions and policies between 2000-2020 (Figure 2, Panel A). The (unweighted) average CAP score increased steadily, with a few exceptions, from 0.77 in 2000 to 3.33 in 2020, indicating that countries' climate policies and actions have become more ambitious and comprehensive.

52. This pattern can be observed for both OECD and non-OECD countries (Figure 2, Panel B). On average, OECD countries achieve higher CAP scores than non-OECD countries in all years. In addition, the gap between OECD and non-OECD countries has widened in absolute terms. This difference is driven by several factors, including the strengthening of existing policies, the implementation of new policies as well as better data availability for OECD countries. However, in relative terms OECD countries' average CAP score increased by 300% in 2000-2020 whereas that of non-OECD countries increased by more than 800%.

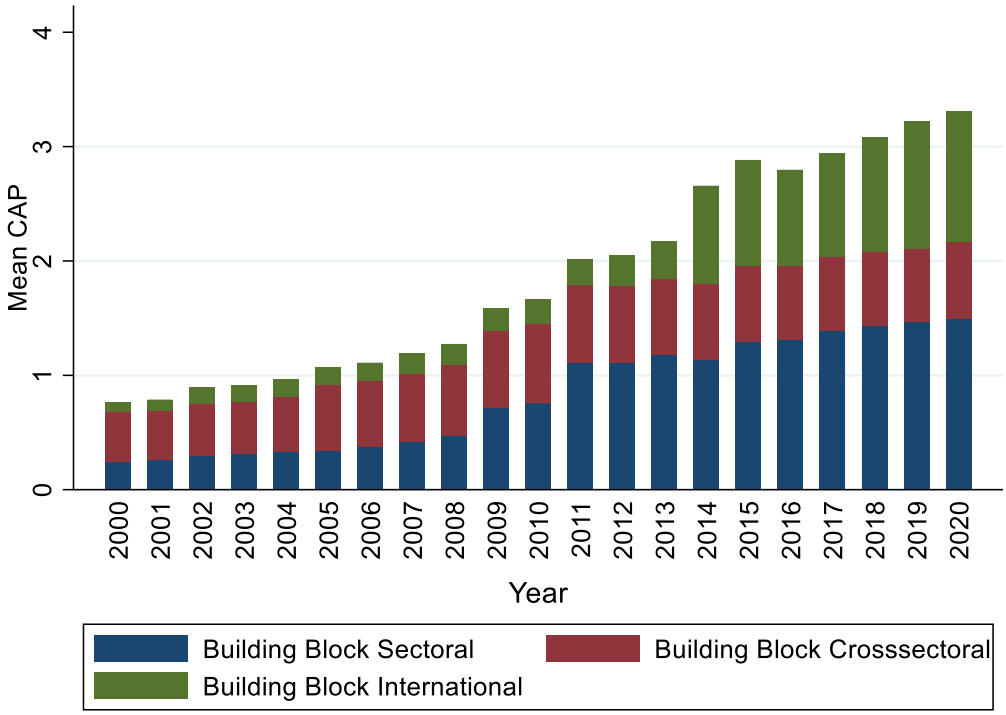
Figure 2. Countries' climate actions and policies have become more ambitious



Note: Unweighted averages across all IPAC, OECD and non-OECD countries are used to construct both graphs.
Source: Authors

53. The conceptual framework of the CAP and its modular structure allows to identify the major drivers of the increase in the value of the CAP. In fact, the building blocks "sectoral climate actions and policies" and "international climate actions and policies" contributed most to the increase in the CAP across all IPAC countries (Figure 3). In the sectoral module, this development is driven by bans and phase-outs of fossil fuel heating systems, mandatory labels and minimum energy performance standards of appliances, as well as building energy codes, bans and phase-outs of new coal power plant, emission limit values for new passenger cars and ban on sales of new conventional passenger cars. For the international module, the increase is caused by the pricing of emissions from international aviation, the evaluation of countries' Biennial (Update) Reports, the ratification of international agreements and countries' participation in international climate initiatives (e.g. Climate and Clean Air Coalition). While the building block "national cross-sectoral climate actions and policies" contributes relatively most to the overall CAP value in the early 2000s, its absolute contribution to the CAP for all IPAC countries remains constant over time.

Figure 3. CAP time trend by building block: all IPAC countries



Note: Unweighted averages across all IPAC are used.
Source: Authors

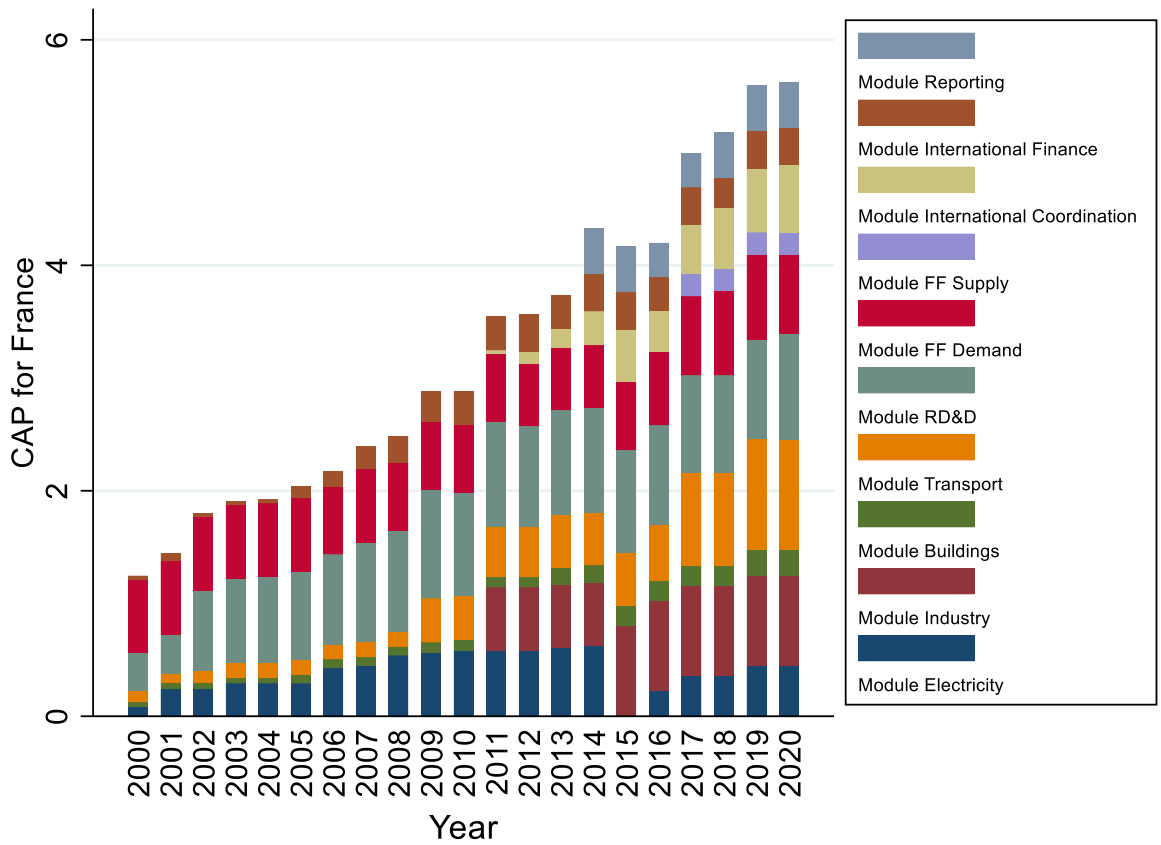
54. One of the major purposes of the CAP is to track countries' progress of climate actions and policies. This allows countries to identify in which policy areas they have made the largest progress and which policy areas may not yet have been covered by policies. The example of France demonstrates that France's CAP value increased because of two developments (Figure 4):

- the *breadth* of policies increased as new policies were enacted in areas previously not covered. For example, Figure 4 clearly shows that the module *International Co-ordination* contributed to the value of the CAP from 2011 because France started participating in international initiatives listed in the UNFCCC NAZCA list (see Section 2.2.1) and started pricing emissions from international aviation under the European Union Emissions Trading Scheme (EU ETS). Similarly, France (and other Annex I countries) submitted its Biennial Reports to the UNFCCC from 2014, which is why the module *Reporting* contributes to the CAP value from that year. Finally, France enacted legislation on the phase out of fossil fuel extraction in 2017, meaning that the module fossil fuel (FF) Supply contributes to France's score from that year.
- The *stringency* of existing policies increased. For example, the value of the module *Transport* increased substantially between 2000-2020. Part of this increase, notably after 2016, is related to the fact that France's infrastructure investments have increasingly shifted from road towards rails, which is an important strategy to reduce car dependency. Similarly, France RD&D budget on low-carbon and other non-fossil fuel energy technologies, notably energy efficiency and storage and power increased steadily from 2001. Finally, the value for the module international co-ordination increased after 2016, notably due to rising EU ETS prices on international aviation.

55. Another important development can be observed for the module *Electricity*. France attains a score for this module in 2014 and 2016, but not in 2015. This is due to the combination of two policy

developments: First, the phase out of FiTs in 2015, leading to a value of zero for the electricity module. Second, the implementation of bans and phase-outs of coal-fired power plants after 2015, leading to an increase of the electricity module value. This clearly demonstrates the importance of capturing a diverse set of policies and updating this set frequently. In fact, similarly to France many countries switched from FiTs to auctions as their primary renewable support system in the 2010s. If data on auctions is not included, then this leads to a misleading picture in which countries appear to have lower ambition whereas they actually only changed the policy instruments. Hence, it is important to account for this type of policy innovation in future updates of the index. This problem can also be observed in the case of the EPS (see below). Note that the CAP plans to include data on renewable auctions for the next version.

Figure 4. Example of France: breadth and stringency of policies increases



Source: Authors

5.2. Comparison with other environmental or climate policy indices

56. The trend of the CAP is very similar to the trend of other validated policy indicators that measure climate or environmental policy (Figure 5).[20] This is reassuring for the validity of the CAP. The CAP and

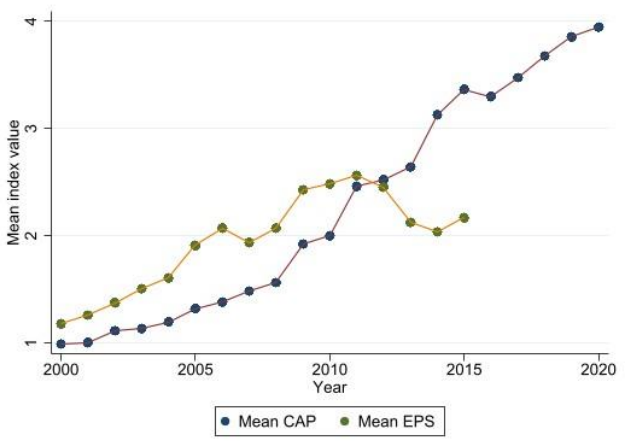
[20] As the EPS and energy price data is only available for OECD countries, the CAP is also only shown for the same country group to avoid biases due to unbalanced samples.

the EPS[21] evolve in a similarly upwards trend until 2011 (Figure 5, Panel A). The EPS measures environmental policy stringency of countries (see Box 1 for more details on the EPS). The trends of the two indices start to diverge only in 2011, when the EPS country scores decrease over a period of three years, whereas the CAP shows a steady upwards trend. One of the reasons for this divergence are indeed the phase outs of FiTs, which are included in the EPS and lead to a decrease of the EPS value. This decrease, however, is outweighed by other policies included in the CAP (e.g. phase outs and bans of coal and fossil fuel equipment and extraction, international emissions pricing, better climate data reporting). This development again shows the importance of frequent updates of the policy set in the CAP. Note that the EPS is currently updated and thus data is only available until 2015.

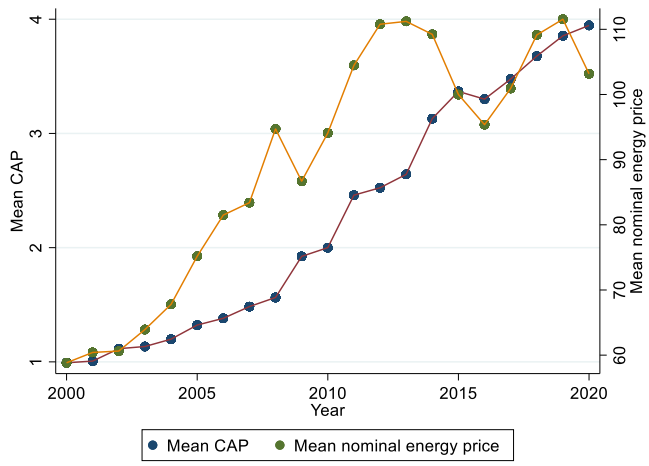
57. The CAP also evolves in a similar manner to nominal energy prices (Figure 5, Panel B). Energy prices can be seen as a proxy of environmental stringency because climate policy developments should be reflected in those prices in one way or another. In fact, energy prices have been used as proxy for climate policy stringency in recent empirical work (Dechezleprêtre, Nachtigall and Stadler, 2020[59]). Reassuringly, the CAP and nominal energy price show a very similar pattern between 2000-2020.

Figure 5. CAP has similar trend as other climate policy indicators for OECD countries

Panel A: CAP vs. EPS time trend



Panel B: CAP vs. energy price nominal

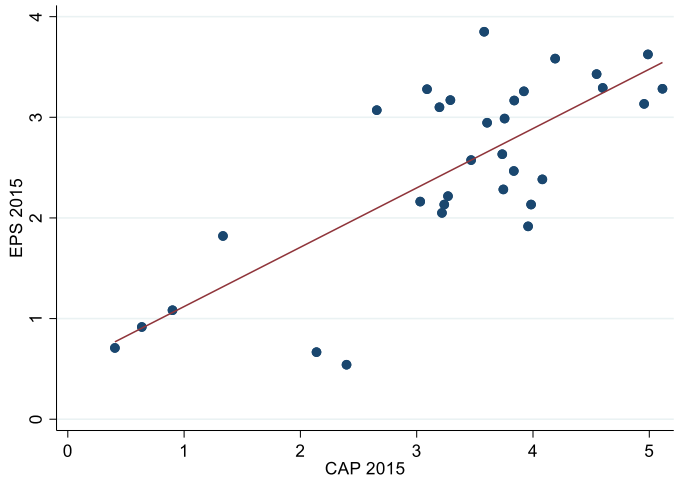


Note: Note that the values for the CAP index in Panel A and B only include OECD countries to enable better comparison with the EPS and the nominal energy prices.
Source: Authors

58. The CAP and the EPS are also highly correlated in 2015 and in all previous years (Figure 6). With a correlation coefficient of 0.76, this means that countries with more ambitious environmental policies measured by the EPS also attain higher values for the CAP index, i.e. implement more and/or more ambitious climate policies and actions. There are several potential reasons for this positive correlation, one being an overlap of indicators such as feed-in tarriffs. Another reason may be that, despite differences in indicators, the CAP and the EPS measure similar policy developments: Over the last two decades, the ambition of climate actions and policies has increased in a similar manner as the ambition of environmental policy.

[21] The elements of the EPS include taxes on CO_2, NO_X, SO_X, CO_2 emission trading schemes, renewable energy certificates, energy efficiency certificates, feed-in tariffs for solar and wind, emission limit values on NO_X, SO_X, PM_X as well as government R&D expenditure on Renewable Energy.

Figure 6. OECD countries with more ambitious environmental policies have higher CAP scores



Note: The correlation coefficient is 0.76 and the slope of the regression line is 0.60.
Source: Authors

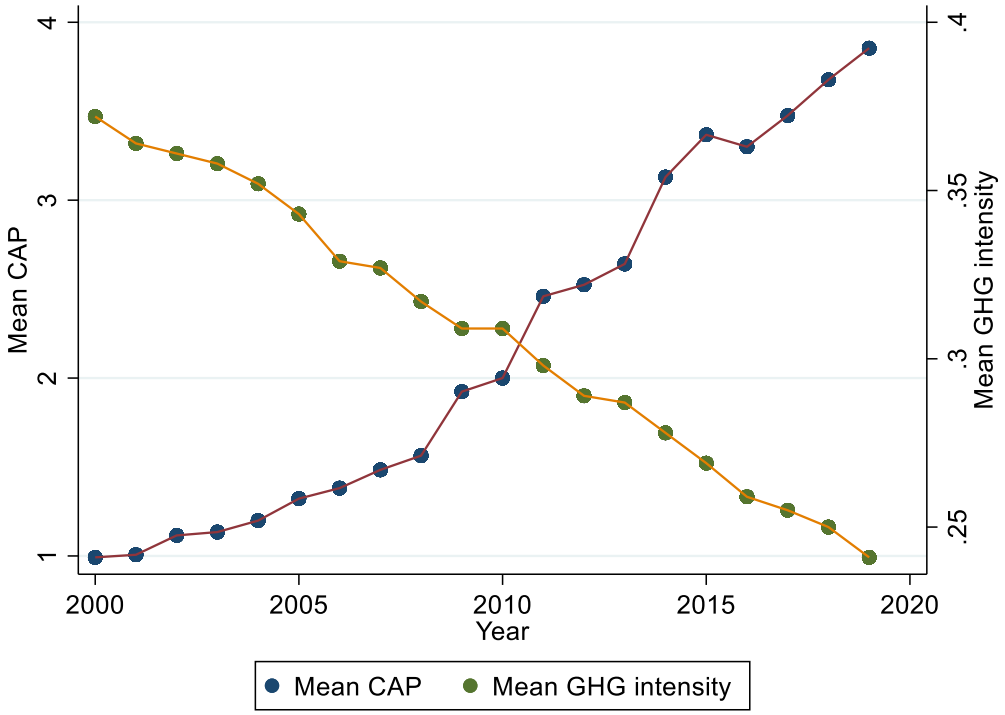
5.3. Comparison of CAP with environmental performance indicators

59. The CAP is negatively related to indicators that measure environmental pollution. For example, as CAP scores increase over time for OECD countries[22], the GHG intensity per unit of GDP (one of the other IPAC Dashborad indicators) of this country group decreases (Figure 7). While this is, of course, no causal relationship it suggests that countries' GHG intensity may decrease as a repsonse to more ambitious climate actions and policies.

60. Reassuringly, a similar development can be observed in a cross-section (Figure 8). Countries with higher CAP values are associated with better environmental performance, both in terms of CO_2 and GHG intensity per unit of GDP. This is demonstrated by the negative relationship between then CAP index and CO_2 intensity in 2018 (Figure 8, Panel A) as well as the negative relationship between the GHG intensity and the CAP index in 2019 (Figure 8, Panel B).

[22] Note that data on GHG intensity per unit of GDP is only available for OECD countries. Hence, Figure 7 and Figure 8 show all indicators only for OECD countries to avoid problems due to unbalanced samples.

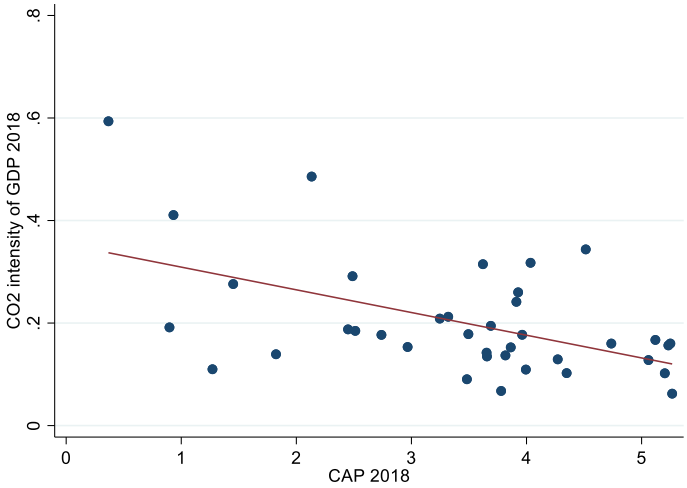
Figure 7. CAP has an inverse relationship with the mean GHG intensity for OECD countries



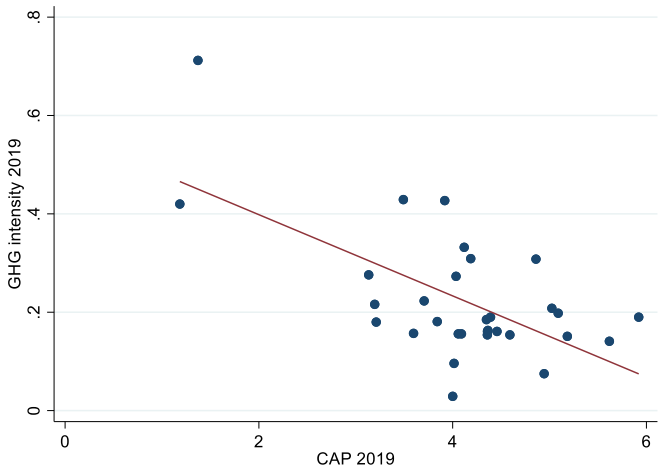
Source: Authors

Figure 8. Higher CAP scores are associated with better environmental performance

Panel A: CO2 intensity of GDP 2018



Panel B: GHG intensity of GDP 2019

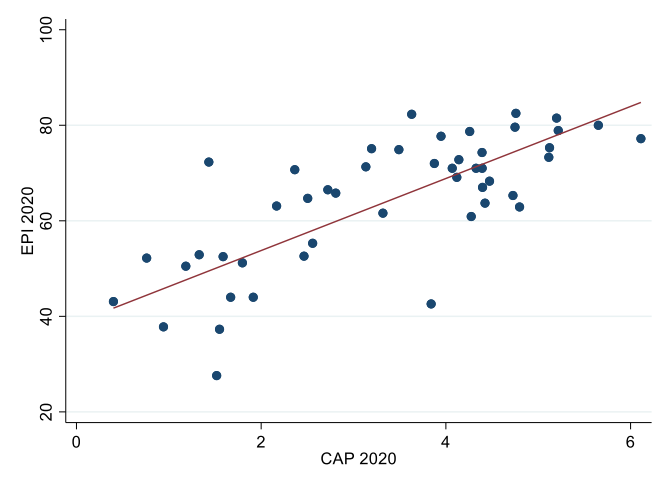


Note: The correlation coefficient in Panel A is -0.51 and the slope is -0.04. The correlation coefficient in Panel B is -0.63 and the slope is -0.08. Note that data on GHG intensity is only available for a selected group of IPAC countries.
Source: Authors

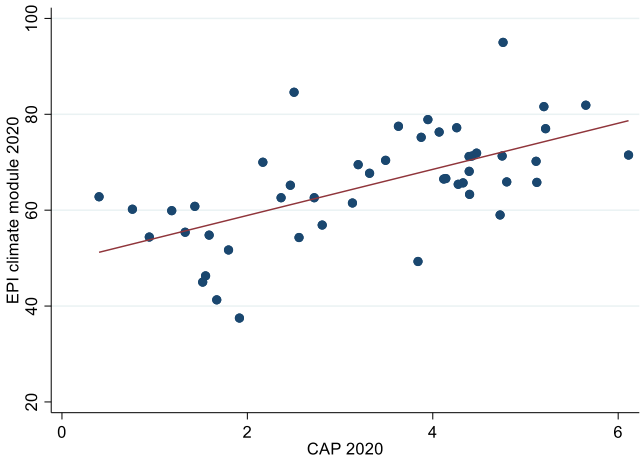
61. Countries with higher CAP scores are also associate with better environmental performance when measured with Yale's EPI (see Box 1 for more information). The EPI measures countries' performance in achieving the two environmental policy objectives environmental health and ecosystem vitality through 11 issue categories[23], including air quality, sanitation & drinking water and climate change, the latter of which accounts for 24% of the overall EPI score. A higher EPI country score indicates a better environmental performance. The CAP has a positive relationship with the whole EPI (Figure 9, Panel A) as well as EPI's climate change module[24] in 2020 (Figure 9, Panel B).

Figure 9. Higher CAP scores are associated with higher EPI scores for all IPAC countries

Panel A: CAP vs. the EPI 2020



Panel B: CAP vs. the EPI climate module 2020



Note: The correlation coefficient in Panel A is 0.74 and the slope is 6.92. The correlation coefficient in Panel B is 0.62 and the slope is 4.81.
Source: Authors

[23] The 11 issue categories of the EPI are organised into 32 indicators. The EPI is constituted of the following 11 issue categories: Air Quality, Sanitation & Drinking Water, Heavy Metals, Waste Management, Agriculture, Pollution Emissions, Climate Change, Water Resources, Fisheries, Ecosystem Services and Biodiversity & Habitat

[24] The EPI's climate change module is constituted of the following elements: Black C, CH4, N2O, GHG/pop, CO2, GHG Int., F-Gas, Land Cover

6 Sensitivity and robustness

62. [PLACEHOLDER: Once data collection is finalised this section will present some conventional robustness checks to test the sensitivity of the index to alternative assumptions about aggregation, missing values, etc.]

7 Conclusion

63. [PLACEHOLDER]

64. Besides the descriptive statistics of the previous sections, the CAP could be used to carry out a number of empirical applications. These could include

- Assessing the environmental effectiveness of the CAP and/or of selected building blocks or components. This analysis would shed light on the relative importance of building blocks or modules within the CAP and could carve out the effectiveness under different country-specific contexts.
- Assessing the socio-economic effects (e.g. employment, investment, productivity, income distribution) of the CAP and/or of selected building blocks or components.

Annex A. Detailed information on indicators

65. Reader's instruction: The tables in the annex will provide more detailed information on the sub-indicators, including country and time coverage, type of variable and timeliness. The tables also include a detailed description on each of the sub-indicators, information on scoring and other remarks. As of January 2022, only the first entry in Table A.1 is complete to provide a glimpse on the quality of information. Other entries are only partially complete with a lot of entries 'to be done' (TBD).

Table A.1. International policy: Detailed information on indicators

Sub-indicator	Country coverage	Time coverage	Type of variable	Timeliness	Description of raw data	Scoring	Other remarks
UNFCCC reporting and climate data							
Evaluation of BRs and BURs	Global	2014- 2021	Continuous	t-1	The methodology is based mostly on the paper of (Weikmans and Gupta, 2021[60]). Raw data is taken from the technical expert reviews of the UNFCCC (see e.g. here for the third BRs and (UNFCCC, 2021[61]) for the third BURs). The reporting requirements and the expert reviews differ across country groups, notably for Annex II, other Annex I, and non-Annex I countries. For Annex II and other Annex I countries, the expert reviews rate both the transparency and the completeness of the sections of countries' BRs in four categories: Fully (='3' points), mostly (='2' points), partially (='1' point) complete or transparent. If a country did not submit a BR, it receives zero points. The sections include 'GHG emissions and trends', 'Assumptions, conditions and methodologies related to the attainment of the quantified economy-wide emission reduction target', 'Progress in achievement of targets, including projections' (Annex I and Annex II countries) and 'Provision of support to developing country Parties' (only Annex II countries). Hence, the maximal number of points for Annex II countries is 24 and that of other Annex I countries is 18. To ensure comparability across country groups, each country's final ratio of points 'x' is calculated as the number of countries' points divided by the maximal achievable number of points by country group multiplied with 100, so that there is a value between 0 and 100. For non-Annex I countries, the expert review rates the extent to which mandatory elements of BUR(s) are included (='2' points), partly included (1 point), or not included (= 0 points). Countries receive zero points in all mandatory elements when not submitting its BUR. There are 13 mandatory elements divided between the national GHG inventory report (4 elements: Decision 2/CP.17, paragraph 41(g); Decision 17/CP.8, annex 14(a); 14 (b); 14 (c) and information on mitigation actions (9 elements: Decision 2/CP.17, annex III, paragraph 12(a); 12(b)(i); 12(b)(ii); 12(c)(i); 12(c)(ii);12(d)(i);12(d)(ii); 12(d)(iii); 12(e)). Hence, the maximal number of points for non-Annex I countries is 26. As for Annex I and Annex II countries, a country's final ratio of points 'x' is calculated as the number of points divided by the number of maximal achievable points.	10: x > 93 9: 93 = x < 91 8: 91 = x < 89 7: 89 = x < 87 6: 87 = x < 84 5: 84 = x < 82 4: 82 = x < 78 3: 78 = x < 73 2: 73 = x < 68 1: 68 = x < 0 0: x = 0	BRs and BURs are published every two years from 2014. The score in each year refers to the latest year available. Values before 2014 are missing because countries did not submit B(U)Rs. These values get a weight of zero in the computation of the CAP.

Sub-indicator	Country coverage	Time coverage	Type of variable	Timeliness	Description of raw data	Scoring	Other remarks
Compliance with reporting requirements of the UNFCCC	Global	From 2003	Sum of dummy variables	t-1	All these subcomponents are dummy variables which are to be added up. The more boxes a country ticks, the more stringent its climate policy. Documents are: BR BUR NC GHG Inventory LT-LEDS National adaptation plan NDC Timely distinguishes between Submission in time Within 3 month after deadline More than 3 month after deadline No submission Due to different reporting requirements, Annex I and non-Annex I countries will be evaluated against their highest possible score.	TBD	TBD
GHG emissions reporting and accounting	TBD	TBD			TBD TBD TBD TBD		
International climate activities							
Participation in international climate initiatives	Global	From 2014	Sum of dummy variables	t-1	TBD	TBD	TBD
Ratification of international agreements	Global	From 1995	Sum of dummy variables		The indicator is based on the methodology of Bernauer and Boehmelt (2013). Three major climate agreements are taken into account: The UNFCCC framework convention, the Kyoto protocol and the Paris agreement. For each agreement, a ratification dummy is constructed. The three dummies are then aggregated into one sub-indicator. For the UNFCCC framework convention, the ratification was open in July 1, 1992. Thus, if a country ratified the convention in 1992, it earns a score of 1 in the year 1992. If a country has not ratified the convention in 1992, the variable takes a value of 0 in 1992 and for all following years, until the country has ratified the UNFCCC framework convention. The data on this indicator stems from ((UNFCCC, 2021[62])) In the case of the Kyoto Protocol, the ratification was open on April 1, 1998.	TBD	TBD

Sub-indicator	Country coverage	Time coverage	Type of variable	Timeliness	Description of raw data	Scoring	Other remarks
					Hence, a country is assigned a score of 1 in 1998 and all subsequent years if it ratified the protocol in that same year. If the country did not ratify the protocol in 1998, it gets a score on 0 in 1998 and all following years until it ratified the protocol. The data for this variable is taken from ((UNFCCC, 2021[63]) For the Paris agreement, the ratification was open on April 2, 2016. Thus, if a country ratified the agreement in 2016, it is assigned a score of 1 for 2016 and all subsequent years. If a country did not ratifiy the agreement in 2016, it is assigned a score of 0 for 2016 and all subsequent years until it ratified the agreement. The data for this indicator was collected from (United Nations Treaty Collection, 2021[64]). Subsequently, all three variables are aggregated into one sub-indicator by summing up the three dummy variables. Thus, countries can ear a score of 1 to 3 for each year from 1992 until 2021.		
Carbon price on CO_2 emissions from international aviation	TBD	TBD			TBD TBD TBD TBD TBD		
Carbon price on CO_2 emissions from international maritime transport	TBD	TBD			TBD TBD TBD TBD TBD		
International climate finance							
International climate mitigation-related ODA	DAC Members (33 OECD countries + EU + 7 non-OECD participants)	From 1990	Continuous	t-2	TBD	TBD	TBD
Ending export credits for unabated coal power plants	Global	TBD	Dummy	t-1	TBD	TBD	TBD
Ending public	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Sub-indicator	Country coverage	Time coverage	Type of variable	Timeliness	Description of raw data	Scoring	Other remarks
finance for fossil fuel infrastructure abroad							

Source: Authors

Table A.2. National cross-sectoral policy: Detailed information on indicators

Sub-Indicator	Country coverage	Time coverage	Type of variable	Timeliness	Description of raw data	Scoring	Other remarks
Targets							
Coverage of NDC	Global	From 2016	Score	t-1	TBD	TBD	Update only every 5 years
Type of NDC	Global	TBD	TBD	TBD	TBD	TBD	TBD
Year of net-zero target	Global	From 2010	Continuous	t-1	TBD	TBD	TBD
Legal status of net-zero target	Global	From 2010	Categorical	t-1	TBD	TBD	TBD
Coverage of net-zero targets	Global	From 2010	Categorical	t-1	TBD	TBD	TBD
Public Research, Development and Demonstration							
Energy efficiency	31 IEA countries	From 1990	Continuous	t-2	TBD	TBD	TBD
Renewables	31 IEA countries	From 1990	Continuous	t-2	TBD	TBD	TBD
Nuclear	31 IEA countries	From 1990	Continuous	t-2	TBD	TBD	TBD
Hydrogen	31 IEA countries	From 1990	Continuous	t-2	TBD	TBD	TBD
Power and storage	31 IEA countries	From 1990	Continuous	t-2	TBD	TBD	TBD
CCS	31 IEA countries	From 1990	Continuous	t-2	TBD	TBD	TBD
Fossil fuel supply policies							
Governments' producer and general service support	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Bans on fossil fuel extraction	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Phase out of fossil fuel extraction	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Fossil fuel demand policies							
Level of diesel tax in EUR/tCO_2e	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Level of gasoline tax	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Level of coal tax	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Level of natural gas tax	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Level of heating oil tax	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Level of kerosene tax	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Per unit consumer support for oil	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Support for natural gas	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Support for coal	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Sub-Indicator	Country coverage	Time coverage	Type of variable	Timeliness	Description of raw data	Scoring	Other remarks
Climate legislation and governance							
Breadth and depth of climate laws	Global	At least from 2000.	Score	t-1	TBD	TBD	TBD
Independent advisory body	Global	From 2010	Dummy	t-1	TBD	TBD	TBD
Climate change education	Global	From 2020	Score	t-1	TBD	TBD	Update every 4 years
Carbon dioxide avoidance and removals							
Policies on Sustainable Forest Management	Global	From 1990	Score	t-1	TBD	TBD	TBD
Forest protection	Global	From 1990	Dummy variable	t-2	TBD	TBD	TBD
Financial incentives for carbon dioxide removals from technological solutions	TBD	TBD	Continuous	t-1	TBD	TBD	TBD
Green Finance indicators							
Existence of qualitative green finance policies	G20 countries + more	From 2018	Sum of dummy variables	t-1	TBD	TBD	TBD

Source: Authors

Table A.3. Sectoral non-market based climate policy: Detailed information on indicators

Sub-Indicator	Country coverage	Time coverage	Type of variable	Timeliness	Description of raw data	Scoring	Other remarks
Electricity							
Phase out of coal-fired power plants	Global	From 2010	Score	t-1	TBD	TBD	TBD
Ban on the construction of new unabated coal-fired power plants	Global	From 2010	Score	t-1	TBD	TBD	TBD
Transport							
Ban on sales of new conventional passenger cars	Global	From 2010	Score	t-1	TBD	TBD	TBD
Emission limit values for new conventional passenger cars	Global	From 1990	Continuous	t-1	TBD	TBD	TBD
Share of rail versus road expenditure	36 OECD countries + 16 non-OECD countries	From 1995	Ratio	t-2	TBD	TBD	TBD
Speed limits on motorways	38 OECD countries + 12 non-OECD countries	From 2013	Continuous	t-1	TBD	TBD	TBD
Industry							
Minimum energy performance standards for electric motors	Global	TBD	Continuous	t-1	TBD	TBD	TBD
Buildings							
Ban on fossil fuel heating systems	Global	From 2010	Score	t-1	TBD	TBD	TBD
Phase out of fossil fuel heating systems	Global	From 2010	Score	t-1	TBD	TBD	TBD
Building energy codes							
Minimum energy performance standards of buildings and appliances	Global	From 2010	Sum of dummies	t-1	TBD	TBD	TBD
Mandatory energy labels for buildings and appliances	Global	From 2010	Sum of dummies	t-1	TBD	TBD	TBD
Agriculture							
Regulation on nitrates	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Ban peatlands cultivation or peat extraction	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Waste							
Mandatory recycled content requirements	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Source: Authors

Table A.4. Sectoral market-based climate policy: Detailed information on indicators

Sub-Indicator	Country coverage	Time coverage	Type of variable	Timeliness	Description of raw data	Scoring	Other remarks
All sectors							
Carbon tax rate	Global	From 2010	Continuous	t-1	TBD	TBD	TBD
Number of GHG covered by carbon tax							
Emissions trading scheme price	Global	From 2010	Continuous	t-1	TBD	TBD	TBD
Emissions trading scheme coverage of GHG	Global	From 2010	Categorical	t-1	TBD	TBD	TBD
Electricity							
Financial support for renewables: Feed-in-Tariffs for solar PV	36 OECD countries and 34 non-OECD countries	From 2000	Continuous	t-2	TBD	TBD	TBD
Financial support for renewables: Feed-in-Tariffs for wind	36 OECD countries and 34 non-OECD countries	From 2000	Continuous	t-2	TBD	TBD	TBD
Financial support for renewables: Auctions for solar PV	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Financial support for renewables: Auctions for wind	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Financial support for renewables: Renewable energy certificates	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Transport							
CO_2-based car taxation	Level of annual vehicle tax based on vehicles' CO_2 emissions	CO_2-based vehicle taxes provide incentives for car owners to choose less emitting or more energy efficient cars.	OECD	2023/2024	TBD	TBD	TBD
Agriculture							
Taxes on synthetic nitrogen fertilisers	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Waste							
Landfill taxes	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Incineration taxes	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Source: Authors

References

Albrizio, S. et al. (2014), "Do Environmental Policies Matter for Productivity Growth?: Insights from New Cross-Country Measures of Environmental Policies", *OECD Economics Department Working Papers*, No. 1176, OECD Publishing, Paris, https://dx.doi.org/10.1787/5jxrjncjrcxp-en. [4]

Almássy, D. (2018), "Environmental governance indices–a brief overview.", in *Routledge Handbook of Sustainability Indicators.*. [5]

Anderson, A. (2012), "Climate Change Education for Mitigation and Adaptation", *Journal of Education for Sustainable Development*, Vol. 6/2, pp. 191-206, http://dx.doi.org/10.1177/0973408212475199. [34]

Averchenkova, A. and L. Lazaro (2020), *The design of an independent expert advisory mechanism under the European Climate Law: What are the options?*, https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/2020/09/GRI_The-design-of-an-expert-advisory-mechanism-under-the-European-Climate-Law_What-are-the-options.pdf (accessed on 16 November 2021). [33]

Baettig, M., S. Brander and D. Imboden (2008), "Measuring countries' cooperation within the international climate change regime", *Environmental Science & Policy*, Vol. 11/6, pp. 478-489, http://dx.doi.org/10.1016/j.envsci.2008.04.003. [15]

Baumol, W. and W. Oates (1988), *The Theory of Environmental Policy*, Cambridge University Press, http://dx.doi.org/10.1017/cbo9781139173513. [30]

Bernauer, T. and T. Böhmelt (2013), "National climate policies in international comparison: The Climate Change Cooperation Index", *Environmental Science & Policy*, Vol. 25, pp. 196-206, http://dx.doi.org/10.1016/j.envsci.2012.09.007. [16]

Beugin, D. et al. (2016), *COMPARING STRINGENCY OF CARBON PRICING POLICIES*. [13]

Botta, E. and T. Koźluk (2014), "Measuring Environmental Policy Stringency in OECD Countries: A Composite Index Approach", *OECD Economics Department Working Papers*, No. 1177, OECD Publishing, Paris, https://dx.doi.org/10.1787/5jxrjnc45gvg-en. [7]

Burck, J. et al. (2020), "BACKGROUND AND METHODOLOGY 2021", http://www.newclimate.org. [9]

Climate Watch (2021), *Net-Zero Tracker*, https://www.climatewatchdata.org/net-zero-tracker?category=target_scope&indicator=nz_ghg. [37]

Compston, H. and I. Bailey (2013), "COMPARING CLIMATE POLICIES: THE STRONG [65]

CLIMATE POLICY INDEX", *Political Studies Association Conference*.

Costantini, V., F. Crespi and A. Palma (2017), "Characterizing the policy mix and its impact on eco-innovation: A patent analysis of energy-efficient technologies", *Research Policy*, Vol. 46/4, pp. 799-819, http://dx.doi.org/10.1016/j.respol.2017.02.004. [53]

Dechezleprêtre, A. et al. (2021), "Measuring Environmental Policy Stringency in OECD countries: An update of the OECD composite EPS indicator". [42]

Dechezleprêtre, A., D. Nachtigall and B. Stadler (2020), "The effect of energy prices and environmental policy stringency on manufacturing employment in OECD countries: Sector- and firm-level evidence", *OECD Economics Department Working Papers*, No. 1625, OECD Publishing, Paris, https://dx.doi.org/10.1787/899eb13f-en. [59]

EBRD (2011), *The Low Carbon Transition, Chapter Four.*. [10]

EEA (2020), *Do lower speed limits on motorways reduce fuel consumption and pollutant emissions?*, https://www.eea.europa.eu/themes/transport/speed-limits-fuel-consumption-and (accessed on 16 November 2021). [47]

Elgouacem, A. et al. (2020), "The fiscal implications of the low-carbon transition", *OECD Green Growth Papers*, No. 2020/01, OECD Publishing, Paris, https://dx.doi.org/10.1787/6cea13aa-en. [54]

Eskander, S. and S. Fankhauser (2020), "Reduction in greenhouse gas emissions from national climate legislation", *Nature Climate Change*, Vol. 10/8, pp. 750-756, http://dx.doi.org/10.1038/s41558-020-0831-z. [32]

Falduto, C. and M. Rocha (2020), "Aligning short-term climate action with long-term climate goals: Opportunities and options for enhancing alignment between NDCs and long-term strategies", *OECD/IEA Climate Change Expert Group Papers*, No. 2020/02, OECD Publishing, Paris, https://dx.doi.org/10.1787/7c980fce-en. [22]

Finnish Government (2019), "INCLUSIVE AND", https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/161935/VN_2019_33.pdf?sequence=1%26isAllowed=y. [21]

Gachau, S. et al. (2021), "Handling missing data in a composite outcome with partially observed components: simulation study based on clustered paediatric routine data", *Journal of Applied Statistics*, pp. 1-14, http://dx.doi.org/10.1080/02664763.2021.1895087. [49]

Galeotti, M., S. Salini and E. Verdolini (2020), *Measuring environmental policy stringency: approaches, validity, and impact on environmental innovation and energy efficiency*, Energy Policy, https://doi.org/10.1016/j.enpol.2019.111052. [6]

Grantham Research Institute (2021), *Climate Change Laws of the World*, https://climate-laws.org/ (accessed on 16 November 2021). [31]

Grantham Research Institute (2021), *Global trends in climate litigation: 2021 snapshot*, https://www.lse.ac.uk/granthaminstitute/publication/global-trends-in-climate-litigation-2021-snapshot/ (accessed on 16 November 2021). [24]

Green, F. and R. Denniss (2018), "Cutting with both arms of the scissors: the economic and political case for restrictive supply-side climate policies", *Climatic Change*, Vol. 150/1-2, [29]

pp. 73-87, http://dx.doi.org/10.1007/s10584-018-2162-x.

Haščič, I. and N. Johnstone (2011), "Innovation in Electric and Hybrid Vehicle Technologies: The Role of Prices, Standards and R&D", in *Invention and Transfer of Environmental Technologies*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264115620-5-en. [26]

Havlík, P. et al. (2011), "Global land-use implications of first and second generation biofuel targets", *Energy Policy*, Vol. 39/10, pp. 5690-5702, http://dx.doi.org/10.1016/j.enpol.2010.03.030. [57]

ICSC (2021), *EMISSION STANDARDS*, https://www.sustainable-carbon.org/library/emission-standards/. [55]

IDDRI (2021), *What to expect from COP26 on climate?*, https://www.iddri.org/en/publications-and-events/blog-post/what-expect-cop26-climate (accessed on 16 November 2021). [23]

IEA (2021), *Energy Efficiency 2021*, http://file:///C:/Users/Lutz_L/OneDrive%20-%20OECD/CPI%20First%20paper%20literature/EnergyEfficiency2021IEA.pdf (accessed on 29 November 2021). [45]

IEA (2021), *World Energy Outlook 2021*, OECD Publishing, Paris, https://dx.doi.org/10.1787/14fcb638-en. [27]

IEA (2020), *GHG intensity of passenger transport modes, 2019*, https://www.iea.org/data-and-statistics/charts/ghg-intensity-of-passenger-transport-modes-2019, https://www.iea.org/data-and-statistics/charts/ghg-intensity-of-passenger-transport-modes-2019 (accessed on 29 November 2021). [46]

IMO (2020), *Fourth Greenhouse Gas Study 2020*, https://www.imo.org/en/OurWork/Environment/Pages/Fourth-IMO-Greenhouse-Gas-Study-2020.aspx. [19]

IPCC (2018), *Global Warming of 1.5°C.*, https://www.ipcc.ch/site/assets/uploads/sites/2/2019/02/SR15_Citation.pdf (accessed on 6 February 2019). [3]

IPCC (2014), *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge, UK, http://dx.doi.org/10.1017/CBO9781107415324. [11]

Jeudy-Hugo, S., L. Lo Re and C. Falduto (2021), "Understanding countries' net-zero emissions targets", *OECD/IEA Climate Change Expert Group Papers*, No. 2021/03, OECD Publishing, Paris, https://dx.doi.org/10.1787/8d25a20c-en. [35]

Johnstone, N., I. Haščič and D. Popp (2009), "Renewable Energy Policies and Technological Innovation: Evidence Based on Patent Counts", *Environmental and Resource Economics*, Vol. 45/1, pp. 133-155, http://dx.doi.org/10.1007/s10640-009-9309-1. [25]

Kozluk, T. and G. Garsous (2016), *How stringent are environmental policies?*, OECD POLICY PERSPECTIVES. [52]

Meckling, J. and J. Nahm (2019), "The politics of technology bans: Industrial policy competition and green goals for the auto industry", *Energy Policy*, Vol. 126, pp. 470-479, http://dx.doi.org/10.1016/j.enpol.2018.11.031. [43]

MFAT (2021), *Supporting our region*, https://www.mfat.govt.nz/en/environment/climate-change/supporting-our-region/. [20]

OECD (2021), *International Programme for Action on Climate*, https://www.oecd.org/climate-action/ipac/. [1]

OECD (2021), *Transport Strategies for Net-Zero Systems by Design*, OECD Publishing, Paris, https://dx.doi.org/10.1787/0a20f779-en. [56]

OECD (2018), *Cost-Benefit Analysis and the Environment: Further Developments and Policy Use*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264085169-en. [51]

OECD & IEA (2021), *Energy price surge underlines need to accelerate clean energy transitions rather than subsidise fossil fuels*, https://www.oecd.org/newsroom/energy-price-surge-underlines-need-to-accelerate-clean-energy-transitions-rather-than-subsidise-fossil-fuels.htm (accessed on 16 November 2021). [28]

OECD and JRC European Commission (2008), *Handbook on Constructing Composite Indicators: Methodology and User Guide*, OECD publishing. [48]

Our World in Data (2021), *Emissions by sector*, https://ourworldindata.org/emissions-by-sector#citation (accessed on 16 November 2021). [40]

Our World in Data (2020), *Climate change and flying: what share of global CO2 emissions come from aviation?*, https://ourworldindata.org/co2-emissions-from-aviation, https://ourworldindata.org/co2-emissions-from-aviation (accessed on 30 November 2021). [18]

Piebalgs, A. and C. Jones (2021), *The Importance of the EU Taxonomy: the Example of Electricity Storage*, https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance_en. [36]

Qin, Z. et al. (2015), "Soil carbon sequestration and land use change associated with biofuel production: empirical evidence", *GCB Bioenergy*, Vol. 8/1, pp. 66-80, http://dx.doi.org/10.1111/gcbb.12237. [58]

Schleich, J., A. Durand and H. Brugger (2021), "How effective are EU minimum energy performance standards and energy labels for cold appliances?", *Energy Policy*, Vol. 149, p. 112069, http://dx.doi.org/10.1016/j.enpol.2020.112069. [44]

Smith, S. and N. Braathen (2015), "Monetary Carbon Values in Policy Appraisal: An Overview of Current Practice and Key Issues", *OECD Environment Working Papers*, No. 92, OECD Publishing, Paris, https://dx.doi.org/10.1787/5jrs8st3ngvh-en. [50]

Talukder, B., K. Hipel and G. vanLoon (2017), "Developing composite indicators for agricultural sustainability assessment: Effect of normalization and aggregation techniques", *Resources*, Vol. 6/4, http://dx.doi.org/10.3390/resources6040066. [66]

UNDP (2021), *Goal 13: Climate action - SDG Financing Solutions*, https://www.undp.org/content/sdfinance/en/home/sdg/goal-13--climate-action.html. [2]

UNFCCC (2021), *International consultation and analysis - Outcome cycle 3*, https://unfccc.int/ICA-cycle3. [61]

UNFCCC (2021), *Portal on cooperative initiatives*, [17]

https://unfccc.int/topics/mitigation/resources/portal-on-cooperative-initiatives.

UNFCCC (2021), *Status of Ratification of the Convention*, https://unfccc.int/process-and-meetings/the-convention/status-of-ratification/status-of-ratification-of-the-convention (accessed on 30 November 2021). [62]

UNFCCC (2021), *The Kyoto Protocol - Status of Ratification*, https://unfccc.int/process/the-kyoto-protocol/status-of-ratification. [63]

UNFCCC (2020), *Compilation and synthesis of fourth biennial reports of Parties included in Annex I to the Convention*, https://unfccc.int/sites/default/files/resource/sbi2020_inf10a01.pdf (accessed on 12 November 2021). [41]

United Nations Treaty Collection (2021), *Status of Treaties - Paris Agreement*, https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-7-d&chapter=27&clang=_en. [64]

United Nations, E. (2019), *GLOBAL FOREST GOALS AND TARGETS OF THE UN STRATEGIC PLAN FOR FORESTS 2030*, http://www.un.org/esa/forests. [39]

Weikmans, R., H. Asselt and J. Roberts (2019), "Transparency requirements under the Paris Agreement and their (un)likely impact on strengthening the ambition of nationally determined contributions (NDCs)", *Climate Policy*, Vol. 20/4, pp. 511-526, http://dx.doi.org/10.1080/14693062.2019.1695571. [14]

Weikmans, R. and A. Gupta (2021), "Assessing state compliance with multilateral climate transparency requirements: 'Transparency Adherence Indices' and their research and policy implications", *Climate Policy*, Vol. 21/5, pp. 635-651, http://dx.doi.org/10.1080/14693062.2021.1895705. [60]

Welsby, D. et al. (2021), "Unextractable fossil fuels in a 1.5 °C world", *Nature*, Vol. 597/7875, pp. 230-234, http://dx.doi.org/10.1038/s41586-021-03821-8. [38]

Wendling, Z. et al. (2020), *EPI 2020 Technical Appendix*, https://epi.yale.edu/. [8]

Yamin, F. and J. Depledge (2004), *The international climate change regime: a guide to rules, institutions and procedures.*, Cambridge University Press. [12]