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Stocktaking and Greenhouse Gas Mapping of Transport Policy Instruments



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Inclusive Forum on Carbon Mitigation Approaches Papers

The IFCMA Papers series brings together outputs from the initiative's work to take stock of different carbon mitigation approaches, map policies to the emissions they cover, and estimate their impact on greenhouse gas emissions, as well as its work on analysing methodologies for computing the carbon intensity of goods and sectors. Comments on IFCMA Papers are welcome at IFCMA@oecd.org.

Background

The Inclusive Forum on Carbon Mitigation Approaches is the OECD's flagship initiative to help optimise the global impact of emissions reduction efforts around the world through better data and information sharing, evidence-based mutual learning, and inclusive multilateral dialogue.

By taking stock of different carbon mitigation approaches, mapping policies to the emissions they cover, and estimating their comparative impact in terms of emissions reductions, the IFCMA is enhancing understanding of the effect of the full spectrum of carbon mitigation approaches deployed around the world and their combined global impact. The IFCMA is also identifying and addressing challenges related to the calculation of sector- and product-level carbon intensity metrics, relevant to the design and evaluation of mitigation policies, and to steer firms' and consumers' decisions towards lower-emission products. This work supports better international coordination to avoid the proliferation of different standards, help minimise compliance costs for business, and avoid disruptions to trade.

To advance its technical work, the IFCMA brings together delegates from the climate, tax, and structural economic policy communities from more than 55 IFCMA members and numerous countries participating as Invitees around the world.

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Executive summary

1. This technical note presents a first stocktake of Swiss and Dutch mitigation and mitigation-relevant road transport policy instruments, and a preliminary mapping of these policies to the emissions they cover. This exercise informs the Inclusive Forum on Carbon Mitigation Approaches (IFCMA)'s stocktaking and mapping work. For the mapping, the note showcases an application of the novel concepts developed in the IFCMA paper, "Proposal for a Greenhouse Gas Mapping Methodology of Climate Change Mitigation and Climate Change Mitigation-Relevant Policy Instruments" (IFCMA(2023)8/FINAL). This form of mapping links policies to their emission base. Describing the amounts and segments of emissions a policy covers allows to describe it not only through its intensity (such as a rate or level) but also by the emissions it potentially affects.

2. The application of stocktaking and mapping concepts in this note is based on data on policy instruments for road transport applied in the Netherlands and Switzerland. It should be considered an example for the work to be carried out under the IFCMA, allowing to identify practical challenges and potential solutions for developing a policy database and for mapping a wide set of instruments. The note focusses on policy instruments related to the vehicle types responsible for the bulk of emissions (i.e. passenger cars), as well as in the case of Switzerland on subnational jurisdictions accounting for most emissions.

3. From the work represented here, the following key insights emerge :

- Defining the scope of the stocktake, particularly for climate change mitigation-relevant policy instruments, requires both guiding principles to ensure a systematic stocktake and expert judgement to account for country specificities.
- The stocktake drew on several OECD reports and databases, but substantial data gaps remain, requiring additional desk research.
- The note proposes an approach of recording policy intensity values as "measure per unit", e.g. tax rate per car, and discusses alternatives for policy instruments that are more complex to capture, such as intensities of instruments that are expressed in equations.
- In road transport the most recorded attributes to define the policy base (i.e. who and what precisely is regulated) are: 1) type of vehicle (e.g. passenger cars, freight light truck); 2) vehicle status (e.g. new or existing); 3) type of powertrain and fuel used (e.g. internal combustion engine and diesel, respectively); and 4) ownership (e.g. private, company). Together these define the policy base of the instrument.
- Determining the relevant emission base requires expert judgement beyond the identification of the policy base, including for identifying potential substitution channels.
- Given the crucial role of electrification in the transport sector, this note finds that as proposed in IFCMA(2023)8/FINAL, the mapping methodology should be able to account for emissions from associated electricity use (Scope 2 emissions) to reflect the emissions covered by electrification-related policies. In such cases (i.e. where low-carbon vehicles replace carbon-intensive ones),

tracking emissions related to both the regulated low-carbon vehicle and vehicle that is to be replaced will be key.

- Policy instruments with very narrow policy bases may require a granular mapping, which can be challenging because of the difficulty in obtaining appropriately disaggregated emissions data. Detailed vehicle fleet data can be used to disaggregate emissions data to arrive at an emission base according to the policy design and precisely estimate the instrument's emission base.

The note identifies and discusses the following avenues to facilitate the stocktaking and mapping of road transport policy instruments specifically across a broader set of IFCMA countries:

- Identification of relevant vehicle fleet data and associated emission factors to estimate emissions at the level of granularity needed for the greenhouse gas mapping.
- Refinement of methodologies based on country pilot studies, for instance on the scope of the stocktaking and mapping, and on the reporting of policy intensity values.
- Possible extension of the method used for country pilot studies to other transport subsectors, such as rail, aviation and maritime transport, to inform the feasibility of scaling up to the full set of IFCMA countries.
- Selection of representative vehicle types that can be used to calculate a representative policy intensity value, when an instrument's intensity is a function of multiple parameters (such as vehicle weight, age, performance, etc.).

1 Introduction

4. With a view to reaching the goals of the Paris Agreement, countries have increasingly taken steps to mitigate climate change by implementing various policy measures. This brings the need to better understand these policies and assess how effective they are. The Inclusive Forum on Carbon Mitigation Approaches (IFCMA) responds to this need. The IFCMA is working to systematically gather data on climate change mitigation and mitigation-relevant policy instruments, map them to the greenhouse gas (GHG) emissions they cover, and create a database containing relevant policy attributes. It is also seeking to evaluate the impact of selected policy instruments and policy packages on GHG emissions in a separate workstream.

5. The information collected in the IFCMA policy database aims to serve several purposes. It supports policy makers in their decision-making and analysts in conducting policy analyses, e.g. on the targeting of tax measures or in analysing alternatives to policy rate changes. By taking stock of mitigation and mitigation-relevant policy instruments, it allows for comparisons across countries in terms of the types of instruments used, priority sectors, timelines, and implementation methods. One key attribute that needs to be considered in describing policy instruments is the policy intensity, e.g. a rate, price or level defined by the instrument.

6. By collecting this policy instrument information, the IFCMA's database primarily aims to provide descriptive information to support policy reform and analysis of instruments as well as to enhance the transparency of climate action. As part of this stocktake, emissions mapping enriches this descriptive information by clarifying which emissions are covered by each instrument to aid policy reform beyond adjusting policy intensities such as rates and levels . This also facilitates cross-country comparisons and effectiveness assessments at the level of policy instruments. In this fashion, the descriptive information on policy instruments also supports IFCMA modelling activities, such as the choice of key policy instruments to focus on. Beyond use of the stocktake data within IFCMA analysis, the information e.g. on mapping can serve other analytical purposes, for example studies on effective tax rates.

7. This note presents a practical application of the stocktaking and mapping processes, focusing on policy instruments in the road transport sector in the Netherlands and Switzerland. The preliminary mapping showcased here is based on concepts outlined in the companion paper "Greenhouse Gas Mapping Methodology of Climate Change and Climate Change-Relevant Policy Instruments" (IFCMA(2023)8/FINAL).

8. The primary objective of this note is to extract lessons for guidance for the stocktaking and mapping in other sectors and for scaling up to all IFCMA member countries. The application of stocktaking and mapping concepts reveals challenges, including issues related to capturing policy intensity values and considerations for addressing gaps in emissions data for mapping. Thus, this application should be viewed as an early learning experience for stocktaking and mapping. Ongoing and upcoming pilot studies in various countries are already building, and will continue to build, on the lessons presented here. These various studies will contribute to the broader implementation of stocktaking and mapping across the IFCMA's membership and a wider array of sectors, with priority for high-emitting sectors.

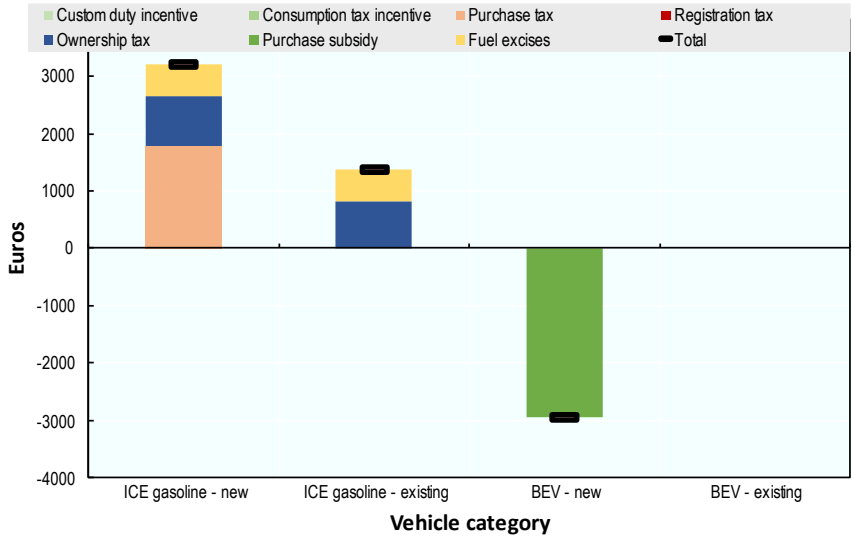
9. Section 2 delves into the stocktaking process of relevant policy instruments in the Dutch and Swiss transport sectors, discussing the scope of the stocktake and outlining attributes to characterise policy

instruments. Section 3 then explores GHG mapping, illustrating how mapping concepts are put into practice and highlighting the importance of sectoral and emissions data disaggregation to map instruments with narrowly specified emission bases. Finally, Section 4 summarises the key takeaways and offers insights into the future work planned for Module 1.

2 A stocktake of selected road transport policy instruments

10. A detailed and harmonised stocktake of instruments allows for comparing instruments across countries, but also facilitates comparing and analysing instruments applied within the same jurisdiction. Figure 2.1, as an example for a use of the stocktake data, illustrates the net effect of different instruments on the same assets (in this case, passenger cars). It provides an overview of the relative importance of these policy instruments across different representative vehicle types. Such descriptive analysis, which is possible thanks to the stocktake, provides insights into the relative importance, as well as interaction, of different policy instruments, enhancing transparency and supporting the identification of potential policy reform options.

Figure 2.1. Net taxes and subsidies for passenger cars across different representative vehicle types in the Netherlands



Note: 2023 data. For each vehicle category, calculations rely on a representative car, e.g. for a car emitting 100g of CO_2 per km and weighting 1500 kg for ICE gasoline car. All policy instruments in the scope of the IFCMA stocktake are mentioned, only those present in the Netherlands and Switzerland are illustrated. ICE is for internal combustion engine, BEV for battery electric vehicles. New refers to newly produced and purchased vehicles, existing refers to vehicles owned and purchased more than one year ago.
Source: Authors research.

11. To create a database that would allow for such analysis, a comprehensive stocktaking based on a clearly articulated and rigorous process is necessary. The remainder of this section discusses how to operationalise the stocktake. It identifies criteria that could be used to define the scope of the stocktake,

and discusses the availability of data in existing OECD-internal databases and the attributes to describe instruments, in order to support the development of a rigorous data collection process.

2.1 Defining policy instrument scope

12. To capture relevant policy instruments, the scope of the stocktake includes both explicit climate change mitigation policy instruments as well as mitigation-relevant policy instruments.[1] Many road transport policy instruments, while not explicitly targeting emissions, influence emissions by altering decisions regarding emitting assets. For example, speed limits and fuel excise taxes can affect fuel consumption, which directly correlates with emissions. Vehicle taxes also have an impact on emissions through their influence on car purchases and ownership.

13. To adopt a comprehensive approach to climate action and notably cover electrification efforts, the application of stocktaking concepts explored in this note includes both standard vehicle tax regimes and measures in support of low-emission vehicles. For example, it covers the canton of Bern's recurrent motor vehicle tax and taxes such as the vehicle purchase tax and their exemptions for electric vehicles (EVs). It also tracks support measures for low-emission vehicles, including exemptions and reduced rates. See Table 2.1 for a list of relevant road transport policies in Switzerland and the Netherlands, embedded in the IFCMA proposed policy instrument typology.

14. Further, the stocktake in the transport sector focuses on instruments influencing choices at the point of asset purchase and use, i.e. mainly vehicles but also fuels and infrastructure. For example, a purchase tax falls within the scope of this stocktake because it affects vehicle choice. On the other hand, subsidies to vehicle manufacturers are not within scope if they do not affect vehicle prices directly, but for example only implies changes in production.Though policy instruments implemented at all levels of government — national, subnational or supranational — are potentially within scope of the IFCMA, feasibility constraints such as resource needs and time-intensive research may limit this scope. Subnational policy instruments are common in IFCMA member countries, notably federal states like Switzerland. While Switzerland has different motor vehicle tax criteria across its cantons, this preliminary stocktake focuses on the cantons responsible for the greatest volume of emissions only, including Zurich and Bern. Table 2.2 shows an overview of the most commonly used attributes for the policy base, i.e. namely what and who is regulated, and the legal obligation established under the regulatory framework, for three key road transport tax instruments and how the relevant parameters differ between jurisdictions. It illustrates the considerable differences between subnational taxes of the same type that make comparing this data informative. In some cases, policy instrument design and implementation may vary at the local level, deviating from national-level instruments. For example, in some instances regional administrations in the Netherlands adjust the annual vehicle tax rates applicable at the national level.

[1] Note that while this paper includes all potentially relevant instruments, the eventual policy scope will build on insights from country pilot studies and may be more constrained.

15.

Table 2.1. Relevant road transport policy instruments in the Netherlands and Switzerland

Category	Type	Instrument	Netherlands	Switzerland
Market-based instruments	Subsidies	For low-GHG technologies/behaviour	Subsidies for purchase of EVs	Subsidies for purchase of EVs (cantons)
		For GHG-emitting technologies/behaviour		
		Feebates		
	Taxes and fees	Carbon tax		
		Tax incentives (CIT, PIT, VAT, import tariff)	CIT and PIT incentives for EVs	
		Other taxes and fees	Fuel excise tax Electricity excise tax Vehicle purchase tax Annual motor vehicle tax Road use charge	Fuel excise tax Electricity excise tax Vehicle purchase tax Annual motor vehicle tax (cantons)
	Trading systems	Emissions trading system		
		Tradable certificates		
Regulatory instruments	Performance standards	Fuel economy standards	CO_2 emission targets for new passenger cars	CO_2 emissions standards for new passenger cars
		Energy efficiency standards		
		Building codes		
	Technology standards	Bans and phase-outs		
		Renewable energy portfolio standards		
		Low-carbon fuel/feedstock standards	Blending standard for fuel	
	Enabling policies		Motorway speed limit Low emissions zone (local)	Motorway speed limit Environmental zone (local) Compensation obligation for fuel importers
Other	Government investment and consumption	Grants for climate R&D		
		Public infrastructure investment	Public investment in road infrastructure	Charging infrastructure Public investment in roads infrastructure
		Public governance		
	Information instruments	Labelling	Energy label for new vehicles (fuel efficiency and CO_2 emissions)	Energy label for new passenger car
		Education/training		
		Reporting requirements & audits		
	Voluntary approaches	Voluntary emission reduction targets		
		Voluntary emission trading system		

Note: CIT: Corporate income tax; PIT: Personal income tax; VAT: value-added tax; EV: Electric vehicle; ETS: emission trading system; GHG: greenhouse gas.
Source: Authors research.

16. Policy instruments in the stocktake are recorded with 2023 values. This ensures data consistency across the two countries by capturing the status of an instrument, as described by its attributes, at the same point in time. Policy instruments adopted but not yet in force as of 2023 are recorded as such. For

example, the EU CO_2 emission standards for vehicles that will apply to Dutch manufacturers, from 2025 or 2030 have been recorded in this stocktake.[2]

Table 2.2. Overview of attributes across key vehicle taxes in the Netherlands and Switzerland to define the policy base

	Tax on purchase	Tax on ownership	Tax on vehicle use
Netherlands	Car, light truck: CO_2 emissions, fuel, powertrain (PHEV), powertrain (BEV)	Car, light truck: weight, fuel, pollution, powertrain (PHEV), powertrain (BEV)	Heavy duty truck: axle, air suspension, pollution, time
Switzerland	Car, light truck, heavy truck: price, powertrain (BEV)	Car, light truck, heavy truck (Bern): weight, registration date and pollution, powertrain (BEV) Car (Geneva): CO_2 emissions, power, registration date and powertrain (BEV) Light truck, heavy truck (Geneva): weight, registration date and powertrain (BEV) Car, light truck (Vaud): power, weight, registration date and CO_2 emissions, fuel Heavy truck (Vaud): weight, pollution Car (Zurich): cm^3, weight, CO_2 emissions, energy efficiency Light truck (Zurich): cm^3, weight, CO_2 emissions Heavy truck (Zurich): pollution, weight	Heavy duty truck: distance, pollution, weight, powertrain (BEV) Car, light truck: -

Note: Parameters in blue set out standard rates, those in grey reflect a surtax, those in red reflect reduced rates, those in green reflect tax exemptions.
Source: Authors.

Focus on road transport

17. This note focuses on road transport, as the subsector that is responsible for the largest share of transport emissions, accounting for 69% of GHG transport emissions globally in 2019. Excluding international aviation and shipping, road transport accounts for 99% and 96% of transport emissions in the Netherlands and Switzerland respectively. Passenger cars, light trucks as well as heavy trucks and buses constitute the bulk of road emissions. This note focuses on instruments related to passenger cars, light trucks, and heavy trucks, without prejudice to other countries in which other vehicles or modes of transport may justify inclusion as well.

2.2 Data sources for the stocktake of road transport policies in the Netherlands and Switzerland

18. In an effort to avoid duplication, the IFCMA stocktake builds on several OECD reports and databases which provide rich input for the transport sector. Data from these sources was complemented by desk research.

[2] The EU Regulation sets EU fleet-wide CO2 emission targets applying from 2020, 2025 and 2030. All three targets/intensity levels will be recorded in the stocktaking, to consider the phasing-in mechanism to achieve the ultimate goal: a 100% reduction, meaning 0 g CO_2/km, from 2035.

19. The stocktake included data from the following five data repositories hosted at the OECD:

- Energy excise taxes, carbon taxes and emissions trading systems can be derived from the Carbon Pricing and Energy Taxation (CPET) database (OECD, 2022[1]);
- The Inventory of Support Measures for Fossil Fuels (OECD, 2023[2]) provides information on subsidies provided in the transport sector, although it has no records of such measures specifically for the road transport sector in the Netherlands and Switzerland;
- The Consumption Tax Trends report (OECD, 2022[3]) provides a list and descriptions of taxes and subsidies for passenger cars as well as light trucks and freight trucks in OECD countries, but without detailed information on the timeframe, rates or emissions covered;
- The Climate Action and Policies Measurement Framework (CAPMF) provides data on certain regulatory instruments, such as bans and phase-outs, fuel economy standards and motorway speed limits; and
- The Policy INstruments for the Environment (PINE) database collects information on a range of instruments (such as taxes and fees, environmentally beneficial subsidies and voluntary agreements) affecting assets relevant to road transport (including fuels, vehicles and vehicle equipment).

20. Table 2.3 provides an overview of the scope of these databases with a view to using them for scaling up the stocktake to a broader set of IFCMA members. As the table shows, while the overall policy coverage matches the IFCMA's scope well, there are important gaps in the coverage of attributes.

Aligning data sources with the IFCMA data structure and filling gaps

21. While existing OECD sources supply relevant data, the available information was not harmonised and required some restructuring for the exercise presented in this note. Existing data sources at the OECD service different policy communities with diverse objectives, thus resulting in important structural gaps in the attribute coverage when compared to that envisioned for the IFCMA. Overall, market-based instruments have a better coverage compared to non-market-based policy instruments. In terms of policy detail, some OECD datasets are focussed on collecting only the policy name and intensity, meaning that other relevant attributes such as those relating to the policy base or administrative details needed to be researched. e.g. for policy instruments covered by the Consumption Tax Trends report and the data from the CAPMF. Existing OECD databases could be aligned for IFCMA purposes.

22. Existing information also needs to be complemented by other sources, notably domestic legislation and other third-party data sources, such as from other international organisations, non-government organisation and commercial data providers. Information on different attributes needs to be updated (e.g. no dataset provided data as recent as 2023) and expanded (e.g. no dataset contains all attributes the IFCMA envisions to collect e.g. on the policy base). There are also several policy instruments that are not covered at all by inhouse databases (e.g. import tariffs, corporate and personal income tax incentives). For road transport, suitable information as the most useful starting point for market-based instruments comes from migrating the Consumption Tax Trends as well as the Carbon Pricing and Energy Taxation database to IFCMA format. Additional policy detail such as the exact assets policy instruments apply to were added through desk research.

23. A clear lesson emerging from the use of these databases is that while much relevant data exists, datasets must be harmonised, which will be time intensive. For example, identifying overlaps and checking potentially conflicting information was necessary to use data for Dutch and Swiss policies, and will likely be necessary for the policy instruments of other countries as well.

24.

Table 2.3 Main data repositories used for the stocktakes for the Netherlands and Switzerland

	Scope of policy instrument types	Timeliness	Geographical coverage	Attributes available
Consumption Tax Trends	All taxes and subsidies for vehicles	Biannual, latest as of 2022. Based on desk research and questionnaire	OECD	English name, selected tax attributes, description
Carbon pricing and energy taxation database	All fuel excise taxes, carbon taxes, ETS, electricity excise taxes	Biannual, latest as of 2021, upcoming 2023. Based on desk research	71 countries incl. OECD and G20 (except Saudi Arabia)	Intensity measure per unit, share of emissions covered
PINE	All taxes and subsidies for vehicles	Annual, but irregular responsiveness. Based on questionnaires	130+ countries	Among many others, English name, domestic name, selected tax and subsidy attributes
IEA PAMS	Selected climate mitigation policy instruments	Depending on countries studies and questionnaires	All countries	English name, description, domestic sources
National communications and biannual update reports	Potentially all climate mitigation policy instruments	Annual or biannual	All countries	English name, description

Note: The colour coding is used to represent the level of criteria fulfilment. Green indicates a high level of fulfilment, orange signifies a medium level, and red shows that the criteria fulfilment is poor.
Source: Authors

2.3 Policy intensity

25. Policy intensity quantifies the level of incentives created or constraints imposed by an instrument. This could for example be the rate of a tax, the premium paid by a subsidy or the technical level required by a standard. Intensity is a core attribute in policy design, though it can be complex to record. While recording intensity is straightforward for many instruments, for others it may not be straightforward. In such cases, a policy's intensity could for example be captured by a set of attributes, based on which a standardised intensity could be calculated, or the stocktaking could use an attribute as a proxy if no useful intensity value is available.

26. Table 2.4 shows three possible ways of recording intensity explored for a selected number of commonly used policy instruments:

- Measure per unit: This is specific to each policy instrument and jurisdiction and is a typical way to describe intensity.[3]
- Other intensity-linked attributes: A set of attributes, which may be the best way to capture complex policy instruments such as incentives integrated into the corporate income tax (CIT) and the personal income tax (PIT).

[3] Note that some instruments may not have an explicit intensity value a priori. For example, ICE bans and phase-outs as well as information instruments are usually characterised only by the enforcement date, the assets to which they apply, or simply by their existence. Quantitative metrics could nevertheless be developed for certain instruments, such as 0 g CO_2/km for a ban on ICE vehicles or 0% of new assets for a ban on coal power plants.

- Fiscal cost: This is a common attribute for public investments or tax incentives, especially when a measure per unit is non-existent, or not straightforward.[4]

Table 2.4. Examples of how to capture policy intensity or a proxy

	Measure per unit	Set of specific attributes	Fiscal cost or revenue
Gasoline excise taxes in the Netherlands	EUR 658.71 per 1000 L		
CIT incentive for electric vehicles in the Netherlands (MIA and VAMIL programs)		MIA +27%/36%/45% of investment deduction. Vamil 75% depreciation of investment. MIA and Vamil can be combined, and the deduction rates could be presented in the context of a larger set of attributes describing the CIT system	EUR 30 million (all transport, 2021)
Subsidy for new electric passengers for private individual in the Netherlands	EUR 2 950 per vehicle		EUR 67 million
Motor vehicle tax (reduced rate for PHEV) in the Netherlands	EUR 434 per vehicle*	50% of the standard rate	EUR 46 million
Motorway speed limit in the Netherlands	130 km/h		
CO_2 emission standards for new passenger car in Switzerland	95 gCO_2 per km		
Compensation obligation for fuel importers in Switzerland		20% of emissions should be compensated	

Note: these policy intensity values are to be read in conjunction with the policy base to which they apply. *tax amount for a gasoline PHEV weighting 1500kg.
Source: Authors

2.4 Standardising policy intensity and describing the policy base

27. Within the context of the IFCMA, the stocktaking process is geared towards making recorded data comparable. This serves a dual purpose: increasing consistency of data across countries and preparing data for use in the mapping process (see Section 3). The following sub-sections explore why standardisation may be useful to record intensity for complex policy instruments, and how it can aid identifying the policy base of policy instruments.

Calculating intensity based on a set of attributes

28. Policy intensity may depend on a combination of policy instrument attributes. Standardisation, i.e. devising a method by which intensity expressed by a set of attributes is summarised, may become necessary in such cases to make information on the intensity comparable across jurisdictions. For example, a vehicle tax rate may be based on an equation. In Switzerland, for instance, the annual vehicle tax depends on weight categories, powertrain types, and fuel consumption.

[4] Note that public budgets may not always be fully or easily accessible, making it hard to accurately collect data. While data collection is possible e.g. when the country establishes specific funds for specific projects, such as the Rail Infrastructure Fund (RIF) in Switzerland, as these usually have dedicated websites and decrees or regulations, in other cases or more diffuse disbursement, it may not.

29. One approach to standardisation would be to simplify by defining a typical vehicle profile representative of a specific market segment or a country's overall car fleet. This profile can be based on specific vehicle models or defined characteristics of a representative car, such as one that weighs 1 500 kg, 4.5l/km and 1 600-cylinder capacity vehicle and other vehicle characteristics such as cost or class.

30. An advantage of defining a typical or representative vehicle profile based on characteristics, rather than brand and model, is that typically policy-related attributes are expressed in terms such as weight, CO_2 emissions per kilometre driven. Access to a global fleet dataset can help identify relevant vehicle segments and their associated characteristics.

Describing the policy base

31. For precise mapping, a detailed understanding of the policy base is essential, including the agents and assets targeted by a policy instrument (see section 3). Carefully chosen categorisations enhance instrument comparability across the attributes of the policy base while also facilitating the identification of the policy base. Standardising attributes of the policy base could for example include vehicle types and ownership types. They could then be matched to emissions data that is disaggregated by the same categories (see Section 3).

32. The following four examples illustrate how attributes of the policy base could be standardised in practice:

- In the case of the excise tax on automotive gasoline in the Netherlands, the policy base is linked to the consumption of automotive gasoline within the country. Consequently, recorded observations are categorised as "gasoline" (rather than just “fuel”), covering both the relevant asset and fuel. These categorisations can be broad or specific.
- For the Dutch subsidy aimed at encouraging personal electric car adoption, the policy base is battery electric vehicles purchased by households. In this case, the policy instrument encompasses "battery electric vehicles (BEV)," "personal," "new," and "car." These attribute values can be standardised into "powertrain," "ownership," "status," and "type of vehicle."
- For subsidies for charging infrastructure in companies in the Swiss canton of Bern, the policy base encompasses all newly established charging stations owned by companies. Using the suggested attributes, recorded observations would include "PHEV; BEV" and "company" for the "powertrain" and "ownership" attributes.
- Switzerland's CO_2 standard applies to all new internal combustion engines (ICE) and plug-in hybrid electric vehicles (PHEV) used in passenger cars and light trucks. Recorded observations here include "ICE; PHEV" and "car; light truck" for the "powertrain" and "type of vehicles" attributes.

33. Further, for example, Dutch and Swiss road transport policies specify details regarding the targeted vehicles when regulating vehicle purchase and usage. Where Dutch and Swiss data distinguish between “new” and “existing” vehicles, instruments of other countries may distinguish between “second hand” and “imported” vehicles. Whenever possible, the stocktaking process adheres to internationally agreed categorisations, with room for country-specific definitions when necessary. For instance, IPCC reporting instructions for light duty trucks give the indication that “gross vehicle weight normally ranges up to 3 500-3 900 kilograms” (Sanz Sánchez, Bhattacharya and Mareckova, 2006[4]). This standard would be applied where vehicle weights are available.

3 Mapping road transport policy instruments to their emission base

34. Emissions mapping is the process of connecting a policy instrument to the specific emissions it addresses, i.e. defining the instrument's emission base (IFCMA(2023)8/FINAL). As Figure 3.1 based on Swiss data shows, a mapping of relevant policy instruments to their emission base can provide insights on the scope of an instrument, can help put coverage in context of intensity and ultimately based on this data can point to what a reform could usefully focus on. The figure shows the emissions coverage of gasoline excise taxes as well as electric vehicle (EV) charging infrastructure subsidies, providing an insight into the reach of these instruments across different vehicle types. When comparing policy instruments across different jurisdictions, it is essential to have information about both their intensity and scope, as looking at either aspect in isolation can be misleading. Additionally, understanding the emission base can provide valuable insights for potential policy reforms by highlighting whether the base is narrow or broad. In addition to this primary purpose, mapping can also provide input to other studies (e.g. input for modelling).

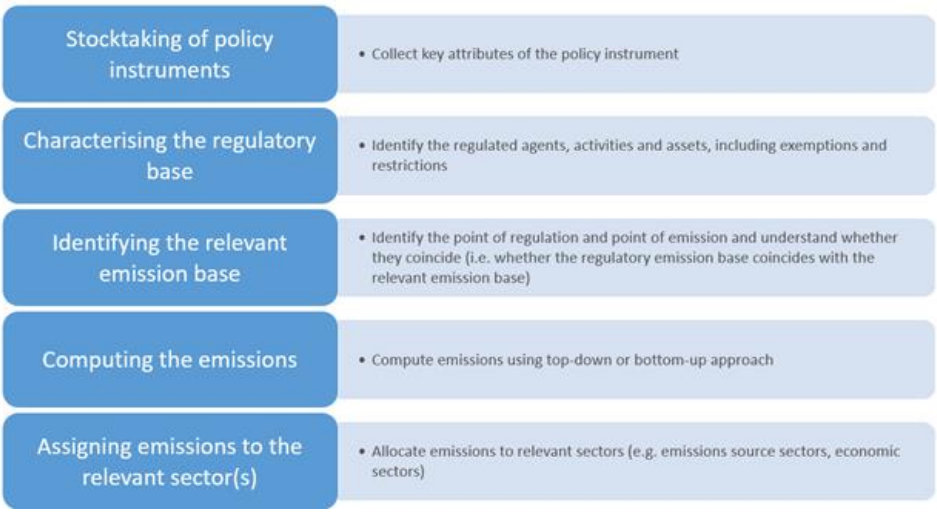
Figure 3.1. The emission base for two selected Swiss road transport policy instruments

	Passenger cars							
	ICE gasoline		ICE diesel		PHEV gasoline		BEV	
	New	Existing	New	Existing	New	Existing	New	Existing
Regulatory emission base (in case different from the relevant emission base)								
Charging infrastructure								
Vehicle purchase tax								

Note: Incentives to low-carbon technologies are highlighted in yellow.
Source: Authors.

35. The process of identifying the emission base such as that shown in Figure 3.1 for any particular policy instrument involves 5 key steps, as illustrated in Figure 3.2. The first two steps, involving stocktaking and characterising the policy base, are covered by the discussion in Section 2. Once the policy base is adequately described in terms of regulated assets, agents, activities, exemptions, and restrictions, steps 3 and 4 come into play. They identify the relevant emission base and compute the related emissions. These two steps are the focus of this section. Step 5, attributing the emission base to relevant sectoral classifications, is beyond the scope of this note.

Figure 3.2. Five steps towards GHG emissions mapping



Note: Step 3 requires several sub-steps which are described in IFCMA(2023)8/FINAL.
Source: IFCMA(2023)8/FINAL).

36. Two core concepts are key to navigate these steps effectively: the **regulatory emission base** and the **relevant emission base**. The regulatory emission base encompasses emissions generated by the regulated assets. For example, the regulatory emission base of a vehicle ownership tax comprises the emissions generated by the vehicles subject to the tax. The relevant emission base, on the other hand, represents the emissions targeted or unintentionally affected by a policy instrument from a GHG mitigation perspective. For instance, in the case of an EV purchase subsidy, the relevant emission base consists of emissions from the passenger car fleet, composed mostly of internal combustion engine (ICE) vehicles. The emissions stemming from the electricity production required to power the EVs are only considered as part of the regulatory emission base. While these two bases often coincide, as in the example of the vehicle ownership tax, this is not always the case, as illustrated by the EV subsidy example. Collecting information on the regulatory emissions base is useful for at least two reasons: first, as the preliminary steps towards the relevant emission base, second in the perspective of potential further analysis (e.g., computing effective tax rates for fiscal instruments) (IFCMA(2023)8/FINAL).

37. When the relevant emission base differs from or extends beyond the regulatory emission base, identifying emission segments can become difficult, possibly necessitating additional concepts. For instance, an instrument aimed at regulating low-emission vehicles like EVs aims to replace high-emission vehicles like ICEs and cannot be fully captured by simply assessing the policy base of EV emissions. This regulatory emission base in this example would only account for Scope 2 emissions, i.e., those related to emissions from power generation caused by electricity use in Evs. In this case, the relevant emission base would be the emissions of the ICEs. A more detailed discussion of these concepts is to be found in the (IFCMA(2023)8/FINAL).

38. The Dutch and Swiss policies in this section are mapped based on currently available emission data. They illustrate the opportunities and challenges associated with scaling up mapping to a larger set of instruments and countries. To provide these practical insights into the mapping process, this chapter applies the concepts outlined in IFCMA(2023)8/FINAL to Dutch and Swiss road transport policy instruments.

3.1. Identifying the emission base

39. Attributes of policy instruments necessary to identify the emission base of Dutch and Swiss policy instruments, especially those relevant to the policy base, are collected during the stocktaking process. Table 3.1 shows attributes that help characterise the policy base, which in turn helps identify an instrument's regulatory emission base in the road transport sector.

Table 3.1. Attributes characterising the policy based relevant for emissions mapping

Attributes for mapping to emissions	Categories for Netherland and Switzerland
Vehicle type	passenger car; freight light truck; freight heavy truck; bus; motorcycle
Ownership	personal; company (commercial, public)
Powertrain	internal combustion engine (ICE); plug-in hybrid EV (PHEV); battery EV (BEV); fuel cell EV (FCEV)
Status	new; second hand; existing
Fuel	biodiesel; biogasoline; diesel; electricity; gasoline; hydrogen; natural gas; LPG
Other	user (taxi drivers, disabled persons, diplomats, low-income households…) or other attributes (content and production origin…)

Note: Information in blue show those parameters which could be mapped with the granularity of emission data proposed in this note. This table presents attributes and related options collected for the road transport stocktake of the Netherlands and Switzerland.
Source: Authors.

40. Early results show that for many road transport policy instruments, and particularly sub-schemes of policy instruments, mapping to the policy base can be carried out at the level of four key attributes: 1) type of vehicle; 2) vehicle status; 3) type of powertrain and fuel; 4) ownership. These attributes are the most frequently used when defining the policy base for policy instruments in the road transport sector. However, even at this level of granularity, disaggregating the regulatory emission base can be challenging due to data limitations, as discussed in Section 3.3.

41. Based on the identification of the policy base, step 3 involves splitting total road transport emissions into segments corresponding to attributes referred to by policy instruments. This process can be applied to both narrowly defined bases and broader specifications of the base. For instance, a subsidy for personal electric vehicles in the Netherlands regulates a narrowly defined set of assets in its policy base: new, personally owned battery electric vehicles. In contrast, the standard rate for annual motor vehicle taxes in Switzerland's Canton of Bern applies broadly to various assets, covering passenger cars with different powertrains and ownership types, new and old.

3.2. Identifying relevant emission base segments

42. With the concepts of regulatory and relevant emission bases in mind, step 3 focuses on establishing the link between a policy instrument and its emission base by identifying specific emission segments. This step can be relatively straightforward for policy instruments where the regulatory and relevant emission bases fully overlap, such as in the case of CO_2 emission standards for passenger cars. However, it becomes more complex when these bases diverge, as is the case of policy instruments aiming to promote low-carbon technologies like EVs to replace high-emission vehicles like ICE vehicles.

43. Considerations for identifying the relevant emission base in cases where it extends beyond the regulatory emission base can include defining the scope of potential substitution (e.g., from ICE vehicles to other modes of transport), establishing a hierarchy of low-carbon technologies (e.g., EVs vs. natural gas

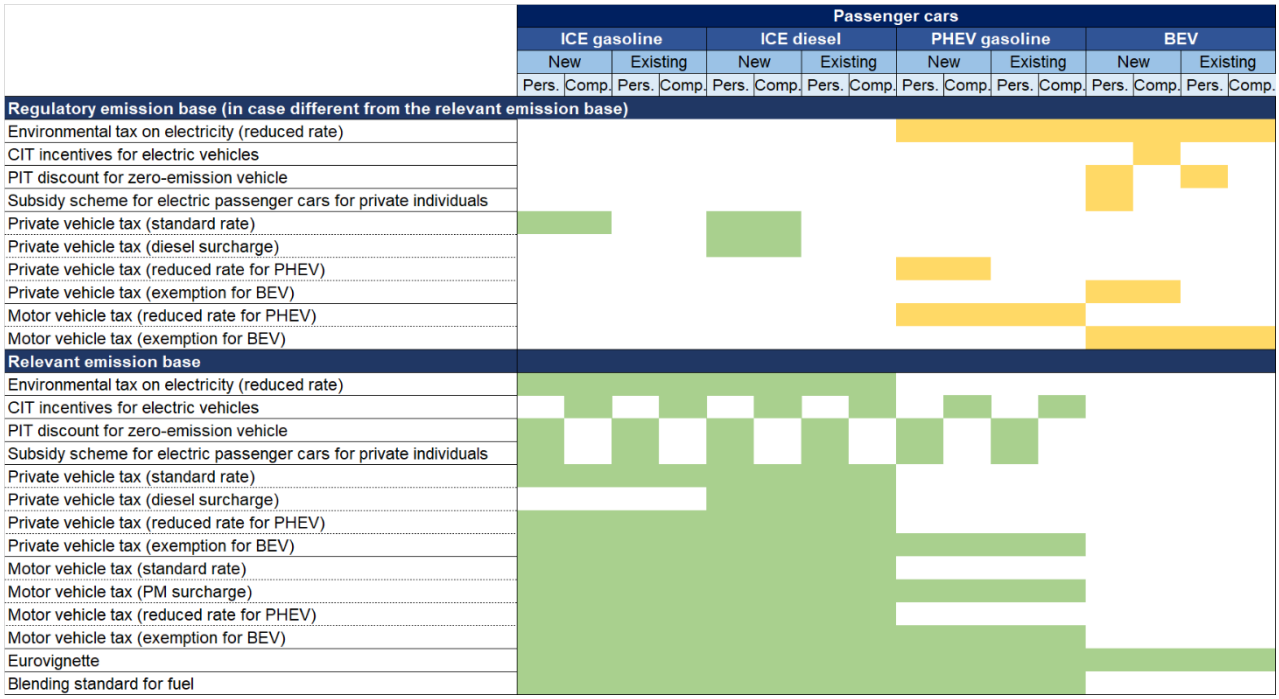
vehicles), and considering the temporal aspect of policy impacts (e.g., short-term vs. long-term emissions reduction). Therefore, the definition of the relevant emission base may be a matter of expert opinion. For example, the relevant emission base of the Dutch subsidy scheme for personal EVs arguably covers all Dutch emissions from personal ICE vehicles, but it could also be interpreted as covering only a subset of these ICEs. This is because there may not be a one-to-one correspondence between EV and ICE vehicles; they may not be perfect substitutes for the entire ICE vehicle fleet.

44. Figure 3.3 and Figure 3.4 illustrate the splitting of the regulatory emission base and the relevant emission base. The policy base, as discussed earlier, is defined using the key attributes defining the scope of the instrument: type of vehicle (i.e. passenger cars), vehicle status, powertrain and fuel (i.e. ICE gasoline, ICE diesel, PHEV gasoline, BEV) and ownership (i.e. personal or company car). For the relevant emission base, the relevant segments depend on whether the instrument is designed to directly reduce emissions or to substitute high-emission vehicles with low-emission vehicles. For simplicity, the assumption for this latter case, is that low-emission vehicles would replace the entire ICE vehicle fleet. Accordingly, the resulting emission bases should be understood as covering the emissions of the assets the policy instrument *regulates* and the emissions that the instrument *aims to mitigate.* So here the regulatory emissions base covers the emissions from the power use of EVs, and the relevant emission base covers the emissions of the ICE vehicles fleet.

45. The set of policy instruments used to carry out the mapping in this note represents a diversity of instrument design in the Netherlands and Switzerland covering the full scope of categories of instruments, including market-based and regulatory instruments. The set of instruments includes those for which the regulatory and relevant emission bases differ and those for which the two bases are aligned. For the Netherlands, the mapping is illustrated via the environmental tax on electricity, the CIT and PIT incentives for zero-emission vehicles, and the private vehicle tax rates applied to different powertrain categories, as well as a motor vehicle tax, and the Eurovignette. In the case of the environmental tax on electricity (i.e. the reduced rate on electricity), the regulatory emission base concerns all personal and company vehicles, new and existing that can be powered by electricity. The regulatory emission base thus tracks emission related to electricity generation (Scope 2). The corresponding relevant emission base covers all emissions from ICE passenger cars since the instrument is meant to support the replacement of these high-emitting vehicles. On the other hand, the CIT and PIT incentives apply to a narrower regulatory emission base, to company and personal BEV, respectively. Similar to the environmental tax, the CIT and PIT measures incentivise the uptake of low-emission vehicles to replace ICE vehicles. Thus, the relevant emission base is all emissions from company ICE passenger cars in the case of the CIT incentive and all emissions from personal ICE passenger cars in the case of the PIT incentive.

46. Those instruments for which the regulatory and relevant emission base align, such as the motor vehicle tax, the Eurovignette and the blending standard for fuel, the mapping is based on the definition of the policy base. For both the motor vehicle tax and blending standard for fuel, the emission base is all ICE vehicles including PHEVs. The Eurovignette covers emissions from the whole fleet of passenger cars.

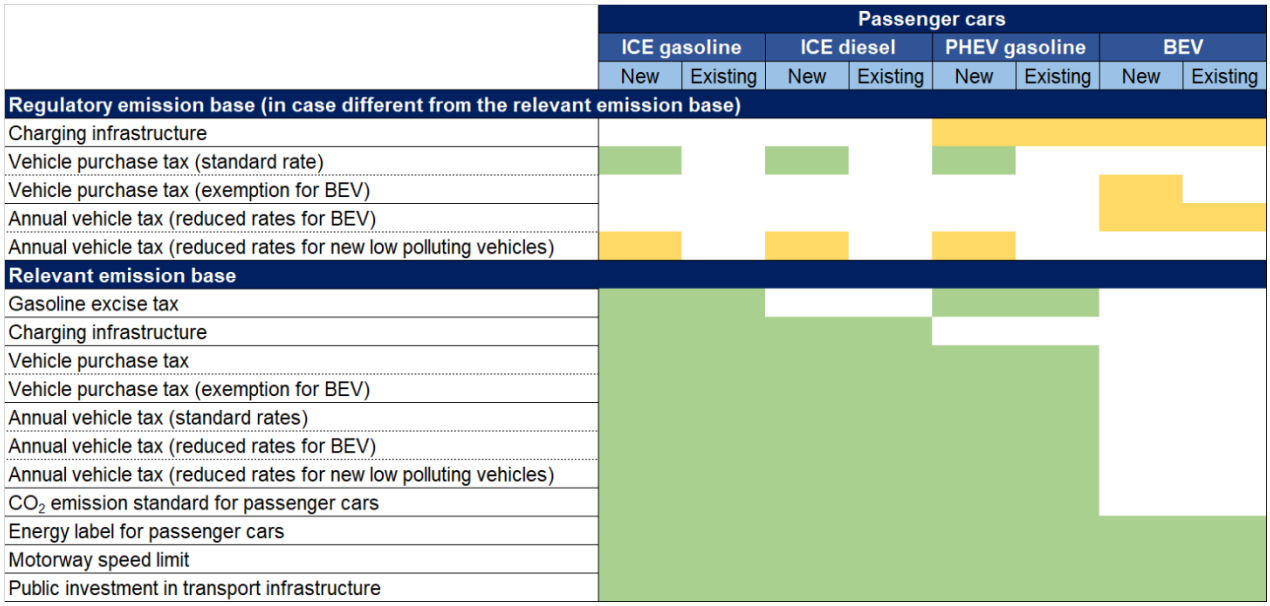
Figure 3.3. Regulatory and relevant emission base of selected policy instruments for passenger cars in the Netherlands



Note: Incentives to low carbon technologies are highlighted in yellow.
Source: Authors research.

47. As in the Netherlands, policy instruments considered in Switzerland also cover the full scope of categories of instruments, including market-based and regulatory instruments, i.e. those that support the expansion of EV charging infrastructure, the vehicle purchase tax and annual vehicle tax with differentiated rates for EV and new low-polluting vehicles, the CO_2 emissions standard, energy label for passenger cars, motorway speed limit and public investment in transport infrastructure. The policy instrument supporting the expansion of charging infrastructure for EVs, albeit not directly defined in terms of vehicle attributes, its regulatory emission base is still identified by specifying which vehicles would benefit from enabling conditions for the uptake of EVs. In this case, the regulatory emission base is related to emissions generated by all EVs, including PHEVs. Relatedly, the relevant emission base is then emissions from all ICE vehicles. For the CO_2 emissions standard, the emission base is all passenger cars except battery electric vehicles (BEV). Other instruments that apply to all vehicles, such as an energy label for passenger cars, cover the entire emission base of passenger cars.

Figure 3.4. Regulatory and relevant emission base of selected policy instruments for passenger cars in Switzerland



Note: Incentives to low carbon technologies are highlighted in yellow. Annual motor vehicle tax in Bern.
Source: Authors research.

3.3. Computing emissions data for each segment of the emission base

48. In step 4, once the segments of the regulatory and relevant emission bases are identified, emissions data can be disaggregated into these segments. Ideally, emissions data would be available at a granular level to match specific segments accurately. For example, the segment covered by Swiss CO_2 emission standards for passenger cars can directly be matched to official UNFCCC emission data which is reported.

49. However, in many cases, emissions data may not be available at the required level of granularity, particularly for narrower or more specific policy bases. This is a common challenge for road transport policy instruments. If so, sector-level data, such as vehicle fleet data, can be used to estimate emissions. For instance, one approach is to approximate emissions based on the composition of the vehicle fleet, where data on the share of the regulated asset within the total fleet is applied to total emissions from road transport. Shares of vehicles covered by each segment are computed based on a combination of different datasets. Data regarding type of powertrain and ownership and on the type of electric vehicles are both obtained from the National Statistical Office(CBS, 2023[5]) (CBS, 2021[6]). Distinctions between new and existing vehicles were estimated using European Environment Agency information on new vehicle registrations for Netherlands (EEA, 2023[7]). Together, these datasets allow for the splitting of the car fleet according to the most common vehicle attributes. Figure 3.5 shows the resulting disaggregation of the passenger car fleet in the Netherlands using these data sources.

Figure 3.5. Composition of the vehicle fleet by vehicle class in the Netherlands

Passenger cars 100%															
ICE gasoline 84%				ICE diesel 12%				PHEV gasoline 1%				BEV 2%			
New 3%		Existing 97%		New 1%		Existing 99%		New 16%		Existing 84%		New 42%		Existing 58%	
Pers. 90%	Comp. 10%	Pers. 90%	Comp. 10%	Pers. 90%	Comp. 10%	Pers. 90%	Comp. 10%	Pers. 65%	Comp. 35%	Pers. 43%	Comp. 57%	Pers. 23%	Comp. 77%	Pers. 20%	Comp. 80%

Source: (National statistical office (CBS), 2023[8])

50. Emissions data may have a time lag of 1-2 years or more, which means that data collected for policy instruments in a given year may not align precisely with emissions data from that year. However, the lag typically does not significantly impact the analysis because emissions data tends to vary only slightly from year to year at the aggregation levels typically used for reporting.

51. Finally, harmonising different accounting methodologies for emissions and sector data is crucial. For example, differences between territory-based emissions (used as the reference for mapping) and residency-based emissions should be carefully considered. IPCC emissions data is territory-based, relying on domestic fuel consumption, while fleet datasets are often residency-based, tracking vehicles registered in a specific country. Table 3.2 shows different sets of emissions and fleet data and their properties. Insights from future IFCMA pilot studies will shed light on data availability and trade-offs between approaches.

Table 3.2. Selected sources for road transport emissions and fleet data

Source	Focus	Disaggregation level in optimal case	Geographical scope and timeliness
UNFCCC, Annex 1 and Non-Annex 1 countries	Emissions	Road transport x fuel x vehicles categories	Vehicle categories level and yearly update for Annex I countries only
IEA, Emissions from fuel combustion	Emissions	Road transport x fuel	IEA countries
CAIT	Emissions	Road transport	All countries; yearly
IEA, Energy efficiency indicators	Emissions	Vehicle category	Some IEA countries depending on responses to questionnaires
ITF-Eurostat-UNECE	Fleet	Vehicles category x (weight | age | [for lorries] load capacity)	Yearly
IEA, Momo (mobility model) and ITF, fleet model	Fleet		By regions
Consulting firms, fleet data	Fleet	Vehicles category x powertrain x fuel x age x weight	Yearly Most of IFCMA countries
Consulting firms, registration data	Fleet	Cars x powertrain x fuel x weight x emissions x prices x ownership	Yearly Emissions and prices only for cars in selected countries Ownership only in selected countries
Countries, publicly available data or registration data	Fleet		

Source: Authors

4 Lessons learned and outlook

52. Since the release of the first version of this note, IFCMA pilot country studies on Switzerland and Chile have been advancing, with the stocktake and mapping exercise already concluded, and further pilots have been initiated for Nigeria and Mauritius. Pilots studies are conducted to inform scaling up empirical work to a broader set of IFCMA members.. Alongside the results described in this note, experiences from the pilot studies have already helped refine the early insights set out in this note and provide answers to the challenges encountered during the stocktake as well as the application of the mapping methodology of the Dutch and Swiss road transport sectors (IFCMA(2023)8/FINAL).

53. While the country pilot studies will cover multiple sectors, this note shows that narrowing the scope to subsectors, and assets accounting for the bulk of emissions, may be appropriate to keep the scope feasible and facilitate scaling up, without significant loss of comprehensiveness. As the road sector example shows, a focus on assets responsible for the bulk of emissions, such as passenger cars, within a subsector may be useful. If the choice of subsectors and emitting assets are defined narrowly initially, they could be broadened beyond these choices at a later point. Similarly, the broad range of mitigation-relevant policy instruments collected in this subsectormay need to be reduced in future mapping exercises based on pilot studies insights.

54. The stocktaking for Dutch and Swiss road transport reveals possible paths forward on subnational policies. A possible way forward for ensuring that the scaling up of the stocktaking would remain feasible would be to undertake the full stocktake only for the subnational jurisdictions accounting for the bulk of emissions in a country. In case of minor policy deviations at the subnational level, case-by-case decisions could be made on the inclusion of those as sub-schemes or possibly as separate policy instruments for major deviations.

55. This note also provides first insights into the attributes needed to comprehensively describe policy instruments, those referring to intensity and the policy base. As practical experience shows, the stocktaking requires a balance between standardisation of attribute observations and comprehensiveness of policy instrument description. Based on the early application of stocktaking and mapping concepts in this note, a follow-up IFCMA note will present a common data structure across the emission sectors. That note will provide a template that ensures comparability and usability of the database, while allowing flexibility to capture relevant policy details.

56. As the preliminary mapping in this note reveals, mapping based on selected attributes defining the policy base may be a feasible compromise between mapping in granular detail and mapping with the emissions data available. With a combination of publicly available data, limited ad hoc requests to national administrations and the possible acquisition of commercial data e.g. on vehicle fleets as well as a focus on policy instrument details that matches this data, a sizable share of policy instruments can be mapped. In more complex cases, mapping to a broader emission base as a proxy may be an appropriate way forward.

References

Asian Development Bank (2003), *Policy Guidelines for Reducing Vehicle Emissions in Asia: Cleaner Two and Three Wheelers*, https://www.adb.org/publications/policy-guidelines-reducing-vehicle-emissions-asia-cleaner-two-and-three-wheelers. [34]

Belastingdienst (2023), *Exemption BZM*, https://www.belastingdienst.nl/wps/wcm/connect/bldcontentnl/belastingdienst/prive/auto_en_vervoer/belastingen_op_auto_en_motor/belasting_zware_motorrijtuigen/vrijstelling_bzm. [37]

Canton de Berne (2023), *Calcul de la taxe sur la circulation routière*, https://www.svsa.sid.be.ch/fr/start/fahrzeuge/steuern-gebuehren/fahrzeugsteuer.html. [30]

CBS (2023), , https://opendata.cbs.nl/#/CBS/nl/dataset/85237NED/table?ts=1686744127458. [5]

CBS (2021), *How many electric cars are driving around?*, https://longreads.cbs.nl/the-netherlands-in-numbers-2021/how-many-electric-cars-are-driving-around/. [6]

Celani, A., L. Dressler and M. Wermelinger (2022), "Building an Investment Tax Incentives database: Methodology and initial findings for 36 developing countries"*, OECD Working Papers on International Investment*, No. 2022/01, OECD Publishing, Paris, https://doi.org/10.1787/62e075a9-en. [14]

Craft, E. and R. Schmidt (2005), "An Analysis of the Effects of Vehicle Property Taxes on Vehicle Demand", *National Tax Journal*, Vol. 58/4, pp. 697-720, https://doi.org/10.17310/ntj.2005.4.05. [22]

D'Arcangelo, F. et al. (2022), "Estimating the CO2 emission and revenue effects of carbon pricing: New evidence from a large cross-country dataset"*, OECD Economics Department Working Papers*, No. 1732, OECD Publishing, Paris, https://doi.org/10.1787/39aa16d4-en. [23]

Dellink, R. et al. (2023), "Approaches to assessing the impacts of mitigation actions on greenhouse gas emissions". [27]

Dutch Road Authority (RDW) (2023), *Open data*, https://www.rdw.nl/over-rdw/dienstverlening/open-data. [45]

EEA (2023), *Monitoring of CO2 emissions from passenger cars Regulation (EU) 2019/631*, https://www.eea.europa.eu/en/datahub/datahubitem-view/fa8b1229-3db6-495d-b18e-9c9b3267c02b. [7]

Federal Office for Customs and Borders (2023), *Bases juridiques de l'impôt sur les véhicules automobiles*, https://www.bazg.admin.ch/bazg/fr/home/documentation/bases-legales/perception-de-redevances/bases-juridiques-de-l-impot-sur-les-vehicules-automobiles.html. [29]

GHG Protocol (2023), , https://ghgprotocol.org/sites/default/files/standards_supporting/FAQ.pdf. [42]

Granger, H. et al. (2021), ""Green" motor taxation: issues and policy options in sub-Saharan Africa", https://www.taxdev.org/research-publications/green-motor-taxation-issues-and-policy-options-sub-saharan-africa. [38]

IEA (2023), , https://www.iea.org/data-and-statistics/data-product/world-energy-balances. [26]

IEA (2023), *Energy end-uses and efficiency indicators*, https://www.iea.org/data-and-statistics/data-product/energy-efficiency-indicators#transport. [36]

IEA (2023), *Rail*, https://www.iea.org/energy-system/transport/rail. [32]

IEA (2021), *Vehicle fuel economy in major car markets 2005-2019*, https://iea.blob.core.windows.net/assets/79a0ee25-9122-4048-84fe-c6b8823f77f8/GlobalFuelEconomyInitiative2021.pdf. [41]

IEA, P. (ed.) (2022), *Global CO2 emissions from transport by subsector, 2000-2030*, https://www.iea.org/data-and-statistics/charts/global-co2-emissions-from-transport-by-subsector-2000-2030. [18]

IPCC (2006), *Guidelines for National Greenhouse Gas Inventories*, https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_3_Ch3_Mobile_Combustion.pdf. [17]

Jaramillo, P. et al. (2022), *Transport*. [35]

Légifrance (2023), *Code des impositions sur les biens et services, Article L312-39*, https://www.legifrance.gouv.fr/codes/section_lc/LEGITEXT000044595989/LEGISCTA000044598377/. [33]

Nachtigall, D. et al. (2022), "The climate actions and policies measurement framework: A structured and harmonised climate policy database to monitor countries' mitigation action", *OECD Environment Working Papers*, No. 203, OECD Publishing, Paris, https://doi.org/10.1787/2caa60ce-en. [19]

National statistical office (CBS) (2023), *StatLine, Transport*, https://opendata.cbs.nl/#/CBS/nl/navigatieScherm/thema?themaNr=9440. [8]

OECD (2023), *Inventory of Support Measures for Fossil Fuel*, https://www.oecd.org/fossil-fuels/. [2]

OECD (2022), *Carbon pricing and energy taxation database*, https://stats.oecd.org/Index.aspx?DataSetCode=ECRS. [1]

OECD (2022), *Consumption Tax Trends 2022: VAT/GST and Excise, Core Design Features and Trends*, OECD Publishing, Paris, https://doi.org/10.1787/6525a942-en. [3]

OECD (2022), *Pricing Greenhouse Gas Emissions: Turning Climate Targets into Climate Action*, OECD Series on Carbon Pricing and Energy Taxation, OECD Publishing, Paris, https://doi.org/10.1787/e9778969-en. [48]

Office fédéral de la statistique (2023), *Véhicules*, https://www.bfs.admin.ch/bfs/fr/home/statistiques/mobilite-transports/infrastructures-transport-vehicules/vehicules.html. [43]

Office fédéral des routes (2023), *Données relative aux véhicules*, https://www.astra.admin.ch/astra/fr/home/documentation/donnees-et-produits-information/donnees-relatives-aux-vehicules.html. [44]

Panos, E. (2021), *Repository of co-identified policies and contextual factors for Switzerland and major European countries. Deliverable 1.2. Swiss decarbonisation pathways towards zero CO2 emissions (POLIZERO) project.*, Swiss Federal Office for Energy, https://www.polizero.ch/energy-and-climate-policy-inventory. [21]

Panos, E. et al. (2021), *Repository of co-identified policies and contextual factors for Switzerland and major European countries. Deliverable 1.2. Swiss decarbonisation pathways towards zero CO2 emissions (POLIZERO) project.*, https://polizero.ch/energy-and-climate-policy-inventory. [28]

Panos, E. et al. (2021), *Repository of co-identified policies and contextual factors for Switzerland and major European countries. Deliverable 1.2. Swiss decarbonisation pathways towards zero CO2 emissions (POLIZERO) project.*, https://polizero.ch/energy-and-climate-policy-inventory. [31]

Röttgers, D. and D. Nachtigall (2023), *Approaches to stocktaking and mapping of climate change mitigation policies*, Submitted to the IFCMA for its February 2023 meeting. [46]

Röttgers, D. and D. Nachtigall (2023), *Scoping note*. [12]

RVO (2023), *MIA and Vamil*, https://english.rvo.nl/subsidies-programmes/mia-and-vamil. [16]

RVO (2023), *Subsidieregeling Elektrische Personenauto's Particulieren (SEPP)*, https://www.rvo.nl/subsidies-financiering/sepp. [15]

S&P (2023), *Global New Vehicle Registration*, https://www.marketplace.spglobal.com/en/datasets/global-new-vehicle-registrations-(248). [40]

Sanz Sánchez, M., S. Bhattacharya and K. Mareckova (2006), *Chapter 8: Reporting Guidance and Tables*, https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/1_Volume1/V1_8_Ch8_Reporting_Guidance.pdf. [4]

SII (2023), *Tasación vehículos*, https://www4.sii.cl/vehiculospubui/#/searchtasacion. [13]

TSC (2018), , https://www.tcs.ch/fr/tests-conseils/conseils/environnement-mobilite/taxe-automobile-cantons.php. [11]

UNECE (2021), "UNECE Statistical Database", https://w3.unece.org/PXWeb2015/pxweb/en/STAT/STAT__40-TRTRANS__03-TRRoadFleet. [39]

UNEP (2021), , https://www.unep.org/es/node/28859. [20]

UNFCCC (2023), *Flexible queries*, https://di.unfccc.int/flex_annex1. [25]

UNFCCC (2021), *Flexible queries for Annex I countries*, https://di.unfccc.int/flex_annex1. [24]

UNFCCC (2020), *Greenhouse Gas Inventory Data - Flexible Queries Annex I Parties*, https://di.unfccc.int/flex_annex1. [9]

Van Dender, K. (2019), "Taxing vehicles, fuels, and road use: Opportunities for improving transport tax practice", *OECD Taxation Working Papers*, No. 44, OECD Publishing, Paris, https://doi.org/10.1787/e7f1d771-en. [47]

Zhinan Chen, Z. (2022), *Overview of asian and asia-pacific passenger vehicle taxation policies and their potential to drive low-emission vehicle purchases*, ICCT, https://theicct.org/publication/asia-vehicle-taxation-jan22/. [10]



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