Impact Assessment study for the review of Directive 2009/33 on the Promotion of Clean and Energy-Efficient Road Transport Vehicles

Final report - Annexes

Study contract no. MOVE/C1/2016-476/SI2.740207

Transport and Environmental Policy Research

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Annex 1 INTERVIEW SCRIPT - TARGETED INTERVIEWS

Study supporting an Impact Assessment for the review of the Clean Vehicle Directive (CVD)

Targeted Stakeholder Interviews

1.1 BACKGROUND INFORMATION

Ricardo Energy & Environment and TEPR have been commissioned by the European Commission (DG MOVE) to undertake a study supporting the Commission in the development of an Impact Assessment (IA) for the review of Directive 2009/33/EC on the Promotion of Clean and Energy-Efficient Road Transport Vehicles, also known as the Clean Vehicle Directive (CVD).

The Directive was evaluated in December 2015. The evaluation found that the principal purpose of the Directive is still relevant, but that it had not proved to be effective in its current form, so should be revised. Problems detected included:

- *Overall functioning:* Limitations in the scope, e.g. little vehicle procurement falls under its remit; Directive covers the procurement of vehicles, but not services.
- *Ineffectiveness and inefficiency*: Different options for implementing the Directive contribute to a patchwork of approaches in Member States, fragmentation makes monitoring difficult, lack of definition of a clean vehicle leads to lack of focus.
- *Wrong incentives of the monetisation methodology:* Methodology has bias towards energy efficiency, leading to lower relevance of emissions, in particular air pollution, and can benefit conventionally fuelled vehicles over low-emission vehicles.

In line with the evaluation, an initial list of options covers two broad areas for the potential revision of Directive 2009/33/EC:

a) Expanding the scope of the Directive; and
b) Changing the implementation mechanisms, with different sub-options for revising the current mechanisms, including:
    a. Revision of the monetisation methodology
    b. Introduction of a minimum requirement, based on an absolute definition of a clean vehicle
    c. Retaining the monetisation methodology and including a definition of a clean vehicle with related minimum procurement provisions with potentially a mandatory choice for Member States between these two alternatives.

The study team undertook a number of exploratory interviews with selected stakeholders in December 2016 and January 2017, which explored the options to be considered later in the project and identified initial views on these options in order to ensure that appropriate options are taken forward. A public consultation was launched on 19th December and closes on 24th March 2017.

This round of interviews explores in more detail some of the potential policy measures that will be subsequently assessed within the IA.

This interview therefore considers the following issues:

- Extending the scope of the Directive
- Defining the basis of a minimum procurement requirement, e.g. on a definition of a clean vehicle
- Setting up a minimum procurement requirement
- Monetisation methodology

It is important to note that if the Directive is amended, it is likely that the associated changes would not come into force until approximately 2020/21. This should be taken into consideration when responding to questions.

1.2 Section 1: Stakeholder details

- Name:
- Organisation:
- Stakeholder type:
- Email address:
- Telephone number:
- Interviewer:
- Interview date:

Use of your feedback (please indicate how you would like your input to be used, below):

The study team will keep detailed notes of the discussion and will make use of your contribution only for the needs of this study. Please indicate how you would like us to present the information provided during our discussion and any other information or data you provide to us:

	Publication of your contribution with personal information (e.g. Your name/ organisation/ City/ Member State)
	Anonymised publication of statements made (without your name or the name of your organisation)
	No publication but use of the contribution for statistical and analytical purposes
	Other - please give details;

1.3 Section 2: Expanding the scope of the Directive – Exploring policy measures

The following options are being considered to extend the scope of the Directive:

a) Remove the procurement threshold, thus ensuring that all vehicles purchased by public authorities are covered by the Directive.

b) Extend the scope of the Directive to vehicles rented, leased and hire-purchased.

c) Extend the scope of the Directive to selected transport services procured by public authorities.

d) Extend the scope of the Directive to all contracts that have a major transport element.

There are questions on each of these options below. Where you do not support extending the scope in accordance with an option, we will not discuss the subsequent questions unless you wish to add your thoughts.

Option a: Remove the procurement threshold, thus ensuring that all vehicles purchased by public contracting authorities or contracting entities or operators for the discharge of public service obligations are covered by the Directive

Discussion: Certain stakeholders have expressed concern that removing the current procurement threshold (set at €414,000[1]) would disproportionately increase the administrative burden for smaller contracts. Consequently, it would seem to be important to have a threshold at some level, even if this might be lower than the current threshold. However, it is not clear at which level a revised threshold should be set.

Question:

1. Which of the following would you support?
    a) The removal of the current threshold, so there would be no threshold – the Directive would apply to all procurement contracts.
    b) The reduction of the current threshold – to a level to be determined.
    c) Retain the current threshold.
    d) Don't know.

    Please explain your answer.

Option b: Extend the scope of the Directive to vehicles rented, leased and hire-purchased

Discussion: As the way in which public authorities procure vehicles is changing with an increasing proportion of vehicles being leased or rented, it is important to consider extending the scope of the Directive to these types of procurement. Some stakeholders have given early indications that they would support this option. However, it has been suggested that the extension of the scope to rental vehicles is premature because there are not yet sufficient numbers of 'clean vehicles' in rental fleets.

Question:

2. Which of the following would you support (select all that apply)?
    a) Extension of the scope of the Directive to rented vehicles.

[1] Article 3(b) of the CVD referring to Article 15(a) of Directive 2014/25

b) Extension of the scope of the Directive to leased and hire-purchased vehicles
c) I do not support either of these options for extending the scope of the Directive.

Please explain your answer.

Option c: Extend the scope of the Directive to selected transport services procured by public authorities

Discussion: As the way in which public authorities procure vehicles is changing with an increasing proportion of services being procured, rather than being operated using the authority's own vehicles, it is important to consider extending the scope of the Directive to these types of procurement activities. This option for extending the scope of the Directive also seems to have some support from certain stakeholders.

Question:

3. Do you support extending the scope of the Directive to selected transport services procured by public authorities?

   Please explain your answer.

Option d: Extend the scope of the Directive to all contracts that have a major transport element

Discussion: The transport 'footprint' of public authorities consists not only of the transport services that they procure, but also the transport required for other contracts that they procure. In such contracts, such as construction contracts, transport is not the main element, but is nonetheless important.

Question:

4. Do you support extending the scope of the Directive to all contracts that have a major transport element?

   Please explain your answer.

1.4 Section 3: Defining the basis of a minimum procurement requirement

As noted above, in the course of the evaluation, an issue that was mentioned was the lack of clear requirements for procurement action, e.g. a minimum requirement based on a definition of a clean vehicle. Such a definition could be based on various different criteria, which are explored in this section, and could be applied within the Directive in various ways, which is covered in the next section. *The following criteria could be used to define a clean vehicle:*

a) *Vehicles that have tailpipe CO_2 emissions below a specified threshold.*
b) *Vehicles that have lifecycle GHG emissions below a certain threshold.*
c) *Vehicles that have real world air pollutant emissions below a certain threshold.*
d) *Any vehicles using an alternative fuel as defined by Article 2(1) of the Alternative Fuels Infrastructure Directive (AFID)[2].*
e) *Vehicles that have zero tailpipe CO_2 emissions.*

Discussion: While defining a clean vehicle according to its CO_2 emissions is straightforward for a car or light commercial vehicle (LCV), information to do this for heavy goods vehicles (HGVs) and buses does not exist until the data has been measured and monitored by VECTO. VECTO will be initially be operable for conventionally-fuelled trucks, but it will take more time to make it operable for buses. At the moment, VECTO is also measuring only conventionally-fuelled vehicles, so no hybrids for example[3]. It is therefore difficult at this stage to identify an appropriate CO_2-based threshold (under either Option a) or b) for HGVs. For Option c), given that the provisions of an amended Directive would probably not need to be applied before 2020, it is not clear how relevant a definition based on air pollutant emissions would be (even one based on real driving emissions (RDE) for cars and vans).

Questions:
5. Which, if any, of these options for defining a clean vehicle would you support? Please explain your answer.
6. Do you agree that thresholds need to become more stringent over time in order to keep the definition of a clean vehicle relevant?

Discussion: Certain stakeholders have suggested an approach which would introduce a label/scale (e.g. A to G) whereby A to D are initially included in the clean vehicle definition, and as the market develops, categories are excluded until only A remains in the definition (the other categories would remain as guidance for private buyers). Vehicles would be allocated to a specific category on the basis of their lifecycle GHG emissions and Euro

[2] Directive 2014/94, which defines the following as alternative fuels: electricity, hydrogen, biofuels (as defined in Directive 2009/28), synthetic and paraffinic fuels, natural gas in compressed and liquefied forms and including biomethane, and LPG.

[3] Vehicle Energy consumption Calculation Tool – simulation method showing fuel consumption per tonne-km in a standardised vehicle.

emissions standard. This approach allows for different ambition levels whilst harmonising the demand in a certain direction.

Question:
7. Would you support defining a clean vehicle using such ***an approach***? What challenges might the implementation of such an approach face and how could these be overcome?

1.5 Section 4: Setting up a minimum procurement requirement

In order to set up a minimum (procurement) requirement, a number of factors need to be considered; *A minimum requirement, based on a definition of a clean vehicle, could be applied in a number of ways:*

a) *An explicit, quantified minimum requirement set by the Directive to be* ***applied in all*** *Member States*
b) *Explicit, quantified minimum requirements set by the Directive* ***differentiated between*** *Member States*
c) *Requirement in the Directive for Member States to set* ***national targets***

Discussion: The first and third options for ***applying a minimum requirement*** (Options a) and b) are relatively straightforward; all that has to be decided is the level of the minimum requirement that should be applied in all Member States in Option a). Option b) is more complex, as it requires the identification of a basis on which to differentiate the minimum requirements to be applied in each Member State. These minimum requirements should be differentiated in a way that takes account of each Member State's capacity to purchase clean vehicles. A potential reference point is the way in which the EU's greenhouse gas reductions requirements have been shared between Member States under the proposed Effort Sharing Regulation. Under this proposal, Sweden and Luxembourg have to reduce their GHG emissions by 40% between 2005 and 2030, whereas Romania only has to reduce its GHG emissions by 2%[4]. These proposed targets take account of a Member State's GDP per capita and thus their capacity to reduce GHG emissions. These proposed targets could be used as the basis of differentiating the 'clean vehicle' mandate between Member States. While the overall level of the minimum requirement will need to be determined, Sweden and Luxembourg's would be 20 times that of Romania's.

Question:

8. Which, if any, of the options for ***applying a minimum requirement*** would you support? Please explain your answer.

The level at which the minimum requirement is to be set, whichever of the above options is chosen, is linked to the threshold to be used, which is based on the criterion to be used for defining a 'clean vehicle'. For example, if the chosen threshold was zero tailpipe CO_2 emissions, the level at which the minimum requirement would be set would have to be low as there are not that many vehicles with zero tailpipe CO_2 emissions on the market. *Options for setting the threshold and the mandate include:*

a) *Setting a demanding threshold, in which case the minimum requirement would need to be low*
b) *Setting a less demanding threshold, in which case the minimum requirement would need to be higher*
c) *Setting a very low threshold, so that the minimum requirement applies to all vehicles procured (i.e. the minimum requirement would effectively be 100%)*

[4] European Commission (2016) 'Source: Factsheet on the Commission's proposal on binding greenhouse gas emission reductions for Member States (2021-2030)'

d) *For Options a) and b), a sub-option would be to differentiate between categories of 'clean vehicle', e.g. between low and zero emission vehicles, which would count differently towards delivering the minimum requirement.*

Discussion: There are different potential rationales for setting the ***level of the minimum requirement and the threshold***. If the Directive is seen as a driver for the 'cleanest' vehicles, Option a) might be most appropriate, whereas if it was seen as a means of ensuring that a range of different low emission vehicles come on to the market, Option c) might be more appropriate. The aim of Option d) is to reflect that some of the different types of vehicle that might be considered to be 'clean' are in fact 'cleaner' than others. For definitions based on emissions, different categories of 'clean vehicle' could be defined on the basis of different levels of emissions. If a clean vehicle is defined by the fuel it uses, vehicles could be allocated to different categories of 'clean vehicle' depending on their relative environmental performance. It is less clear how this option could be applied if a clean vehicle was defined as one with zero tailpipe CO_2 emissions. In each case, vehicles in the 'cleaner categories' would count more towards delivering the minimum requirement than would 'less clean' vehicles.

Question:

9. Which, if any, of these options for ***setting the level of the mandate and the threshold*** would you support? Please explain your answer.

    a) For the option that you support, how might it be implemented in the context of your preferred criterion for defining a clean vehicle?

Once the basis for the minimum requirement has been defined it is necessary to consider how it might be implemented; *Options for implementing the minimum requirement include:*

a) *Require public authorities to use the definition of a clean vehicle (i.e. the chosen criterion and threshold) when procuring vehicles, but do not specify how.*

b) *Require public authorities to apply the minimum requirement to each relevant procurement contract.*

c) *Require public authorities to deliver the minimum requirement over a fixed time period.*

d) *As above, set a very low threshold, in which case the minimum requirement applies to all vehicles procured.*

Discussion: A mandatory minimum requirement would ensure that the revised Directive improves the uptake of clean vehicles by public authorities by requiring these to be procured (or used in contracts), but such an approach has the potential to increase public authorities' costs, at least in the short-term. A concern has been raised that requiring the delivery of the minimum requirement over a fixed period of time (Option c) would be difficult to monitor and enforce, so it would be more appropriate to apply a minimum requirement per contract (Option b). An argument against applying a minimum requirement to each contract or over a fixed period of time was that it would be far too complicated to procure "clean" and other vehicles at the same time, so Option a) could be preferred instead. The risk with this option is that nothing changes in practice. Option d) would not need any further consideration of how to implement the minimum requirement, as it would be applied to all vehicles purchased.

Question:

10. Which, if any, of the options for ***implementing the minimum requirement*** would you support? Please explain your answer.

   a) For whichever option you support, how could it be implemented in practice? What challenges do you see and how could these be overcome?

Differentiating a clean vehicle mandate by scope: If the scope of the Directive was expanded to fleets, e.g. those of transport service providers or the fleets of suppliers for contracts with a major transport element, it might be appropriate to apply a lower mandate to such contracts to recognise that fleets have older vehicles.

Question:

11. If you previously supported either of the ***following options for extending the scope and the implementation of a minimum requirement***, what proportion of the minimum requirement for vehicle procurement would it be appropriate to apply to:

(Please explain your answer in the context of your preferred choice of the clean vehicle definition, minimum requirement and threshold).

   a) Fleets of transport service providers?

   b) Fleets if suppliers of contracts with a major transport element?

1.6 Section 5: Monetisation methodology

The use of a monetisation methodology to determine life cycle costs as an award criteria in the Directive offers a number of benefits but was identified in the evaluation of the Directive as being overly complex, having a bias towards energy efficiency and for benefitting conventionally fuelled vehicles over low-emission vehicles.

Questions:
12. In your view should there be a requirement to follow the methodology for calculating operational lifetime costs when using energy and environmental impacts as award criteria? a) If you find it important, how should the methodology best evaluated and updated?
13. In your view, how important is it to require a regular evaluation and update of the methodology?
14. Do you have any general comment on the scope of a possible revision of the monetisation methodology?

Annex 2 METHODOLOGY

2.1 Process / methodology

The following data collection activities have been carried out:

- Desk research and data collection
- Open Public Consultation (OPC)
- Interviews with selected stakeholders
- Data Requests
- Case studies
- Workshops

An overview of each of the activities is provided in the following sections.

2.2 Desk research and data collection

The desk research relied on the identification, extraction and analysis of secondary data sources (studies, reports, databases). All relevant literature and data sources used is referenced throughout the report and a list is compiled in the references section at the end of this report.

2.3 Open public consultation

An Open Public Consultation was launched by the Commission on 19th December 2016 and was open for responses until 24th March 2017 (12 weeks).

In total, 130 responses were received (from across 20 Member States), covering a variety of stakeholder groups, as shown in Table 2-1. The public consultation ran in parallel to other activities with the aim of collecting stakeholder opinions.

In terms of geographic coverage, 13 (10%) were from EU-13 Member States, 109 (85%) were from EU-15 Member States, and 8 (5%) were unknown. The highest number of responses came from respondents based in Belgium (34), followed by France (19) and Germany (16) (see Table 2-1). Based on the information received, EU-13 Member States were under-represented in the public consultation. The study team attempted to address this imbalance by targeting additional EU-13 based stakeholders for interviews. Stakeholders within EU-13 countries were largely unreceptive within the timescales allowed, nevertheless an in-depth interview was conducted with a representative from Warsaw, Poland who shared detailed feedback and comments on the proposed amendments.

Table 2-1: Responses by country of residence

Country of residence	No. of responses	Country of residence	No. of responses
Belgium	34	Austria	3
France	19	Sweden	3
Germany	16	Ireland	2
Denmark	8	Netherlands	2
Finland	6	Croatia	1
Not listed	8	Hungary	1
Italy	5	Latvia	1
Spain	5	Portugal	1

United Kingdom	5	Slovak Republic	1
Czech Republic	4	Slovenia	1
Poland	4	TOTAL	130

The largest proportion of respondents replied on behalf of a company (33, 26%), followed by non-governmental organisations (25, 19%) and public authorities (e.g. ministry, agency, or other form of public administration) (16, 12%) with 15 (11%) participants representing themselves as an individual (see Table 2-2).

Table 2-2: Response by type of respondent

Replying as a:	No. of responses
Company	37
Contracting authority (procurer)	10
Non-governmental organisation	29
Public authority (ministry, agency, other form of public administration, at national, regional or local level)	21
An individual in your personal capacity	17
Other (including industry/trade associations, experts etc.)	27
TOTAL	143

NOTE: 130 responses were received to the OPC. However, respondents were able to select more than one option describing the capacity in which they were responding (leading to 143 responses to this question).

Responses were received from a wide spread of stakeholders. However, public authorities were under-represented in the public consultation. This can be explained to a certain extent by the fact that contributions to the public consultation by city networks such as Eurocities or Polis were representative of a larger number of cities and regions that themselves abstained from contributing individually. Contributions from large member organisations were hence analysed and weighted carefully in the analysis of the overall contributions.

The responses to the Open Public Consultation have been analysed and a detailed overview of the results is presented in the Stakeholder Consultation Report (included in Annex 5).

2.4 Interviews with stakeholders

Potentially relevant stakeholders were identified through reviewing stakeholders previously contacted during the 2012 Monitoring Report study and 2015 ex-post evaluation, as well as EU-wide organisations with links to the Directive. Stakeholders were contacted multiple times to enquire as to whether they would be willing to participate.

A total of 144 stakeholders were contacted in order to secure interviews. However, only 13 stakeholders agreed to participate in the interview programme (primarily telephone interviews).

Reasons for non-participation included time constraints (with interviews potentially taking 1 to 3 hours of a participant's time). Alternative methods of participation were offered to potential interviewees, including attendance at stakeholder workshops and/or providing information or answering questions via email.

Participants in the targeted interviews are outlined in Table 2-3. Three EU-wide stakeholders participated in the interview programme – Eurocities, UITP and ICLEI. They participated in an exploratory interview[5] at the start of the study, and undertook follow up interviews in order to explore further some of the issues that they initially raised. Additionally, these interviews were used to explore elements that might be part of an amended Directive, but which had not been covered in the exploratory interviews, such as differentiating the minimum requirements between Member States.

Six procurement authorities participated in interviews, including those based in Warsaw (PO), London (UK), Municipality of Rijssen-Holten (NL), City of Niort (FR), and two cities in Sweden and Ireland[6]. Interviews with procurement authorities explored a range of issues, including expanding the scope of the Directive, revising the monetisation methodology, defining a clean vehicle and link between a clean vehicle and minimum requirement.

Finally, four representatives of industries that could potentially be effected by an expansion of the scope of the Directive were interviewed, including FordServices Europe, DHL, GeoPost and Malta Post. They were asked to provide insight into how any changes might impact on their tendering activities. They were also asked whether or not the capacity would exist to allow public procurement authorities to specify 'clean' vehicles and meet potentially more stringent targets and requirements.

Table 2-3: Stakeholder interviews by stakeholder type

Stakeholder type	Organisations interviewed
EU Level stakeholders or associations (including NGOs representing environmental interests, city networks, interest groups representing alternative fuel producers and retailers	1. ICLEI 2. Eurocities 3. International Association of Public Transport (UITP)
Procurement authorities (e.g. national, regional authorities, municipalities)	4. Warsaw, Poland, EU13 5. London, United Kingdom, EU15 6. Municipality of Rijssen-Holten, The Netherlands, EU15 7. City of Niort, France, EU15 8. City, Sweden, EU15 9. City, Ireland, EU15
Contractors (representative of EU-wide interests)	10. Food Service Europe 11. DHL 12. GeoPost 13. Malta Post (members of EuropPost)

The responses to the stakeholder interviews have been analysed and a detailed overview of the results was presented in the Stakeholder Consultation Report (included in Annex 5).

2.5 Data requests

In addition to the interviews, direct information requests were made to selected stakeholders regarding details of their procurement activity. A short questionnaire with four key questions was sent to 51 procurement authorities (including non-case study Member States). Seven completed responses were received.

[5] Exploratory interviews were undertaken at the start of the study with the three wider stakeholder organisations listed (a wider pool was contacted) with the aim of identifying the initial views on the long list of options in order to ensure that appropriate options were taken forward in the study.

[6] Two cities chose to remain anonymous.

The questions aimed to ascertain the reliability of the information available in TED concerning the public procurement of vehicles (size of contracts, types of vehicles procured, share of clean vehicles, coverage by the CVD).

The responses received and any additional data that was supplied by stakeholders has been discussed in the Stakeholder Consultation report (see Annex 5), including how the information had influenced any assumptions made.

2.6 Case studies

Four national case studies were also conducted aiming to support the existing data on the numbers of clean vehicles procured and support the overall robustness of the analysis. The countries covered included Germany (Kraftfahrt-Bundesamt), Sweden (City of Stockholm, The Swedish Bus & Coach Federation), Italy (Consip) and the UK. Information was also requested from the Czech Republic, France and Spain.

The case studies were mainly based on the analysis of national data sources to help determine the numbers of procured vehicles under purchase, lease, rental, and hire in those MS. At the same time, information was also sought on specific policies and initiatives which have taken place in each of the MS to present a cross section of the manner in which the CVD has been implemented in these Member States.

Once publicly available data had been reviewed, stakeholders within those Member states were also approached in order to obtain any additional data about vehicle fleets and procurement activities (see Annex 7).

2.7 Workshops

During the course of the study, four meetings were held intending to enable the Commission to discuss preliminary conclusions, potential policy measures and the consequences of those directly with stakeholders. They included:

- A stakeholder workshop (28th April 2017);
- A meeting with city experts to analyse the Territorial Impacts with the use of the Quick Scan Methodology (co-organised by DG REGIO and DG MOVE) (11th May 2017).
- Two informal meetings with expert representatives of Member States organised by DG MOVE (8th February 2017 and 28th April 2017).

The **stakeholder workshop** brought together 65 participants. It featured a discussion of the results and feedback from the public consultation, and the principal policy measures under consideration. The workshop was informed by presentations from different public and private stakeholders and helped to validate assumptions and findings of the study.

The **Territorial Impact Assessment workshop** brought together 20 stakeholders representing public authorities or city networks and focused on the assessment of the possible territorial impacts of the CVD. In general, participants to the meeting concluded that the review of the Clean Vehicles Directive is not expected to have asymmetrical territorial impacts, requesting special attention to certain urban or regional entities.

Finally, the **informal meetings with experts from Member States** enabled an early on informal exchange with expert representatives of Member States on the overall problem analysis and related principal policy measures. A recurrent issue in the discussions was the corroboration of the identified problem and the call for a much simplified, yet effective policy framework.

An overview of the discussions at the stakeholder workshops is presented in the Stakeholder Consultation Report (included in Annex 5).

2.8 Survey

The initial methodology also included a survey of procurement authorities, contractors and Member State representatives intended to obtain detailed information on the possibly impacts of the policy measures under consideration. However, due to the timing of other stakeholder engagement activities (including the public consultation and targeted interviews) it was agreed early on the study that a targeted survey should not take place to avoid confusion of stakeholders and possible survey fatigue. This task has instead focussed on developing a set of relevant questions to use in the targeted stakeholder interviews (see Section 5.2.3).

2.9 Limitations of the methodology

There are certain limitations to the methodology that need to be taken into consideration and have an impact on the analysis of policy measures presented in the final report.

A first key limitation is that the level of stakeholder participation for this study has been rather low. As indicated, out of 144 stakeholders contacted only 13 agreed to participate (9% success rate). Whilst stakeholders from EU-level organisations, procurement authorities (regional/local) and representatives of industry-wide interests were interviewed, some groups were not represented, e.g. national level procurement authorities or manufacturers/other contractors. This clearly has an impact on the robustness of the conclusions that can be drawn and the capacity to triangulate information on the practices followed and impacts of the proposed measures. It is also not possible to get a view of the impacts for all stakeholder groups across the Member States.

This limitation is partly counterbalanced by the significantly higher number of responses to the Open Public Consultation (130 responses) that cover a range of stakeholder groups across 20 Member States. Furthermore, where possible, additional desk research was performed intended to address information gaps.

Another limitation is the lack of data concerning public procurement activity covering vehicles. This is primarily due to the following:

- There is no EU level monitoring mechanism in place other than the production of consultancy reports;
- There are no reporting requirements in place for Member States; and
- Few Member States have undertaken any monitoring or evaluation of effects on their own in this respect, so there is little information on MS implementation.

Access to reliable data is very important in understanding the impacts of the CVD and the proposed measures. We have attempted to make the best possible use of data on public procurement contracts provided in TED, complimented with data collected from the case studies.

Last but not least, the fact that we were not able to obtain detailed input on the proposed policy options through the procurers' survey is an important limitation when it comes to assessing and quantifying some of the policy measures. It means that we have no comprehensive input from procurers across the EU in terms of the expected impact of the proposed measures on their procurement activities (e.g. impact on administrative costs, choices that would make on the base of the proposed scenarios, issues or limitations that may arise). In some cases, we were able to address this using input from interviews or other secondary sources. In other cases, we relied on the procurers' survey in the ex-post evaluation study where relevant input was often provided. However, in some cases we had to make assumptions that were considered reasonable but were not based on input from stakeholders or other relevant sources. We have clearly indicated this whenever it applied explaining the limitations and the high level of uncertainty involved.

Annex 3 BASELINE

The quantitative baseline has been developed by modifying the tool developed during the previous evaluation study (Ricardo et al, 2015). The tool is a spreadsheet-based model implemented in Microsoft Excel. Box 1: Overview of the CVD IA cost-benefit tool provides an overview of the tool.

Box 1: Overview of the CVD IA cost-benefit tool

As part of the ex-post evaluation study on the CVD, an Excel-based cost-benefit calculation tool was developed that quantitatively estimated the impacts of the Directive on overall pollutant and CO_2 emissions from vehicles procured during the period 2012-2014. These impacts were monetised (over the lifetime of the vehicles procured during the assessment period) and compared to additional capital and administrative costs incurred as a result of the Directive.

For this project, the cost-benefit tool has been modified to develop a quantified baseline scenario that projects the total costs, as well as air pollutant and CO_2 emissions from publicly procured vehicles over the period 2020-2035. It has been expanded to include greater detail on alternatively fuelled vehicles and sensitivity options have been added to allow the assessment of a possible expansion of the scope of the Directive.

Several key parameters used in the CVD Evaluation cost-benefit tool have been updated with more recent data and supplemented with relevant projections for the situation in future years. The excel-based tool is now referred to as the CVD Impact Assessment cost-benefit tool.

The CVD Impact Assessment baseline provides estimates of public sector vehicles procured between 2020 and 2035. Four main types of vehicles are considered in the analysis:

- Passenger cars,
- Vans (light commercial vehicles),
- Rigid trucks (with a gross vehicle weight <16 tonnes), and
- Buses.

The tool includes a breakdown of each vehicle type into petrol (where relevant), diesel and different types of alternatively fuelled vehicles (AFVs). This means that, for example, plug-in hybrid electric vehicles (PHEVs) are now in a separate category, rather than being grouped together with other AFVs that may have very different emissions profiles.

Overall, the powertrain/fuel types match those in the PRIMES-TREMOVE model developed by ICCS-E3MLab and used for the EU Reference scenario 2016 and its updates. However, the powertrains have been grouped in a slightly different way relative to PRIMES-TREMOVE model:

- For both passenger cars and vans 'Petrol' and 'Petrol Hybrid' vehicles have been combined into one category in the Impact Assessment tool.
- Similarly, 'Diesel' and 'Diesel Hybrid' have also been combined into one category for each vehicle type.

The full list of vehicle types and powertrain/fuel categories included in the analysis is shown in Table 3-1, below:

Table 3-1: Vehicle types considered in the cost-benefit analysis tool

Vehicle type	Powertrain/fuel type	Total categories
Passenger cars	Petrol + Petrol Hybrid, Diesel + Diesel Hybrid, Petrol PHEV, Diesel PHEV, LPG, CNG, E85, Battery electric, Hydrogen fuel cell electric	9
Vans	Petrol + Petrol Hybrid, Diesel + Diesel Hybrid, Petrol PHEV, Diesel PHEV, LPG, CNG, Battery electric, Hydrogen fuel cell electric	8
Rigid trucks	Diesel, Diesel Hybrid, LPG, LNG, Battery electric, Hydrogen fuel cell electric	6
Buses	Diesel, Diesel Hybrid, LPG, CNG, Battery electric, Hydrogen fuel cell electric	6

3.1 Detailed model inputs

In order to ensure consistency between the baseline for the CVD Impact Assessment and other initiatives which are part of the Mobility Packages, the majority of data inputs have been obtained directly from an update of the EU Reference Scenario 2016[7] (so-called "REF2016+" in the table below) developed by the ICCS-E3MLab using the PRIMES-TREMOVE model. This update EU Reference scenario has also been used as baseline in the Impact Assessment accompanying the revision of the Eurovignette Directive[8].

In cases where the required data is not available from PRIMES-TREMOVE, data from Ricardo Energy & Environment's SULTAN transport policy analysis tool has been used.[9] A full list of model inputs and the key sources of data are presented in Table 3-2 below.

Table 3-2: Data inputs and sources used for the baseline scenario

Input	Description	Sources
Number of new vehicle registrations		
Projection of total new vehicle registrations	Number of new vehicles registered per year in the EU from 2015-2035 by mode (passenger cars, vans, rigid trucks, and buses).	REF2016+ scenario[10]

[7] The update builds on the EU Reference scenario 2016 but additionally includes some updates in the technology costs assumptions (i.e. for light duty vehicles) and few policy measures adopted after its cut-off date (end of 2014) like the Directive on Weights and Dimensions, the 4th Railways Package, the NAIADES II Package, the Ports Package and the replacement of the New European Driving Cycle (NEDC) test cycle by the new Worldwide harmonised Light-vehicles Test Procedure (WLTP)

[8] Source: Impact Assessment accompanying the Proposal for a Directive amending Directive 1999/62/EC on the charging of heavy goods vehicles for the use of certain infrastructures; SWD (2017) 180

[9] Exploration of EU transport decarbonisation scenarios for 2030, Ricardo Energy & Environment project for DG CLIMA, forthcoming

[10] A detailed description is available in the Impact Assessment accompanying the Proposal for a Directive amending Directive 1999/62/EC on the charging of heavy goods vehicles for the use of certain infrastructures, SWD (2017) 180

Input	**Description**	**Sources**
Projected split of new registrations by powertrain in each year	For passenger cars and vans the split of new registrations has been projected for petrol, diesel and a number of types of alternatively fuelled vehicles. For heavy duty vehicles (HDVs), diesel and a number of types of alternatively fuelled vehicles are considered.	REF2016+ scenario
Projection of publicly procured vehicles falling under the CVD	Number of vehicles procured by the public sector where specification of environmental criteria as set out in the CVD is legally required; i.e. tender beyond procurement threshold value, purchase only. Annual figures indexed to total new registrations projections. The same fuel/powertrain split as for private registrations is assumed in the baseline.	EU's public tender platform (TED database)[11]
Projection of the number of vehicles procured by the public sector via methods other than purchasing (to assess a possible expansion to the scope of the CVD)	Two further procurement methods were considered. For both methods, only contracts above the procurement threshold for CVD were considered. • Number of hired vehicles procured by the public sector. • Number of vehicles procured by the public sector via contracts for transport services	TED database
Projection of the total number of new public sector vehicles	Number of vehicles procured by the public sector in each year, by vehicle category (car, van, truck, bus). The same fuel/powertrain split as for private registrations will be assumed in the baseline.	TED database combined with national-level datasets when applicable.
Vehicle cost and performance		
Vehicle capital cost and fixed annual cost projections	Projection of one-off purchase cost (excluding tax) of new vehicles over time for each vehicle type and powertrain analysed. Annual fixed costs account for aspects such as maintenance and insurance.	REF2016+ scenario, capital costs of efficient diesel and petrol types determined using cost curves developed by Ricardo E&E
Annual vehicle mileage	Average lifetime mileage for vehicles considered in the analysis.	SULTAN, calibrated to REF2016+ scenario

[11] http://ted.europa.eu/

Input	Description	Sources
Vehicle survival rates	In the form of a distribution over time since the vehicle was purchased.	SULTAN
Average energy consumption of new vehicles	New vehicles' average energy consumption over time. This is one element used to calculate the fuel costs.	REF2016+ scenario
Passenger cars and vans: CO_2 emissions	New vehicles' average CO_2 emissions over time, by fuel type. Real-world emissions are used in the model.	REF2016+ scenario
Passenger cars and vans: air pollutant emissions	Real-world NOx, PM and NMHC emissions performance by fuel type, from empirical studies up to 2019. From 2019 onwards following Commission legislation on real-driving emissions (RDE). A conformity factor of 2.1 is assumed in 2020 and a factor of 1.0 from 2021 onwards.	Studies from the International Council on Clean Transportation (ICCT), in addition to RDE legislation
HDV CO_2 emissions	Real-world average CO_2 emissions for trucks and buses. These have been calculated based on the energy consumption of HDVs and by applying emissions factors from combustion for each fuel type.	REF2016+ scenario, IEA for emissions factors
HDV pollutant emissions	Real-world NOx, PM and NMHC emissions by fuel type from empirical studies, in line with Euro VI standard.	Studies from the ICCT, own estimates based on Euro VI limit values
Other inputs		
GDP projections	Projected GDP growth over time.	REF2016+ scenario, based on the 2015 Ageing report (ECFIN/EPC)
Fuel price projections	Estimates for pre-tax petrol and diesel prices for each year of the assessment period.	REF2016+ scenario
CO_2 external cost projections	Climate change costs from CO_2 emissions	2014 Handbook on external costs of transport
Pollutant emission cost projections	Social costs from NOx, PM and NMHC emissions	2014 DG MOVE External Cost Handbook
Administration cost projections	Additional ongoing costs for authorities and vehicle suppliers for complying with the legislation –	Ex-post evaluation – based on procurers'

Input	Description	Sources
	expected to remain (fairly) constant over time	and suppliers' questionnaire results

3.1.1 *Projections of publicly procured vehicles*

One of the key inputs to the impact assessment tool is the **number of vehicles publicly procured in the EU** per year. As there is no single European database that reports new registrations (or vehicle stock) by type of owner, a precise picture of the number and type of new public sector vehicles cannot be directly obtained. The evaluation study (Ricardo et al, 2015) took two separate approaches for estimating publicly procured vehicles:

- **Total number of publicly procured vehicles falling under the CVD,** informed by analysis of the EU's public tender platform (TED database). The approach tends to disregard vehicle procurement outside the scope of the CVD such as procurements below the typical threshold value of around €200,000 (see following section). In the CVD Evaluation, this was referred to as the 'lower-bound estimate'.
- **Total number of publicly procured vehicles**, consisting of a bottom-up analysis of national-level datasets on new vehicle registrations and public sector procurement from Germany, Italy, France and the UK, and subsequent scaling using public sector employment in each EU Member State as a factor. In the CVD Evaluation, this was referred to as the 'upper-bound estimate'.

In this Impact Assessment support study, we have refocussed the analysis towards the former approach, using a substantially improved dataset and a more thorough estimation procedure. The details of this approach are set out below.

The EU's public tender platform (Tenders Electronic Daily – TED) is a database that publishes public procurement notices from across the EU. All procurements that fall under the procurement procedures set out in Directives 2014/24/EU and 2014/25/EU are required to be published in TED. Typically, these are procurements that exceed a threshold value of just over €200,000 (€135,000 in the case of central government authorities). These same criteria make the application of the CVD mandatory for vehicle procurement contracts. Therefore, it can be generally assumed that procurement contracts published in the TED database should include all procurements to which authorities are required to apply the clean vehicle criteria, as set out in the CVD. A baseline estimate on the number of publicly procured vehicles in Europe that fall under the scope of the CVD has thus been developed by extracting relevant information from the TED database.

We extracted data on tenders from 2009 - 2015 to give an estimate of the average number of vehicles publicly procured by year that would fall under the scope of the CVD. Our analysis also takes account of the need to examine extensions in the scope of the Directive to rented and leased vehicles, as well as to private transport services contracts.

Baseline calculations – vehicle procurement figures

Data in TED typically does not include information on the number of vehicles procured but includes information pertaining to the monetary value of the awarded contract. The evaluation study therefore estimated the number of vehicles purchased based on average prices of vehicles. The cost estimates used in this part of the analysis were derived from a survey of procurers also carried out during the evaluation study. The methodology to estimate the number of public procurements per year is summarised below:

- **Step 1:** Extract 2009-2015 data from the TED database and identify the contracts relevant to vehicle purchases, hired vehicles and the procurement of transport services.

- **Step 2:** Identify the number of contracts in each category, the value of each contract and the types of vehicles procured (passenger cars, vans, rigid trucks or buses).
- **Step 3**: Using average cost values per vehicle and the contract values, estimate the number of vehicles publicly procured per year (for each category – purchases, hired vehicles and transport services).
- **Step 4:** Assume that on average, the fuel type split for public sector procurements is the same as the EU average (based on data from the REF2016+ scenario) and project the number of public sector procurements in future years.

A more detailed explanation of each step, along with a results overview is provided below.

Step 1

So-called Common Procurement Vocabulary (CPV) codes, which classify the business area of a contract in TED, were used to identify contracts for the procurement of vehicles by vehicle type, and procurement of transport related services. Table 3-3 lists the CPV terms for all areas related to vehicle procurement and road-transport services, and categorises these as cars, LCVs, trucks or buses/coaches – the four vehicle categories which are separately assessed within the present study's quantification tool.

Table 3-3: Vehicle-related CPV codes used, and their categorisation for purposes of the Impact Assessment study

CPV term	Categorised	CPV term	Categorised as
Motor Vehicles	Broad category	Vehicles for the emergency services	Exempt [1]
Passenger cars	Cars	Firefighting vehicles	Exempt [1]
Estate and saloon cars	Cars	Turntable-ladder trucks	Exempt [1]
Estate cars	Cars	Water-tender vehicles	Exempt [1]
Saloon cars	Cars	Fire engines	Exempt [1]
4-wheel-drive vehicles	Cars	Breakdown vehicles	Trucks
Jeeps	Cars	Mobile bridges	Trucks
All-terrain vehicles	Cars	Road-maintenance vehicles	Trucks
Off-road vehicles	Cars	Gully emptiers	Trucks
Specialist vehicles	Exempt [1]	Salt spreaders	Trucks
Emergency vehicles	Exempt [1]	Road-sweeping vehicles	Trucks
Rescue vehicles	Exempt [1]	Suction-sweeper vehicles	Trucks
Paramedic vehicles	Exempt [1]	Gritter vehicles	Trucks
Ambulances	Exempt [1]	Sprinkler vehicles	Trucks
Patient-transport vehicles	Exempt [1]	Vehicles for refuse and sewage	Trucks
Police cars	Exempt [1]	Vehicles for refuse	Trucks
Prisoner-transport vehicles	Exempt [1]	Refuse-collection vehicles	Trucks
Welfare vehicles	Exempt [1]	Refuse-compaction vehicles	Trucks
Minibuses	LCVs	Sewage tankers	Trucks
Other passenger cars	Cars	Utility vehicles	Trucks
Motor vehicles for the transport of fewer	LCVs	Wheeled loaders	Trucks
Second-hand transport vehicles	LCVs	Aircraft-refuelling vehicles	Trucks
Motor vehicles for the transport of 10 or	Buses/Coaches	Aircraft-towing vehicles	Trucks
Buses and coaches	Buses/Coaches	Cargo carriers	Trucks
Public-service buses	Buses/Coaches	Straddle carriers	Trucks
Articulated buses	Buses/Coaches	Mobile library vehicles	Trucks
Double-decker buses	Buses/Coaches	Mobile homes	Trucks
Low-floor buses	Buses/Coaches	Electric vehicles	Cars
Coaches	Buses/Coaches	Electric buses	Buses/Coaches
Motor vehicles for the transport of goods	Trucks	All vehicle parts, bodies, trailers and two-wheelers	Exempt
Pick-ups	Cars	Road transport services	Broad category -- proportionate spread b/w cars, LCVs & trucks
Motor sledges	Exempt		
Articulated trucks	Trucks		
Tankers	Trucks		
Fuel-tanker trucks	Trucks	Public road transport services	Buses/Coaches
Flatbed and Tipper trucks	Trucks	Taxi services	Cars
Flatbed trucks	Trucks	Special-purpose road passenger-transport services	Buses/Coaches
Tipper trucks	Trucks	Non-scheduled passenger transport	Buses/Coaches
Vans	LCVs	Passenger transport by animal-drawn vehicles	Buses/Coaches
Light vans	LCVs	Mail transport by road	LCVs
Panel vans	LCVs	Parcel transport services	LCVs
Second-hand goods vehicles	LCVs	Hire of passenger transport vehicles with driver	Broad category -- categorised as LCVs
Road tractor units	Trucks		
Chassis	Trucks		
Chassis cabs	Trucks	Hire of passenger cars with driver	Cars
Chassis bodies	Trucks	Hire of buses and coaches with driver	Buses/Coaches
Complete chassis	Trucks	Hire of goods-transport vehicles with	Trucks
Heavy-duty motor vehicles	Trucks	Hire of trucks with driver	Trucks
Crane and dumper trucks	Trucks	Hire of industrial vehicles with driver	Trucks
Elevator-platforms trucks	Trucks	Hire of vans with driver	LCVs
Skip loaders	Trucks	Refuse transport services	Refuse vehicle
Dumper trucks	Trucks		
Winter-maintenance vehicles	Trucks		

CPV term	Categorised		CPV term	Categorised as
Special-purpose motor vehicles	Trucks			
Mobile drilling derricks	Trucks			

Notes: "vehicles designed and constructed for use by the armed services, civil defence, fire services and forces responsible for maintaining public order" are exempt from the CVD

Step 2

The source database re-lists each lot within a tender. For example, if a contract award notice includes five separate lots, these show as five separate contract awards within in the database, each re-stating the total contract value. Therefore, as a first step, it was necessary to remove all duplicates of total contract value from within the database.

Contracts with values near or in excess of €1bn were manually checked through online searches and adjusted if the figures were erroneous or implausible. Moreover, in almost 25% of all relevant contracts listed, data on the contract value was missing. In these cases, the gap was filled using the average value across all known contracts with the same CPV code.

Vehicle procurement codes within the TED database do not differentiate between vehicle purchase and vehicle lease, rental, or hire-purchase. In order to estimate what proportion of vehicle procurement contracts were for purchase (thus falling under the current scope of the CVD) and what proportion were for different forms of vehicle hire, a keyword search was conducted in European languages in the contract title field. It was assumed that contracts with titles containing text sequences such as *leas*, *rent*, *hire*, etc. refer to vehicle hire contracts while those contracts with (non-blank) titles not including such text sequences refer to vehicle purchase contracts.

Preliminary results for vehicles, as well as transport services indicate substantial variations throughout the years. As illustrated in Figure 3-1, a sharp drop in the number of service contracts can be observed between 2012 and 2013 (most prominently for buses, but also for trucks, vans and cars). Fluctuations in the overall value of contracts between years are more pronounced (Figure 3-2), where significant variation can also be observed in the overall value of passenger car purchases. The project team attempted to investigate the reasons for these variations, but was unable to determine whether fluctuations were due to genuine variations in public authorities' demand for vehicles, or due to issues in the TED database.

Figure 3-1: Count of procurement contracts by category and year

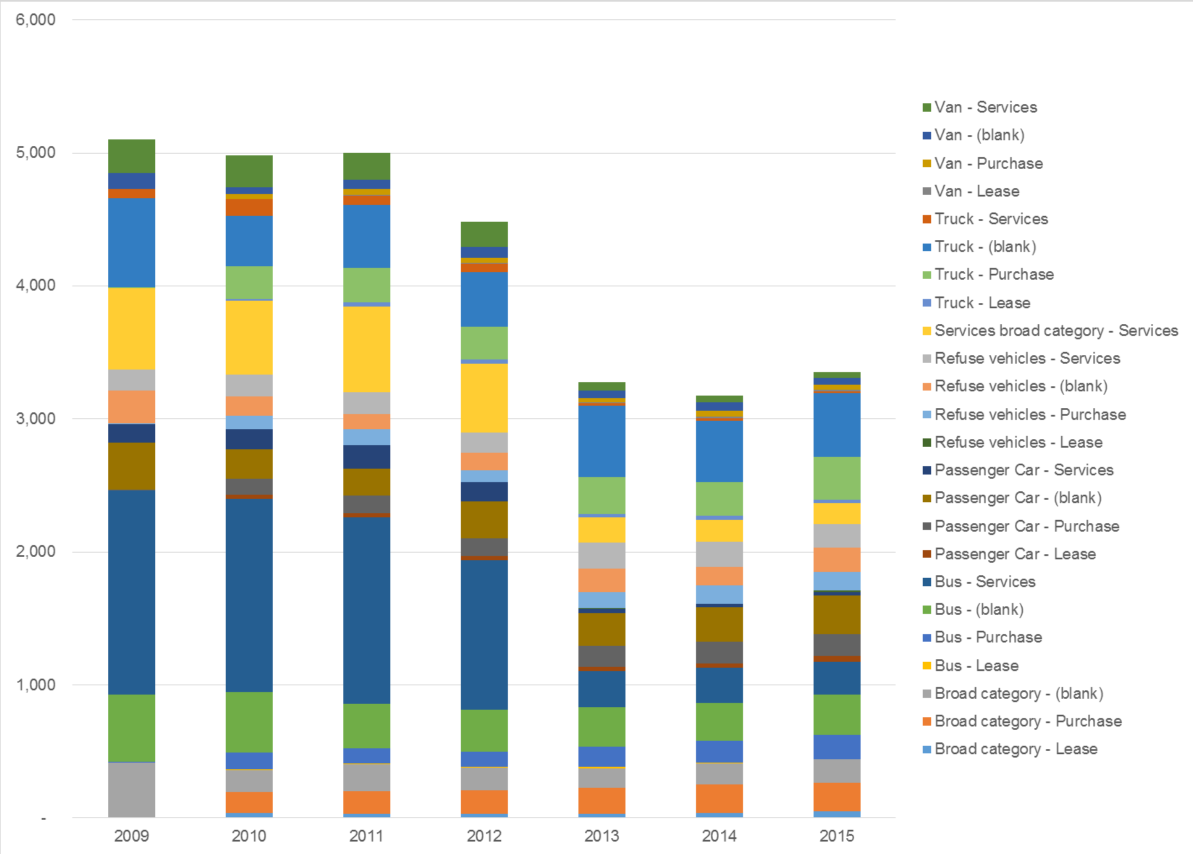


Figure 3-2: Total value of procurement contracts by category and year (Million Euros)

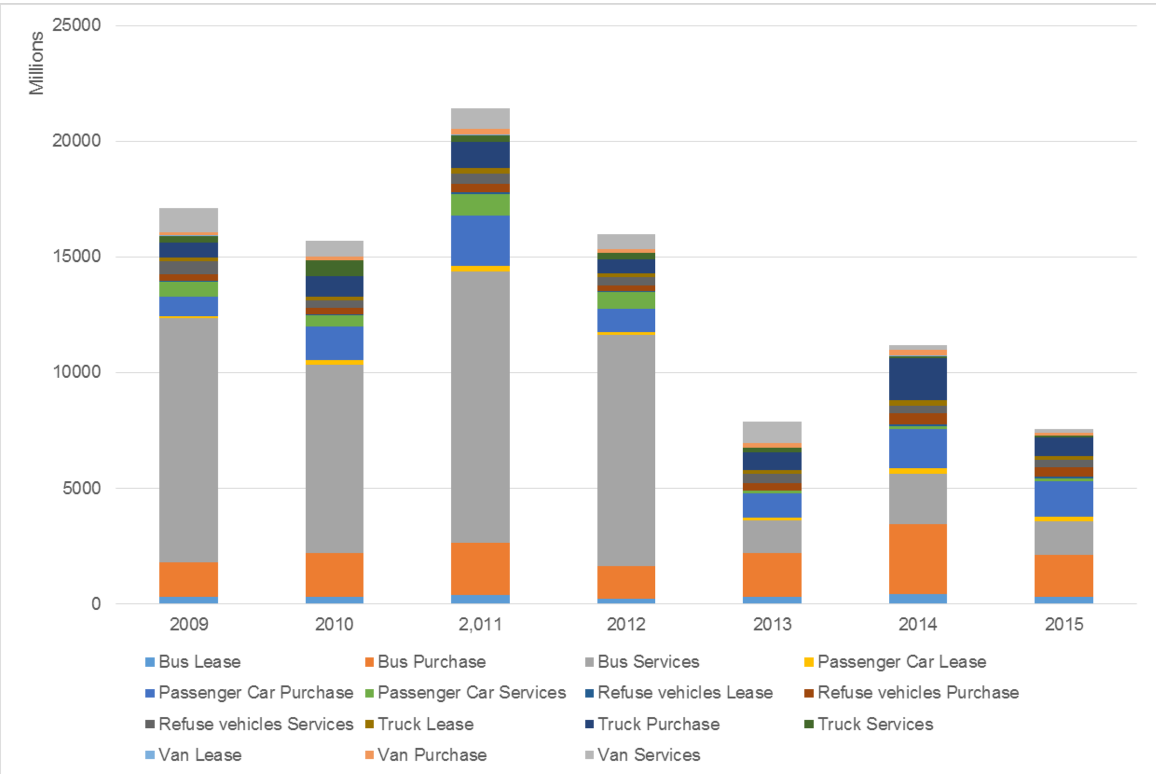
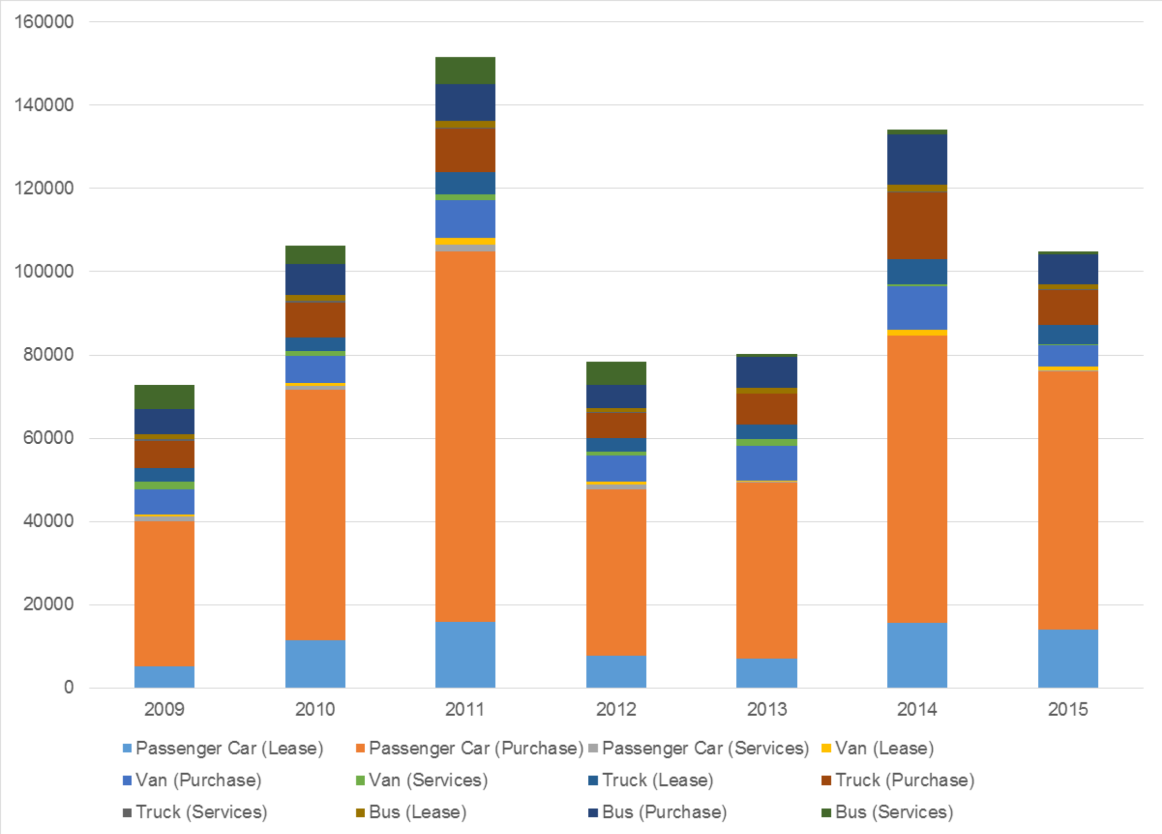


Figure 3-3: Number of Publicly Procured Vehicles by category and year



Step 3

Based on the total contract values within each category, it is possible to derive an estimate of the number of new vehicles procured, through the use of average values per vehicle (see Table 3-4). In the case of vehicle purchase, the same values were used as the ex-post evaluation, where they were derived from a survey of public authorities that requested the number of vehicles procured, and associated procurement costs for recent years. For leasing and rental contracts, average values per vehicle were derived from a 2014 survey of Leaseurope members, indicating both the number of leasing and rental contracts as well as their overall value within the categories of passenger cars, light duty vehicles and heavy-duty vehicles. Estimates for service contracts were made by estimating the overall cost required for operating a vehicle over its utilisation period in public service. For example, a bus is expected to have overall costs of €1.8m associated with its use over a 12-year utilisation period (€150,000 per year), including driver, vehicle, fuel, insurance, maintenance, etc.

Table 3-4. Average contract values per vehicles for purchase, hire and vehicle services in Euros over period 2009-2015

Vehicle	Purchase [1]	Hire [2] (lease, rental etc.)	Services [3] *assumed utilisation period in brackets*
Cars	24,603	15,386	600,000 (10 y.)
LCVs	22,769	25,669	600,000 (10 y.)
Trucks (excl. waste collection)	136,371	55,248	1,200,000 (12 y.)
Buses/coaches	252,806	252,806	1,800,000 (12 y.)
Waste collection vehicles	172,604	172,604	1,680,000 (12 y.)

Sources: [1] EC (2015a), *[2]* (Leaseurope, 2015)*, same value as purchase for buses and waste collection, based on an analysis of a sample of leasing contracts for these vehicle types, [3] Cars: Gerotax (n.d.), LCVs and trucks: DFF International (2014), Buses: Frank, et al.(2008) Waste collection vehicles: Audit Scotland (2000) and Verheyen (2005).*

Given the variations in total procurement values over time, an annual average number of new vehicles procured is estimated based on the average procurement value over the 2009-2015 period. These values provide the basis for modelling future public sector vehicle procurement that falls under the scope of the CVD (Table 3-5). Using a long-run average helps to smooth out fluctuations in procurement cycles that affect the year-on-year data, making these estimates more reliable.

Table 3-5: Estimates of typical annual public sector vehicle procurement over current procurement threshold values (i.e. numbers of vehicles that fall within the scope of the CVD), average over period 2009-2015

	Purchase	Rental/leasing	Services
Passenger cars	53,840	16,320	770
LCVs	7,350	1,050	1,090
Trucks	9,200	3,140	450
Buses/coaches	8,310	840	3,600

Step 4

Using the average number of public sector procurements per year (from Step 3), projections for future public sector procurements were then indexed to annual total new registration projections provided by the REF2016+ scenario. The same powertrain/fuel type split projection for each year in the REF2016+ scenario by vehicle type was applied to public sector procurements.

3.2 Vehicle costs and performance

3.2.1 Costs of new vehicles

Vehicle costs by type of powertrain and their evolution over time draw on the REF2016+ scenario. The annual fixed costs (which include cost elements such as maintenance) also draw on the REF2016+ scenario; they are assumed to remain constant over time.

3.2.2 Vehicle mileage

The average lifetime mileage of a vehicle is generally dependent on the vehicle and fuel type. The mileage per year also tends to vary depending on the age of the vehicle. The average vehicle mileage used for each vehicle type in each year of ownership draws on SULTAN. It has been calibrated to REF2016+ but differences still persist. For passenger cars and vans, Petrol, E85 and battery electric vehicles typically have lower mileages compared to other fuel types. However, for the purposes of this impact assessment, all fuel types are assumed to have the same mileage as diesel vehicles. This is to account for situations in which public authorities may replace a diesel vehicle with a petrol vehicle.

3.2.3 Vehicle survival rates

The Impact Assessment tool assumes that a fraction of vehicles procured are retired in each year after purchase. Vehicle survival rates - in the form of a distribution over time since the vehicle was purchased - for each vehicle type (passenger car, van, rigid truck, bus) have been obtained from SULTAN. The survival curves in SULTAN have been calibrated to the REF2016+ scenario but certain differences still persist.

3.2.4 Environmental performance of new vehicles

Based on the findings of the ex-post evaluation study, assumptions have been made concerning the **effects of the Directive** in its current state on the CO_2 and air pollutant emissions of vehicles procured. A summary of the estimates from the Evaluation study are provided in Box 2: Effects of the CVD on CO_2 and air pollutant emissions of vehicles procured, together with the values incorporated into the Impact Assessment baseline.

Box 2: Effects of the CVD on CO_2 and air pollutant emissions of vehicles procured

Impact of the CVD on CO_2 emissions

- In the Ex-post evaluation study, the type of vehicles procured under the Directive were compared to the wider market in terms of CO_2 performance. The results of the analysis found a maximum 5.5% improvement in tank-to-wheel (TTW) CO_2 emissions for passenger cars procured and 2.3% for vans procured, as a consequence of the CVD. However, as there were significant uncertainties in the analysis it was also noted that it is entirely possible that the CVD had not had any appreciable impact on CO_2 performance. For HDVs, no change in CO_2 performance compared to the market average was assumed.
- Based on this analysis, the **Impact Assessment baseline assumes that the CVD has zero impact on the average CO_2 emissions** of vehicle purchases. This means that publicly procured vehicles are considered to have CO_2 emissions equal to the expected fleet average for that vehicle type and fuel type in each year of purchase. For example, the REF2016+ scenario assumes that a plug-in hybrid petrol car bought in 2020 will, on average, have CO_2 emissions of 48g/km. A publicly procured vehicle would also be assumed to have this level of performance.

Impact of the CVD on air pollutants.

- In the Ex-post evaluation study, evidence was drawn from stakeholders that applied the minimum standards option. Here, it was found that the majority of respondents had adopted Euro emissions standards as a minimum criterion for local air pollution but that most had applied the prevailing Euro standard that was already the minimum legal requirement for any new vehicle of that type. In the Evaluation study, this was modelled by assuming Euro standards were introduced six months early for 1% of all procured vehicles. This has a minimal impact on the air pollutant emissions of publicly procured vehicles.
- Considering that this is a minimal impact, the Impact Assessment baseline assumes that the CVD has a **0% impact (in comparison to the fleet average)** on air pollutant emissions of publicly procured vehicles.

As stated in Box 2, publicly procured vehicles are assumed to have the same environmental performance as other vehicles purchased in Europe. A summary of the inputs for the fleet average CO_2 and air pollutant emissions performance are provided in the next sections.

3.2.5 CO_2 emissions

Cars and vans

The projected **real-world** CO_2 emissions of new vehicles draw on the REF2016+ scenario for each vehicle and fuel type. In cases where two vehicle categories have been combined in the Impact Assessment tool (e.g. Petrol cars and Petrol Hybrid cars), the weighted average CO_2 emissions have been calculated.

Buses and trucks

For HDVs, the projected CO_2 emissions of new vehicles are not readily available in the REF2016+ scenario. Therefore, the CO_2 emissions of new HDVs have been calculated based on the 'average energy efficiency of new registrations'. To convert from energy efficiency (in MJ/km) to tailpipe CO_2 emissions, the energy efficiency has been multiplied by emissions factors from the combustion of fuel. The emissions factors used in this calculation are presented in Table 3-6

Table 3-6: Emissions factors from the combustion of fuel

Fuel	Emission factor (gCO_2/MJ fuel)
Petrol	69.30
Diesel	74.07
LPG	63.07
CNG	56.10

Source: IEA (2014)

3.2.6 Air pollutant emissions

The Impact Assessment tool also considers the following air pollutant emissions: non-methane hydrocarbons (NMHCs), nitrogen oxides (NO_x) and particulate matter (PM).

Cars and vans

It has been widely reported that the real-world emissions performance of LDVs differs significantly to the latest Euro standards, particularly concerning the NO_x emissions of diesel vehicles. For example, recent studies by the ICCT reported that on average, in real-world driving conditions, diesel cars emit 7.1 times the Euro 6 limit value (ICCT, 2017). The real-world NO_x emissions of new vehicles have therefore been implemented into the Impact Assessment tool.

To mitigate the discrepancy between type approval/test-cycle emissions and real-driving emissions the (RDE) package is due to be implemented in the near future. A conformity factor of 2.1 for NO_x emissions will apply to all new vehicle models from September 2019, meaning that new vehicles must emit no more than 2.1 times the NO_x Euro 6 limits during real-world tests. This is captured by the baseline and the emissions performance of new vehicles can be summarised as follows:

- From 2016 to August 2019 new diesel LDVs are assumed to have NO_x emissions 7.1 times the Euro 6 NO_x limit.
- From September 2019, new diesel LDVs are assumed to have NO_x emissions 2.1 times the Euro 6 NO_x limit. No improvements are incorporated into the baseline for future years.
- Petrol, LPG and CNG vehicles are assumed to meet Euro 6 NO_x limits.
- With respect to other air pollutant emissions, it is assumed that non-methane hydrocarbon (NMHC) and particulate matter (PM) emissions meet the Euro standards for all fuel types.

Buses and trucks

In contrast to LDVs, HDVs are reported to exhibit real-world emissions performance in line with the Euro VI standards. Average NOx emissions of Euro VI HDVs will be taken from ICCT (2017). No tightening of standards over time is assumed in the baseline.

3.2.7 Other inputs

In addition to projections of publicly procured vehicles and vehicle performance and cost parameters, there are a number of other important inputs used in the Impact Assessment tool. These inputs are summarised in the next sections.

GDP forecasts

Projections of GDP for EU-28 Member States have been obtained from the REF2016+ scenario and draw on the 2015 Ageing report (ECFIN/EPC).

Table 3-7: GDP (in 000 M€2016)

	2015	2020	2025	2030	2035	2040	2045	2050
GDP: EU-28	13,532	14,664	15,706	16,813	18,118	19,584	21,088	22,703

Fuel price forecasts

Fuel price projections draw on the REF2016+ scenario and are shown in Table 3-8: End-user fuel prices for the transport sector (in €2016/MJ).

Table 3-8: End-user fuel prices for the transport sector (in €2016/MJ)

Fuel	2015	2020	2025	2030	2035	2040	2045	2050
Excluding taxes								
Petrol	0.0144	0.0198	0.0216	0.0233	0.0241	0.0252	0.0257	0.0262
Diesel	0.0146	0.0198	0.0216	0.0234	0.0243	0.0254	0.0260	0.0265
LPG	0.0125	0.0183	0.0198	0.0211	0.0217	0.0225	0.0228	0.0232
CNG	0.0162	0.0170	0.0179	0.0190	0.0199	0.0205	0.0208	0.0210
Ethanol	0.0261	0.0313	0.0303	0.0310	0.0310	0.0302	0.0306	0.0312
Electricity	0.0411	0.0500	0.0520	0.0519	0.0525	0.0522	0.0512	0.0506
Hydrogen	0.0472	0.0462	0.0443	0.0433	0.0422	0.0409	0.0398	0.0386
Including taxes								
Petrol	0.0400	0.0465	0.0486	0.0506	0.0515	0.0528	0.0534	0.0540
Diesel	0.0338	0.0400	0.0421	0.0441	0.0452	0.0465	0.0471	0.0478
LPG	0.0211	0.0284	0.0302	0.0318	0.0325	0.0335	0.0339	0.0343
CNG	0.0208	0.0216	0.0226	0.0240	0.0252	0.0258	0.0262	0.0266
Ethanol	0.0261	0.0313	0.0303	0.0310	0.0310	0.0302	0.0306	0.0312
Electricity	0.0574	0.0675	0.0694	0.0690	0.0695	0.0689	0.0675	0.0666
Hydrogen	0.0472	0.0486	0.0480	0.0475	0.0465	0.0446	0.0444	0.0446

Unit cost of climate change

For calculating the external costs of climate change, the unit cost of climate change (central price assumption) has been taken from the Updated Handbook on External Costs of Transport (Ricardo-AEA et al., 2014). In the data source, figures are presented in 2010 prices – these have been converted in 2016 constant prices. These are used for monetising the potential impacts of changes to the CVD on CO_2 emissions in the impact assessment tool when policy options are analysed.

Air pollutant emission cost projections

The costs of air pollutant emissions are also used within the Impact Assessment tool to monetise the potential impacts of changes to the CVD. NMHC, NO_x and PM damage costs are taken from the Updated Handbook on External Costs of Transport (Ricardo-AEA et al., 2014). The Impact Assessment tool calculates impacts at the EU-28 level, therefore damage costs for 'all areas' are used, rather than assuming an urban/rural split. In the data source, figures are presented in 2010 prices – these have been converted into 2016 prices and are assumed to be constant over time.

Table 3-9: Cost of air pollutant emissions, in €2016 prices per tonne

Cost	2015	2020	2025	2030	2035	2040	2045	2050
NMHCs	97.45	97.45	97.45	97.45	97.45	97.45	97.45	97.45
NO_x	1,696	1,696	1,696	1,696	1,696	1,696	1,696	1,696
PM	11,520	11,520	11,520	11,520	11,520	11,520	11,520	11,520

Administration cost forecasts

The costs for complying with the CVD were assessed as part of the Evaluation study as part of the stakeholder consultation activities. The average additional admin costs per vehicle are shown in Table 3-10. These are assumed to remain constant throughout the assessment period.

Table 3-10: Administration costs for complying with the CVD

Cost category	Average additional admin cost per vehicle (€)
Procurers	2.28
Suppliers	2.52

3.3 Alternative Baseline

As explained in the previous section, the baseline projection of total new vehicle registrations draws on the EU REF2016+ scenario.

The projections of clean buses from the REF2016+ scenario are conservative, suggesting a very slow uptake of clean vehicles. This is in contrast with input from a recent survey conducted by UITP and ACEA in the context of the ZEEUS project (ZeEUS, n.a.) that collected information on the expected development of the bus market covering 90% of the market in the period 2020-2030. The responses suggest that electric buses may represent up to a 50% of the market by 2030, with fuel cell buses reaching 15% while diesel buses reducing from 52% in 2020 to 7% in 2030 (see Table 3-11). It is however not clear if these projections anticipate policies to be adopted in the future. Such projections would also suggest a very different picture in terms of the future uptake of buses and the impact of any targets set in the context of the CVD.

Table 3-11 – Projected share of buses procured by powertrain on the basis of UITP data – selected years

Powertrain/fuel	2020	2025	2030	2035
Diesel	54%	31%	9%	9%
Diesel Hybrid	9%	11%	13%	13%
LPG	0%	0%	0%	0%
CNG	15%	17%	15%	15%
Electric	19%	34%	52%	52%
Fuel Cell	2%	5%	9%	9%
Share of clean buses	***36%***	***56%***	***77%***	***77%***

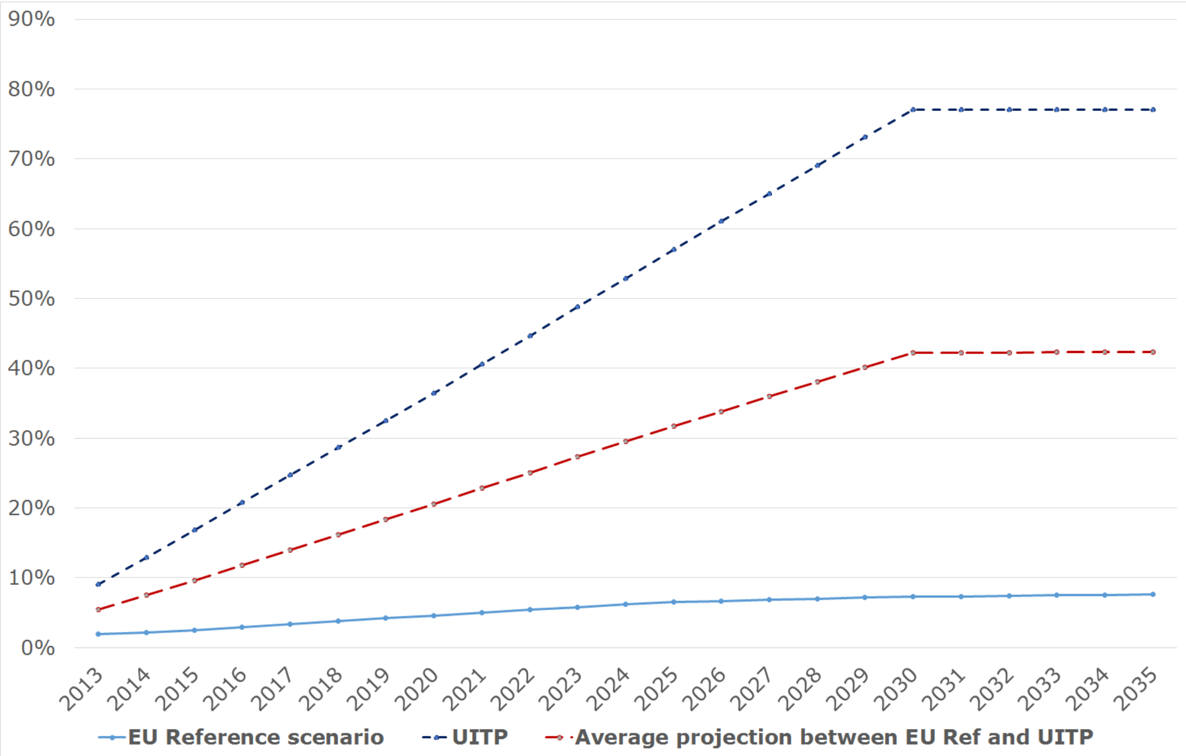
Source: UITP Note: Data provided for 2020, 2025 and 2030. For the period 2030-2035, a zero growth rate has been assumed, given the high share of clean vehicles already reached by 2030.

Given the uncertainty of the projections and the absence of alternative sources, we have selected the following approach in developing the baseline scenario for buses:

- we have used the REF2016+ scenario projections as the main baseline;
- we have developed an alternative baseline scenario that represents an average of the projected numbers of clean buses from the EU REF2016+ scenario and projections from the UITP study.

Figure 3-4 below presents the projected share of clean buses used for the alternative scenario (red line).

Figure 3-4 – Project share of clean buses in total share of procurement according to different scenarios.



Annex 4 SELECTION OF OPTIONS FOR DEFINING A CLEAN VEHICLE AND SCREENING PROCESS

This Annex contains the full analysis behind the selection of the most promising options for defining a clean vehicle and for setting a minimum target based on this definition.

4.1 Defining a clean vehicle – identifying the criterion and the threshold

There are two elements to a possible definition of a clean vehicle: the criteria to be used; and the thresholds to be applied. The **potential criteria** on which a definition of a clean vehicle might be based are assessed in Table 4-1 by vehicle type. The assessment is based on the possibilities of defining relevant and meaningful threshold parameters based on existing legislation, as it is important that any criteria and thresholds used to define a clean vehicle have common legislative bases throughout the EU. Additionally, it is important that meaningful thresholds can be defined, i.e. ones that enables appropriate differentiation between 'clean and 'other' vehicles. In this respect, it is important to remember that any amendment to the Directive is unlikely to be applicable in Member States until around 2021. As a contribution to the revision of the CVD, a paper has been developed for the Sustainable Transport Forum (STF), which proposes an approach for defining a clean vehicle (see Box 3).

Box 3: Overview of the proposal for defining a clean vehicle in the paper prepared for the STF

Box 3: Overview of the proposal for defining a clean vehicle in the paper prepared for the STF

The STF was set up by the Commission after the adoption of the AFID in order to assist with the implementation of the Directive and to take forward the Commission's work on alternative fuels for transport, more generally. One of its sub-groups was on alternative fuels in cities, which had a mandate *inter alia* to provide input into the revision of the CVD[12].

The paper that was developed for this purpose set out an approach that could be easily used for non-experts and was based on the lifecycle, i.e. well-to-wheel, GHG emissions and air pollutant emission standards (including RDE) of different vehicle-fuel combinations. It consisted of allocating vehicle-fuel combinations to a particular category. There would be seven categories, labelled 'A' to 'G', which could be presented in the same format as the EU energy label for household goods (as defined by Directive 2010/30/EU). In the first instance, only those vehicle-fuel combinations in categories 'A' to 'D' would be considered to be clean. The definition would become more stringent over time. As the market develops, categories would be excluded from the definition of a clean vehicle until only those in category 'A' remained.

Source: Sustainable Transport Forum (2017), Delivery 4

Basing a definition on **tailpipe CO_2 emissions** would not be problematic for LDVs, as a means of measuring such emissions already exists and there will be standards post-2020, which can be used to inform the definition of the thresholds. However, a mechanism to measure such emissions from HDVs, as well as future standards based on these, are still under development, and are being developed in stages (i.e. for common types of HGVs first, before being extended to buses and other types of HGV at a later date). This means that, at least in the short-term, there is a lack of information to for setting the necessary thresholds for HDVs. This might be addressed by setting a clean vehicle definition based on tailpipe CO_2 emissions for LDVs now, and then introducing relevant definitions for buses and heavy duty vehicles into the CVD at a later date, e.g. through a technical amendment.

If a definition of a clean vehicle was based on **WTW CO_2 emissions**, the same analysis applies, but with the added complication that the WTT factors for each vehicle and fuel

[12] https://ec.europa.eu/transport/themes/urban/cpt/stf_en

type would need to be agreed. Although there are research reports on these, such as the work of the JRC, including these in legislation would be potentially challenging. Some potential factors – but only for biofuels and biogases and their fossil fuel alternatives – already exist in the amendment to the Fuel Quality Directive (2009/30/EC) (and the Renewable Energy Directive 2009/28/EC). However, these do not specify factors to be used for electricity or hydrogen – methodologies to do this were to be proposed at a later date.

By 2021, all new vehicles will have to meet the existing regulatory standards for **air pollutant emissions**. For buses and trucks, the Euro VI emission standards deliver emissions reductions in the real world, but the same cannot be said for the Euro 6 standards applied to cars and LCVs. For the latter, the RDE Euro standards, which would require all new cars to be no more than 50% above Euro 6 standards by 2021 (i.e. they all must have a conformity factor no more than 1.5), aim to address this by reducing real world air pollutant emissions. However, no regulatory standard yet ensures that cars and LCVs will eventually meet the Euro 6 standard as originally set out in legislation. The actual values of certain air pollutants will be included on the certificates of conformity of vehicles, and these could be used to further define a clean vehicle – but only for cars and LCVs – in the context of the revised CVD.

If the basis of a **wider set of environmental criteria** were to be the GPP criteria, there would be potential timing issues, as these criteria will have been in place for three years already by 2021, and would probably soon be in need of updating, as they are typically in place for around five years. Additionally, it is probably more appropriate for the GPP criteria to complement, rather than be integrated into, the CVD. On the other hand, basing a definition on the **use of alternative fuels**, with reference to the definition used in the AFID definition, or defining a clean vehicle as a **zero emission vehicle** (ZEV), do not cause any obvious legislative problems.

Table 4-1: Relevance of different options for defining a CV by vehicle type

Option	Cars	LCVs	Buses	HGVs
Tailpipe CO_2	Targets are in place for 2020 and may be revised in the coming years		Standards for buses expected, but will be later than the first standards for trucks	Standards may be set in the forthcoming years for certain categories of new trucks (and be applicable from early 2020s)
WTW CO_2	WTT factors could be used with the tailpipe targets based on JRC work combined with above tailpipe emission standards		WTT factors could be used with the tailpipe targets based on JRC work combined with above tailpipe emission standards	WTT factors could be used with the tailpipe targets based on JRC work combined with above tailpipe emission standards
Air pollutant emissions	Euro 6 has been applicable to all new cars since 2015; new cars and LCVs will need to comply with RDE from 2021; RDE values will be included on the certificates of conformity		Euro VI has been applicable to all new engines used in buses and HGVs since 2015; unlike with LDVs, these standards are delivering significant emissions reductions	
Wider set of environmental criteria	Would depend on what these are; revised EU's transport GPP criteria are due to be published in early 2018; by the time of the entry into force of revised CVD requirements, these GPP criteria will have already been in place			

Option	Cars	LCVs	Buses	HGVs
	for three years and could soon be subject to review; not clear what other environmental criteria might be used			
The use of alternative fuels, based on Article 2 of the AFID	List of alternative fuels to which AFID applies has been listed in the Directive since 2014; Commission has to review the Directive and propose amendments as necessary by the end of 2020; the list could be revised as part of this process, with a revised list not being implemented before 2022			
Zero tailpipe CO_2 emissions	For all vehicle types, it is clear that only pure electric and hydrogen fuel cell vehicles meet this definition, so no legislative barriers to this.			

For each of the potential criteria, an assessment of the way in which a threshold might be set is set out in Table 4-2. The result of the assessment is broadly in line with that undertaken in Table 4-1, as there is no need to set a threshold if a clean vehicle is defined by its **use of an alternative fuel** or if it is a **ZEV**. For **tailpipe** and **WTW CO_2**, the presence (or not) of a tailpipe CO_2 target influences the potential to identify a threshold for a type of vehicle. It should also be remembered that an appropriate value for the threshold will need to be set, ideally linked to the CO_2 emissions standard in some way. For cars and LCVs only, a threshold for the emission of **air pollutant emissions** could be se set with reference to the emissions values included on the certificates of conformity. If the GPP criteria are used to define a clean vehicle on the basis of a **wider set of environmental criteria**, the thresholds could be taken as the respective core and comprehensive criteria. However, the GPP criteria are currently being revised, and the updated criteria will not become available in time for the conclusion of the legislative proposal on the revision of the CVD.

Table 4-2: Threshold that might be used for defining a CV for different options by vehicle type

Option	Cars	LCVs	Buses	HGVs
Tailpipe CO_2	Could be linked to the tailpipe CO_2 target, e.g. 50% of the targets		Could be linked to the future tailpipe CO_2 target	Could be linked to the future tailpipe CO_2 target
WTW CO_2	Could be linked to the tailpipe CO_2 target, combined with the relevant WTT factor		Could be linked to the tailpipe CO_2 target combined with the relevant WTT factor	Could be linked to the tailpipe CO_2 target, combined with the relevant WTT factor
Air pollutant emissions	Any threshold would have to go beyond RDE, and could require real-world compliance with Euro 6, or even go beyond this		Any threshold would have to go beyond Euro VI; it is not clear on what basis such a value might be set	
Wider set of environmental criteria	Could be based on either the respective core and comprehensive criteria of the GPP; if another set of environmental criteria used, would depend on the detail of these			
Based on Article 2 of the AFID	There is no need to define a threshold if all vehicles using alternative fuels (as listed in Article 2(1) of the AFID) would be considered to be a clean vehicle Alternatively, vehicles only using selected fuels might be considered to be a clean vehicle, on the basis of a consideration of the respective environmental performance (e.g. taking an approach such as that set out in the STF's paper			

Option	Cars	LCVs	Buses	HGVs
Zero tailpipe CO_2 emissions	No need for threshold (is de facto zero)			

In summary, it appears that the options for defining a clean vehicle that would merit further consideration are defining a clean vehicle on the basis of:

- For cars and LCVs only, its tailpipe CO_2 emissions; or
- For cars and LCVs only, their air pollutant emissions; or
- Whether or not it is uses an alternative fuel; or
- If it has zero tailpipe emissions; or
- A combination thereof (including requirements on zero-tailpipe emissions as part of a broader mandate).

It seems most logical to combine the criterion of air pollutants with the criterion of tailpipe CO_2 emissions, as both are measures of tailpipe emissions of different pollutants.

The fourth option is relatively narrow and arguably would not be appropriate to use as the sole criterion, as it would be challenging and expensive to meet with respect to some vehicle types in some parts of the Union, particularly in the short-term. Furthermore, at least in the short-term and potentially longer for some modes, it is likely that a wider range of alternative fuels will be needed rather than simply zero-emission vehicles in order to reduce emissions and transition towards a zero emission vehicles in the future. Consequently, it is proposed that the fourth option is considered only in combination with the first two as a way to allow differentiating between different types of clean vehicle. This could be achieved by 'double-counting', i.e. for the purpose of assessing compliance with the requirements of the revised Directive, a ZEV counts twice as much as another type of clean vehicle would. The simple approach to doing this would be that a ZEV counts as two clean vehicles, although this risks weakening the target. Consequently, it is proposed to:

- Count every ZEV as one clean vehicle; and
- Count every vehicle, except ZEVs, complying with the clean vehicle definition (based on **tailpipe CO_2** or a vehicle that **use alternative fuels**) as 0.5 clean vehicles.

These values would effectively be 'credits' in the context of delivering a minimum requirement (see next section), with a ZEV counting as one credit and any other clean vehicle counting only as half a credit. An alternative option would be to rate all clean vehicles on a linear scale between a ZEV and the threshold. In this case a ZEV would still count as two credits and a vehicle *exactly meeting the threshold* would count as one credit, while all those in between would contribute somewhere between one and two credits. This approach would be relatively straightforward for a definition based on a vehicle's tailpipe CO_2 emissions, but would be more complex for a definition based on alternative fuels, as it would need to be determined how to distinguish between different vehicles. In order to be different to an approach based on tailpipe CO_2 emissions, this would have to use WTW CO_2, which would then face all of the challenges faced by a definition based on WTW CO_2, as discussed above. Consequently, such a graduated linear differentiation is probably unnecessarily complex and so should be rejected.

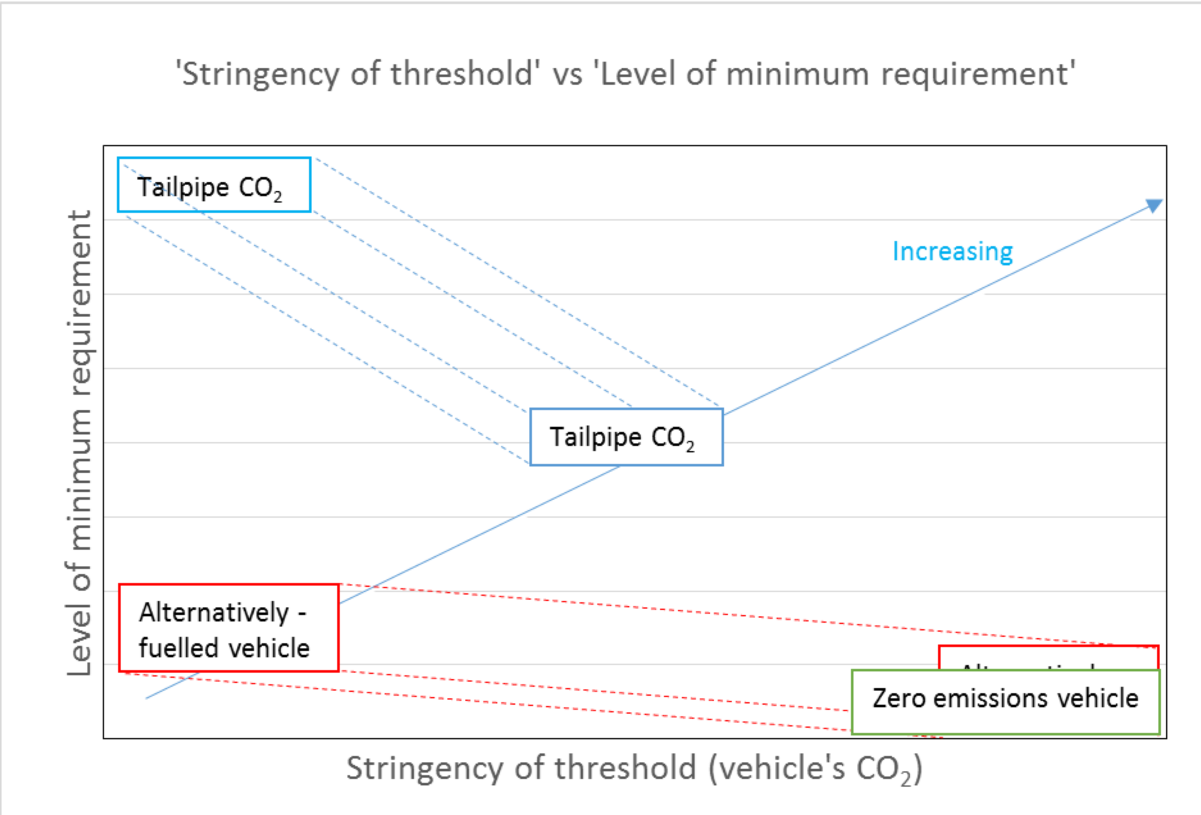
4.2 Link between a threshold used to define a clean vehicle and the minimum requirement

Where there is a need to set a minimum requirement, a decision will need to be made as to how the definition should be applied in practice. This is dependent on the criterion used and on the threshold applied. For the options taken forward as a result of the analysis in the previous section, the relationship between the 'stringency of the threshold' and the 'level of the mandate' is presented in Figure 4-1.

If the threshold was stringent, e.g. requiring all clean vehicles to have zero tailpipe emissions, the minimum requirement would have to be relatively low, as otherwise the cost of achieving the minimum requirement, in terms of the cost of purchasing the vehicles, would be far too high (so this option appears in the bottom right-hand corner of Figure 4-1).

At the other extreme, if the threshold was less stringent, a mandate could be set at a higher level, perhaps even at a level that would effectively require 'clean vehicles' to be purchased (and so be at the top left-hand corner of Figure 4-1). For example, if a clean vehicle was defined as having CO_2 emissions less than the next fleet-wide target, which would fall within the next five years, it might be appropriate to require all publicly procured vehicles to have emissions less than this target. Alternatively, if a clean vehicle was defined as, say, 50% of the next target, a lower level of mandate would be more appropriate (e.g. towards the centre of Figure 4-1).

Figure 4-1: Indicative Relationship between the 'stringency of the threshold' (in terms of CO_2 emissions) and the 'level of the mandate' for a CVD mandate linked to a vehicle's CO_2 emissions for short-listed options for defining a clean vehicle



As noted above, there is no need to define a threshold if a clean vehicle was defined as being a ZEV, but the figure illustrates that the level of the minimum requirement would need to be low in this case. Strictly speaking, there is also no need to determine a threshold if a clean vehicle was defined as a vehicle using an alternative fuel.

Figure 4-1 made it clear that in theory it might be possible to set different threshold-minimum requirement combinations for each criterion. Consideration needs to be through to how this might work in practice and whether this would bring sufficient added value to be explored further as part of the policy options. In other words, whether it is possible to identify the following that are sufficiently different to make further exploration of different thresholds within the same definition worthwhile:

- Have a less stringent threshold, so a higher minimum requirement; and

- Have a more stringent threshold, so a lower minimum requirement.

However, some potential cases that meet these criteria are already being taken forward. For example, the most stringent threshold would be zero tailpipe CO_2 emissions, but this is already being taken forward in combination with both of the other potential criteria that might be used for defining a clean vehicle. At the other extreme, the highest potential minimum requirement, i.e. where procuring vehicles below the threshold is required as a low threshold value is set, which would probably be the level of the next legislative target, e.g. whatever CO_2 target is set for 2025 for cars and LCVs. Consequently, within these two extremes, it needs to be considered whether it is possible – for each criterion for defining a clean vehicle that is being considered – to define two other threshold-minimum requirement combinations that it would be worthwhile to explore further.

For cars, currently of those on the market in the UK, the lowest CO_2 emissions of a conventional diesel car, i.e. one that is not a hybrid, is 79 gCO_2/km[13] and it is considered that ultimately the CO_2 emissions per kilometre of such vehicles are unlikely to go much below is 70 gCO_2/km (ICCT, 2016)[14]. On the other hand, emissions of many plug-in hybrids on the EU market are already less than 40 gCO_2/km, while the best performing model has CO_2 emissions of 22 g/km, while a range extended car has emissions of only 12 gCO_2/km[15].

Hence, alternative thresholds could be set so as to encourage: i) the most efficient conventional cars, so perhaps at 75 gCO_2/km; and ii) the most efficient plug-in hybrids, so perhaps around 30 gCO_2/km. The same logic should be used to set the CO_2 thresholds for LCVs, i.e. the less stringent threshold should encourage the most efficient diesel vans, while the more stringent threshold should encourage the best plug-in hybrids. Note that these thresholds would be defined using the current NEDC test cycle, which is being replaced by a new test cycle, the WLTP. At the present time, setting thresholds according on the basis of the WLTP test cycle is not possible, as sufficient data are not available. However, by the time the revised Directive is transposed by Member States, the WLTP is likely to be in use to measure the CO_2 emissions of cars and LCVs. Consequently, the thresholds used to define a clean vehicle under this option would need to be amended accordingly.

For air pollutant emissions from cars and LCVs, thresholds would need to go beyond the RDE requirements, i.e. the conformity factor with which a clean vehicle must comply should be less than 1.5, which is the figure applied in the RDE legislation from 2021. Given that the Euro 6 standards should have been complied with in the mid-2010s, defining a clean vehicle as one that delivers Euro 6 standards on the road by 2025, i.e. it should have a conformity factor of 1.0, does not seem too ambitious. For 2030, given that EU air quality standards are still above those recommended by the World Health Organisation, a clean vehicle could be defined as having air pollutant emissions lower than those required by Euro 6, e.g. these vehicles should have emissions only 80% of the value of Euro 6 standards, which could be interpreted as applying a 'conformity factor' of 0.8.

Additionally, even if using the same criterion, it might be appropriate to set a different minimum requirement for different types of vehicle. Reasons for setting different minimum requirements, include:

- **The legislative framework**: Cars have been subject to legislation to improve their fuel efficiency and reduce their CO_2 emissions since 2009, while LCVs have been subject to similar legislation since 2011, whereas buses and HGVs are not

[13] http://carfueldata.direct.gov.uk/search-by-fuel-economy.aspx

[14] ICCT (2016) *2020-2030 CO2 standards for new cars and light-commercial vehicles in the European Union*, International Council on clean Transportation, Berlin

[15] Ricardo Energy & Environment, E3M Lab and TEPR (forthcoming) *Assessing the impacts of selected options for regulating CO2 emissions from new passenger cars and vans after 2020*, report for DG CLIMA

yet subject to such legislation. This legislation has been an important driver in improving the fuel efficiency and reducing the CO_2 emissions of the new car and LCV fleet, and has also been driving the increased uptake of alternatively-fuelled vehicles.

- **Stages of technological development**: It has generally been assumed that electrification, which is an important driver in reducing CO_2 emissions from cars in particular, is less relevant for heavier vehicles, such as buses and HGVs, although it is now anticipated that the majority of bus services could eventually be electrified, even though the technology is lagging behind that of LDVs. The development of hydrogen-based propulsion systems and sustainable biofuels that could be used for heavier vehicles is also lagging behind the development of electric cars in particular.

As a result, it might be concluded that cars and LCVs should have a higher minimum requirement than buses and HGVs.

4.3 Setting the minimum requirements for procurers (based on the clean vehicle definition)

There are a number of elements that need to be considered with respect to how to set the minimum requirements for procurers, including:

1. The way in which the minimum requirement is applied;
2. Whether or not there should be any differentiation between Member States; and
3. If there is to be differentiation, on what basis this should be set
4. What the minimum requirement should be.

These are covered in turn below.

4.3.1 Determining how a minimum requirement might be applied

There are number of options for the way in which a **minimum requirement might be applied**, including for extending the scope of the Directive):

- Define a clean vehicle with a ***relatively low threshold*** and then ***require this to be applied*** in:
    - The purchase of all vehicles;
    - The lease, rental and hire purchase of all vehicles; and
    - To a certain percentage of the fleets of operators providing specified transport services.
- Define a clean vehicle with ***a higher threshold*** and then ***require that a certain proportion*** of the vehicles:
    - Procured ***in each purchase contract*** should be clean vehicles;
    - Procured in each lease, rental or hire-purchase contract should be clean vehicles; and
    - In each operator's fleet that are providing specified transport services under contract to the local authority should be clean vehicles. In this case the required percentage would be less than the percentage required when a vehicle is purchased, leased, rented or hire-purchased.
- Define a clean vehicle with a ***higher threshold*** and then ***require that a certain proportion*** of the vehicles:
    - Purchased ***over a fixed period of time***, say four years, should be clean vehicles;
    - Leased, rented or hire-purchased over a fixed period of time, say four years, should be clean vehicles; and

    - In each operator's fleet that are providing specified transport services over a fixed period of time, say four years, should be clean vehicles. In this case the required percentage would be less than when a vehicle is purchased, leased, rented or hire-purchased.
- Set a future target to be achieved by a specified year, say 2030, and then require that a certain percentage of vehicles:
    - Purchased ***in the specified year*** should be clean vehicles;
    - Leased, rented or hire-purchased in this year should be clean vehicles; and
    - In each operator's fleet that are providing specified transport services in this year should be clean vehicles. Again, in this case the required percentage would be less than when a vehicle is purchased, leased, rented or hire-purchased.
- Define a clean vehicle and **set a minimum requirement for each Member State to be achieved by a specified year**, but leave it to each Member State to decide how to deliver this. The minimum requirement would require that a percentage of vehicles:
    - Purchased by public authorities ***in the specified year*** should be clean vehicles;
    - Leased, rented or hire-purchased by public authorities in this year should be clean vehicles; and
    - In each operator's fleet that are providing specified transport services in this year should be clean vehicles. Again, in this case the required percentage would be less than when a vehicle is purchased, leased, rented or hire-purchased.
- Define a clean vehicle and **leave it to Member States** to decide how to use this.

These alternatives are now discussed in turn. If a clean vehicle was defined with a ***low threshold and this was required*** to be applied in all procurement, there is no need to set a minimum requirement for the procurement of vehicles. When the criterion is tailpipe CO_2 emissions, the threshold for passenger cars could be set at the next CO_2 target under the passenger car CO_2 Regulation, and similarly for other vehicle types. Such an approach for cars has been effective in Sweden (although the definition was not mandatory). However, when the criterion is the use of alternative fuels, it is not currently realistic for all vehicle types to require only alternatively-fuelled vehicles to be procured (although perhaps it might be possible in some Member States to apply this for cars). The only way of making this meaningful would be to apply the approach similar to that proposed in the STF paper.

Various stakeholders have argued that applying ***the minimum requirement to each procurement contract*** is impractical. From the perspective of buses, few public authorities will simply buy buses without specifying the technology. Most will choose the technology first and then aim to procure buses accordingly. Hence, the choice as to whether to procure 'clean buses' is made prior to launching the call for tender. There are practical reasons for this. For example, procuring electric buses requires dedicated infrastructure and specialised staff training, so procuring a small number of such buses while also procuring diesel buses would mean that the additional costs are spread of fewer vehicles, thus reducing the practical and economic case for such vehicles. Buying more buses of the same type within the same contract also helps to deliver economies of scale. Additionally, some manufacturers may be able to supply only electric buses, while another may specialise in diesel buses, so requiring a single contract to cover electric buses and 'non-clean' technologies potentially excludes such specialised companies. Consequently, purchasing clean and other vehicles on the same contract may not allow the public authority to procure the best vehicle of either type.

There are also practical barriers to applying the ***minimum requirement over a fixed period of time***. Smaller public authorities do not procure vehicles as frequently as a larger authority might. If the time period was too short, say one year, some public authorities might only make one procurement in a year in which case applying the minimum requirement over a fixed period of time would effectively be applying the minimum requirement per contract, with all of the challenges noted above. Consequently, it would probably be appropriate to set the fixed time period at something like four years. A further challenge with a minimum requirement over a fixed time period is the challenge of monitoring and enforcing such legislation. In order to ensure compliance, the procurement of each public authority for each type of vehicle would need to be monitored, as otherwise it would not be clear if the minimum requirement was being delivered. Self-reporting could be used to do this, e.g. if a portal was set up to facilitate this, but this would only deliver a partial picture.

An alternative approach would be to set a ***target to be achieved in a specified year***, say 2025 or 2030. For procurement, leasing, rental and hire-purchase, this option has similar challenges to those already discussed for a time-based approach, although only in the final year. A fleet-based approach could set a target that, for example, all public authority bus fleets should contain a certain proportion of clean buses by 2030. Even if it would be potentially challenging to monitor, it would at least set a direction for the market, which would be clear both for manufacturers and for public authorities. If such a target was applied to the public authority procurement of transport services, e.g. bus services, the same target could be applied to these fleets, i.e. those of contractors providing services to public authorities.

If it was desired to bring more flexibility, a variation would be to set each Member State a minimum requirement, but each ***Member State would be left to decide how to deliver the requirement***. In this variation, the responsibility for meeting the target would be with each Member State. With such an approach, the Member State would have the possibility to differentiate between smaller and larger cities, or those that are more or less polluted. In this way, national financial support could focus on the cities that are most in need and most capable of developing the infrastructure for and utilising clean vehicles. With such an approach, there would still be a clear direction in terms of the development of the market, but action could be more targeted within countries at areas where the need and capacity is greatest.

The final option proposed was that a definition of a clean vehicle is developed, but that ***Member States would be left to decide how to use this***. With this option, there is a clear risk that no appropriate action would happen in some Member States, or that Member States would set low targets that would not provide a sufficiently strong signal to develop the market, and which would then need to be tackled through lengthier follow-up processes between the European and national level leading to a considerable delay of action impact. However, it would be the option that gave maximum flexibility to Member States.

On the basis of the above discussion, it appears that the principal options that are of most relevance to take forward are:

- Define a clean vehicle and **set a minimum requirement for each Member State**, but leave it to each Member State to decide how to deliver this.
- Define a clean vehicle and **leave it to Member States** to decide how to use this.

4.3.2 Whether to differentiate between Member States

The next element is to identify whether or not it is appropriate to **differentiate between Member States**. It is necessary to make a decision about whether or not differentiation is necessary for the various options above in which a percentage is applied. This could be to set a minimum requirement at a Member State level, or to apply to fleets in the event that services are procured.

Purchasing clean vehicles costs money, and so some Member States, and even some cities within Member States, are likely to be more able to afford to purchase clean vehicles more than others. Additionally, some Member States and cities have a stronger culture of purchasing clean vehicles than others, which means that the former will already have more clean vehicles in their fleets and operating in their cities. Consequently, setting the same minimum requirement throughout the EU risks being meaningless for some and too challenging for others. Hence, there is a strong case for differentiating the minimum requirement – and other percentages to be applied – between Member States.

4.3.3 Approach to differentiate procurement mandates among Member States

The next element to be determined, therefore, is on **what basis to differentiate the minimum requirements between Member States**. There are a number of potential ways of doing this, which are assessed in

Table 4-3.

Table 4-3: Options for setting a mandate/threshold accordingly to differentiate between different cities

Option	Pros	Cons
Based on a Member State's GDP	• Reflects differences in wealth between Member States, and so potentially the ability to finance the procurement of clean vehicles	• GDP varies a lot between cities in the same Member State • Does not (necessarily) link to environmental need • Would need to identify how GDP should be converted into a mandate (or threshold)
Based on a Member State's GDP	• Reflects differences in wealth between Member States, and so potentially the ability to finance the procurement of clean vehicles	• GDP varies a lot between cities in the same Member State • Does not (necessarily) link to environmental need • Would need to identify how GDP should be converted into a mandate (or threshold)
Based on a city's GDP	• Reflects differences in wealth between cities, and so potentially the ability to finance the procurement of clean vehicles	• Does not (necessarily) link to environmental need • Would need to identify how GDP should be converted into a minimum requirement • Becomes administratively complex, as there are hundreds of cities • Not clear how it would apply to public authorities that are not city authorities
Based on a city's population	• Reflects differences in size of cities	• Does not (necessarily) link well to environmental need • Not clear how a city's population should be converted into a minimum requirement • Becomes administratively complex, as there are hundreds of cities • Not clear how this would apply to public authorities that are not city authorities
Based on a Member State's financial capacity for reducing its GHG emissions	• Directly related to a relevant environmental need	• Does not take into account the GDP of different cities

Option	Pros	Cons
(based on the way in which GHG emissions reductions are shared in the proposed Effort Sharing Regulation)	• Directly related to a Member State's environmental objective of relevance • Should take account of a Member State's ability to reduce GHG emissions (including its economic capacity to do so), as related to its GDP	
Based on the extent of a city's lack of compliance with EU air quality limits	• Directly related to a relevant environmental need in a city	• Does not take account of a city's (financial) ability to procure CVs • Becomes administratively complex, as there are hundreds of cities • Not clear how this would apply to public authorities that are not cities • For cities in compliance with EU air quality limits, there would be no requirement under the CVD

In order to determine the criterion to be used to set the minimum requirement for each Member State, four variants were initially tested, all based on data from Eurostat:

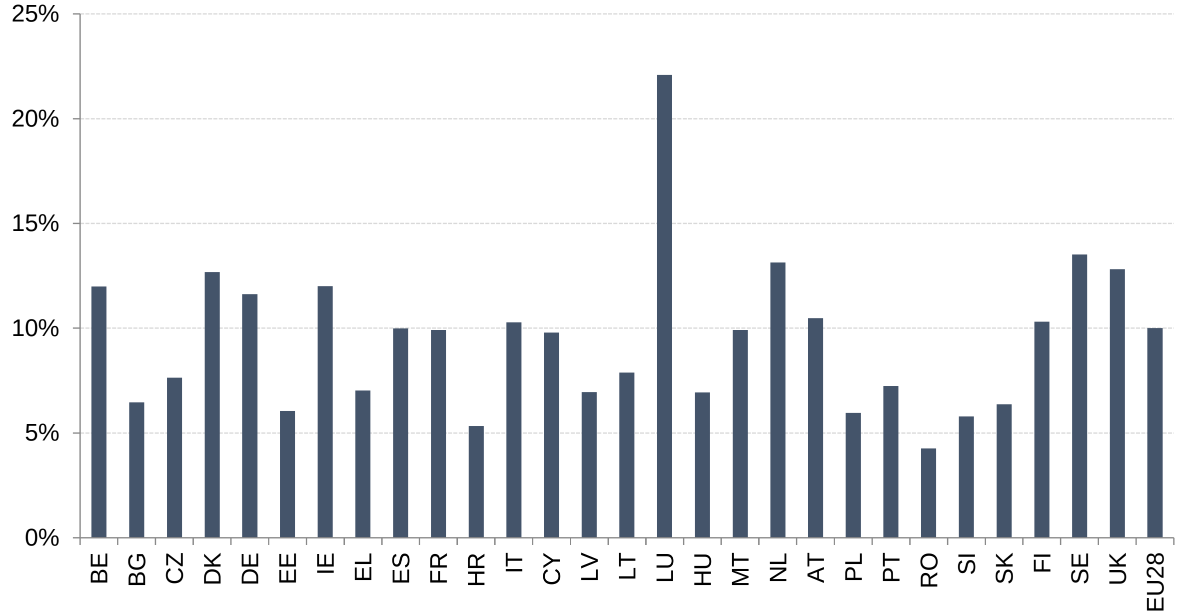
- Variant 1: using the share of urban and intermediate regions population (50% weight) plus GDP per capita (50% weight) for modulation
- Variant 2: using the share of urban and intermediate regions population
- Variant 3: using GDP per capita
- Variant 4: using the share of GDP from predominantly urban and intermediate regions

As discussed in the pre-screening of measures (Section 5.1.2.2), a starting assumption was that the combination of GDP per capita and share of urban and intermediate regions population (variant 1) would provide a well-founded approach, as it accounts for both economic capacity of Member States (in order to deal with introduction of more innovative technologies), and also for urban problems such as air quality exposure (which is higher in more densely populated areas). To test the validity of the approach, other variants of only using the share of urban and intermediate regions population, only using GDP per capital or only using the share of GDP from predominantly urban and intermediate regions were tested as well.

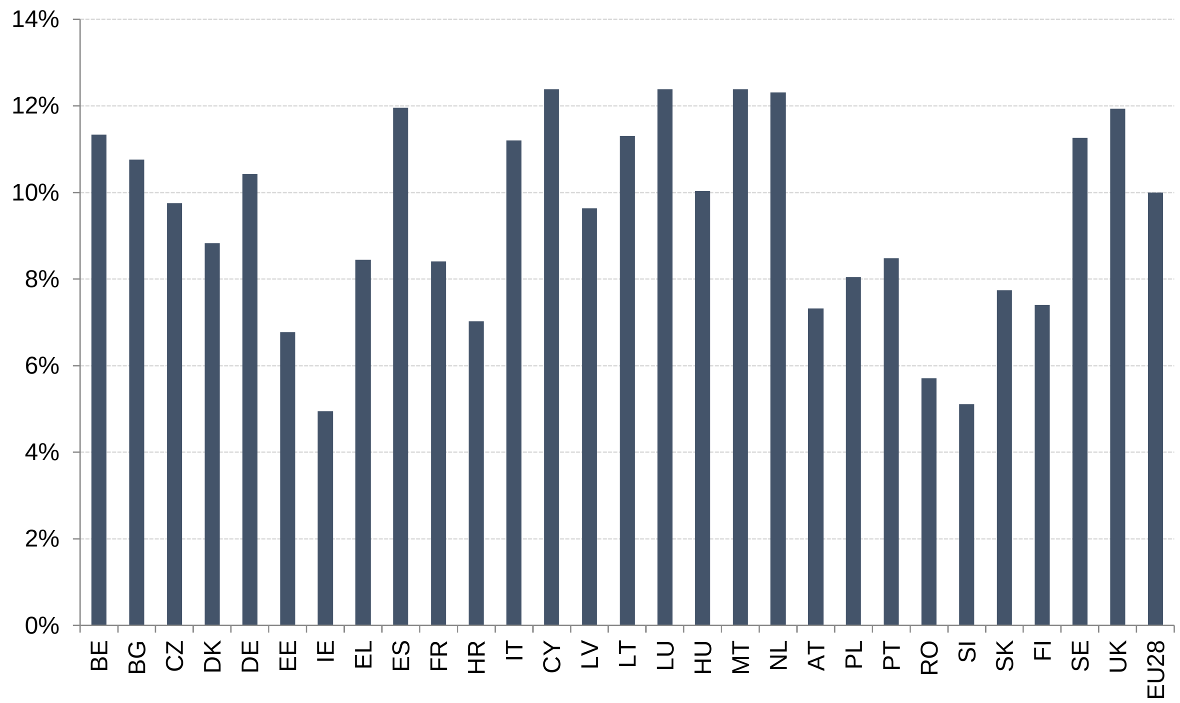
Box 2 below shows the initial results of a testing of the different variants, on the basis of an initial average assumption of 10%.

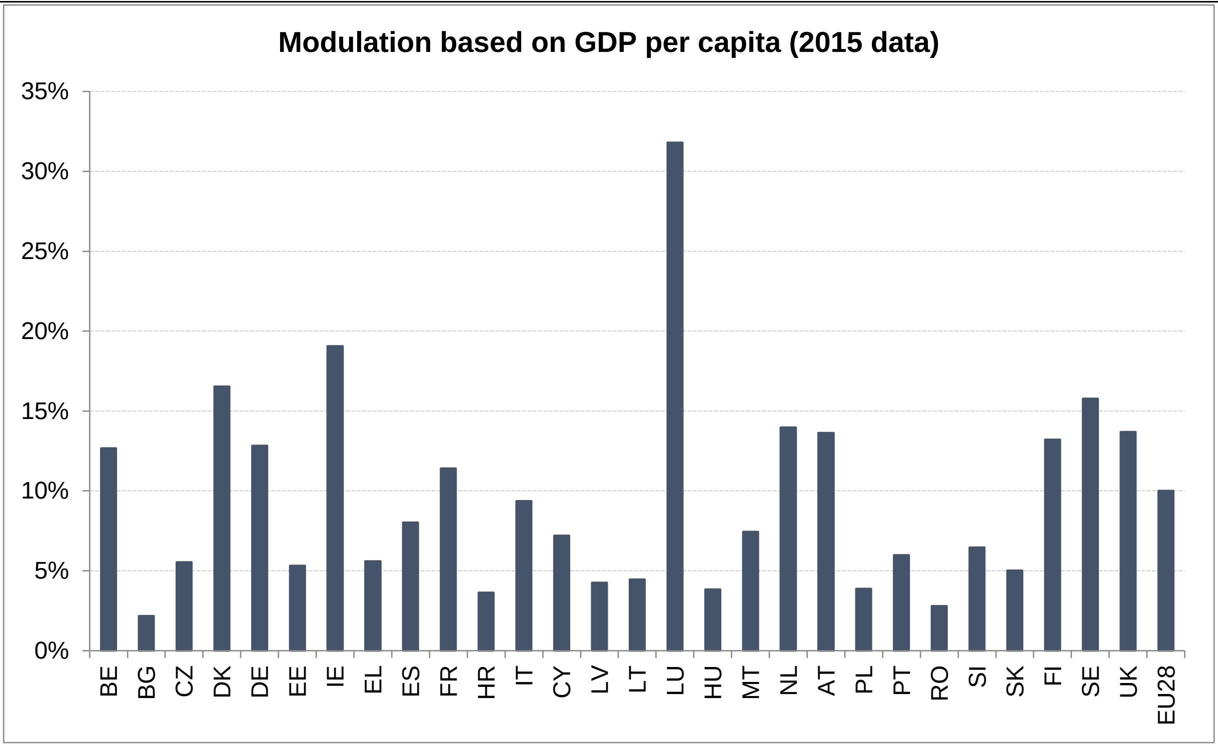
Box 2: Variants for the modulation of minimum procurement requirements by Member States (based on an assumed average ambition of 10%)

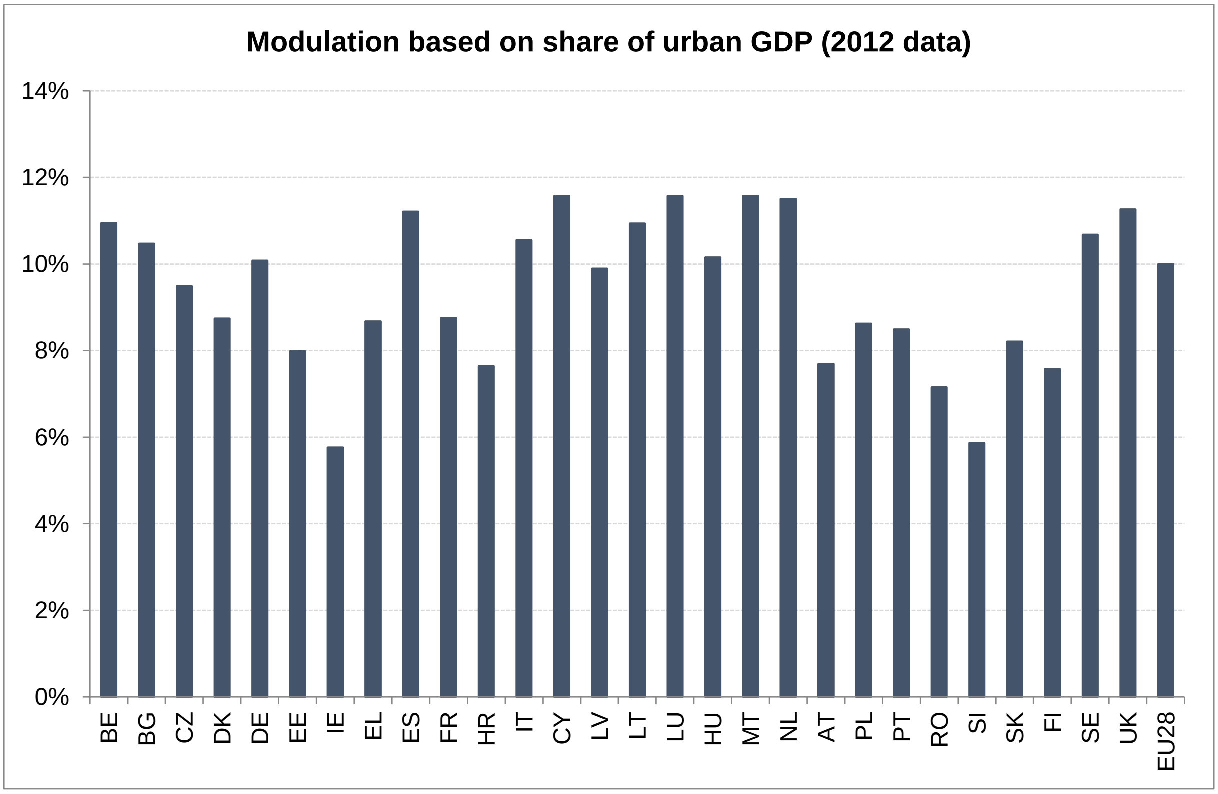
Modulation based on the degree of urbanisation and GDP per capita (2015 data)



Modulation based on the degree of urbanisation (2015 data)







From the initial analysis, it appeared that variant 2 (based on urbanisation data only) would lead to cases where Member States economic capacity (which is not reflected in this variant) would be overstretched. This could be, for example, particularly the case with Bulgaria that would be above the main European average. Even if all Member States above the European average are capped to get the same full target, some of those would still be non-proportionally mandated.

A similarly, though less pronounced outcome, could be found for the use of the urban GDP approach (variant 4). Modulating solely on the basis of the GDP per capita (variant 3) leads to a very high mandate for Luxembourg, and also comparatively high mandates for e.g. Ireland or Denmark; with the additional drawback that this measure does not include a take on the actual problem pressure. Also, the combination of GDP/capita and urbanisation data leads to a still high value for Luxembourg. In all cases, the modulations lead to mandates for some Member States above the European average level of ambition.

From the comparison of all four variants, it appears that none of the compared variants had significant advantages over variant 1. Accordingly, it was decided to use variant 1 as the basis for the differentiation of Member State mandates as it combines economic capacity and problem pressure in terms of urban population density (with a 50% weighting for each factor). The main rationale for using the modulation was to ensure that Member States with lower economic capacities are not burdened too much, which could result in further decreases of public transport services offer and overall public transport quality, but are still being incentivised to accelerate their transition to a low-emission mobility. Also, modulation leads in some cases to mandates for Member States which exceed the EU average considerably. It was hence concluded that the objectives of the policy initiative are best reflected if the modulation is used to differentiate all Member State mandates below the EU average level and if all Member States above the EU average level are capped at the average level (1.0) to have a full target.

4.3.4 Determining the minimum requirement

Besides the approach and the threshold set to define clean vehicles, **the proposed policy measures should set minimum requirements in terms of the share of such clean vehicles in the total number of vehicles procured**. Given that data on share of clean vehicles were only available at EU level, it was considered appropriate that such targets should be determined at EU level.

In terms of the EU targets, three potential thresholds were identified of increasing level of stringency (Low, Medium, and High) and varying depending on the type of vehicle as summarised in the table below. These thresholds were set so that they represent increasing levels of improvement in comparison to the current level of uptake of clean vehicles, as described in more detail in the Annex 4.

Table 4-4: Thresholds on the share of clean vehicles at EU level

Vehicle type	Low	Medium	High
Cars and vans	20%	35%	50%
Trucks	5%	10%	15%
Buses	30%	50%	75%

4.3.4.1 Minimum mandates under PO3 and PO4 that were used in the assessment of impacts

The tables below provide an overview of the differentiated minimum mandates under PO3 and PO4. Note that only the approach of using an average level of ambition of 35% of vehicle procurement was used to analyse the impacts of PO3.

Table 4-5 - Minimum mandates differentiated by Member State under PO3

		2025 & 2030		
	Scaling factor	20% (all cars and vans)	35% (all cars and vans)*	50% All cars and vans
		Low	Medium	High
Luxembourg	1.00	20%	35%	50%
Sweden	1.00	20%	35%	50%
Denmark	1.00	20%	34%	50%
Finland	0.92	18%	35%	46%
Germany	1.00	20%	35%	50%
France	0.95	19%	34%	48%
United Kingdom	1.00	20%	35%	50%
Netherlands	1.00	20%	35%	50%
Austria	1.00	20%	35%	50%
Belgium	1.00	20%	35%	50%
Italy	1.00	20%	35%	50%
Ireland	1.00	20%	35%	50%
Spain	1.00	20%	33%	50%
Cyprus	1.00	20%	29%	50%
Malta	1.00	20%	35%	50%
Portugal	0.81	16%	27%	40%
Greece	0.76	15%	23%	38%
Slovenia	0.67	13%	20%	33%
Czech Republic	0.93	19%	27%	46%
Estonia	0.71	14%	21%	36%
Slovakia	0.77	15%	20%	39%
Lithuania	0.94	19%	19%	47%
Poland	0.74	15%	20%	37%
Croatia	0.64	13%	17%	32%
Hungary	0.84	17%	21%	42%
Latvia	0.80	16%	20%	40%
Romania	0.57	11%	17%	29%
Bulgaria	0.77	15%	16%	39%

* used for quantification of impacts

Table 4-6- Minimum mandates differentiated by Member State under PO4

		Cars and vans				Trucks				Buses			
		EU target											
		P4a		P4b		P4a		P4b		P4a		P4b	
		2025	2030	2025	2030	2025	2030	2025	2030	2025	2030	2025	2030
		20%	35%	35%	50%	5%	10%	10%	15%	30%	50%	50%	75%
	Scaling factor	National targets											
Luxembourg	1.00	20%	35%	35%	50%	5%	10%	10%	15%	30%	50%	50%	75%
Sweden	1.00	20%	35%	35%	50%	5%	10%	10%	15%	30%	50%	50%	75%
Denmark	1.00	20%	35%	35%	50%	5%	10%	10%	15%	30%	50%	50%	75%
Finland	0.92	18%	32%	32%	46%	5%	9%	9%	15%	28%	46%	46%	69%
Germany	1.00	20%	35%	35%	50%	5%	10%	10%	15%	30%	50%	50%	75%
France	0.95	19%	33%	33%	48%	5%	10%	10%	15%	29%	48%	48%	71%
United Kingdom	1.00	20%	35%	35%	50%	5%	10%	10%	15%	30%	50%	50%	75%
Netherlands	1.00	20%	35%	35%	50%	5%	10%	10%	15%	30%	50%	50%	75%
Austria	1.00	20%	35%	35%	50%	5%	10%	10%	15%	30%	50%	50%	75%
Belgium	1.00	20%	35%	35%	50%	5%	10%	10%	15%	30%	50%	50%	75%
Italy	1.00	20%	35%	35%	50%	5%	10%	10%	15%	30%	50%	50%	75%
Ireland	1.00	20%	35%	35%	50%	5%	10%	10%	15%	30%	50%	50%	75%
Spain	1.00	20%	35%	35%	50%	5%	10%	10%	14%	30%	50%	50%	75%
Cyprus	1.00	20%	35%	35%	50%	5%	10%	10%	13%	30%	50%	50%	75%
Malta	1.00	20%	35%	35%	50%	5%	10%	10%	15%	30%	50%	50%	75%
Portugal	0.81	16%	28%	28%	40%	4%	8%	8%	12%	24%	40%	40%	61%
Greece	0.76	15%	27%	27%	38%	4%	8%	8%	10%	23%	38%	38%	57%
Slovenia	0.67	13%	23%	23%	33%	3%	7%	7%	9%	20%	33%	33%	50%
Czech Republic	0.93	19%	32%	32%	46%	5%	9%	9%	11%	28%	46%	46%	70%

		Cars and vans				Trucks				Buses			
		EU target											
		P4a		P4b		P4a		P4b		P4a		P4b	
		2025	2030	2025	2030	2025	2030	2025	2030	2025	2030	2025	2030
		20%	35%	35%	50%	5%	10%	10%	15%	30%	50%	50%	75%
	Scaling factor	National targets											
Estonia	0.71	14%	25%	25%	36%	4%	7%	7%	9%	21%	36%	36%	53%
Slovakia	0.77	15%	27%	27%	39%	4%	8%	8%	9%	23%	39%	39%	58%
Lithuania	0.94	19%	33%	33%	47%	5%	9%	9%	8%	28%	47%	47%	70%
Poland	0.74	15%	26%	26%	37%	4%	7%	7%	9%	22%	37%	37%	56%
Croatia	0.64	13%	23%	23%	32%	3%	6%	6%	7%	19%	32%	32%	48%
Hungary	0.84	17%	29%	29%	42%	4%	8%	8%	9%	25%	42%	42%	63%
Latvia	0.80	16%	28%	28%	40%	4%	8%	8%	9%	24%	40%	40%	60%
Romania	0.57	11%	20%	20%	29%	3%	6%	6%	7%	17%	29%	29%	43%
Bulgaria	0.77	15%	27%	27%	39%	4%	8%	8%	7%	23%	39%	39%	58%
EU weighted average		**19%**	**34%**	**34%**	**48%**	**5%**	**10%**	**10%**	**14%**	**28%**	**48%**	**48%**	**72%**

Table 4-7- Minimum mandates differentiated by Member State under PO6

		EU Targets					
		2025	2030	2025	2030	2025	2030
		Cars and vans		Trucks		Buses	
		35%	50%	10%	15%	50%	75%
	Scaling factor						
Luxembourg	1.00	35%	50%	10%	15%	50%	75%
Sweden	1.00	35%	50%	10%	15%	50%	75%
Denmark	1.00	34%	50%	10%	15%	50%	75%
Finland	0.92	35%	46%	9%	15%	46%	69%
Germany	1.00	35%	50%	10%	15%	50%	75%
France	0.95	34%	48%	10%	15%	48%	71%
United Kingdom	1.00	35%	50%	10%	15%	50%	75%
Netherlands	1.00	35%	50%	10%	15%	50%	75%
Austria	1.00	35%	50%	10%	15%	50%	75%
Belgium	1.00	35%	50%	10%	15%	50%	75%
Italy	1.00	35%	50%	10%	15%	50%	75%
Ireland	1.00	35%	50%	10%	15%	50%	75%
Spain	1.00	33%	50%	10%	14%	50%	75%
Cyprus	1.00	29%	50%	10%	13%	50%	75%
Malta	1.00	35%	50%	10%	15%	50%	75%
Portugal	0.81	27%	40%	8%	12%	40%	61%
Greece	0.76	23%	38%	8%	10%	38%	57%
Slovenia	0.67	20%	33%	7%	9%	33%	50%
Czech Republic	0.93	27%	46%	9%	11%	46%	70%
Estonia	0.71	21%	36%	7%	9%	36%	53%
Slovakia	0.77	20%	39%	8%	9%	39%	58%

		EU Targets					
		2025	2030	2025	2030	2025	2030
		Cars and vans		Trucks		Buses	
		35%	50%	10%	15%	50%	75%
	Scaling factor						
Lithuania	0.94	19%	47%	9%	8%	47%	70%
Poland	0.74	20%	37%	7%	9%	37%	56%
Croatia	0.64	17%	32%	6%	7%	32%	48%
Hungary	0.84	21%	42%	8%	9%	42%	63%
Latvia	0.80	20%	40%	8%	9%	40%	60%
Romania	0.57	17%	29%	6%	7%	29%	43%
Bulgaria	0.77	16%	39%	8%	7%	39%	58%

EU weighted average		**34%**	**48%**	**10%**	**14%**	**48%**	**72%**

Annex 5 STAKEHOLDER CONSULTATION REPORT

5.1 Presentation of consultation activities

The stakeholder consultation methodology for the Impact Assessment study for the review of Directive 2009/33 on the Promotion of Clean and Energy-Efficient Road Transport Vehicles was designed in accordance with the principles of Better Regulation of the European Commission.

Following the outline of the stakeholder consultation strategy of the European Commission for this Impact Assessment, consultation activities were planned to maximise stakeholder engagement and to allow stakeholder comments and views to feed into the Impact Assessment (IA) and the related Impact Assessment support study. These activities included:

1. Exploratory Interviews
2. Open Public Consultation
3. Targeted Stakeholder Interviews
4. Case Studies
5. Questionnaire for procurement authorities (bilateral discussions)
6. Stakeholder workshops

Stakeholder engagement activities were fine-tuned during the project inception. It was agreed that the study team would align interview guides and the questionnaire for the public consultation. Throughout the stakeholder engagement activities, the list of possible policy measures has been further refined as feedback has been received and as analysis of the qualitative data has been carried out.

In addition to the planned stakeholder engagement activities (activities 1 – 4 and 6, above), the study team identified a need to corroborate the public procurement data available on the EU's public tender platform (TED database). Consequently, a supplementary, short questionnaire (activity 5, above) was sent out to public procurement authorities to gain 'real-world' figures, ensure a more accurate summary of the current situation and provide realistic impact projections for the different policy measures. The questionnaire, stakeholder responses and how this information will be used are detailed in Section 5.4.

The first sections of the following report outline the methodology employed during stakeholder engagement activities and details the stakeholders that have provided information for the study – and the form that their participation took. Section analyses the responses we have received from all groups of stakeholders and Section 5.6 details conclusions that have been reached based on all responses to the stakeholder engagement activities and the policy measures that have been selected for further investigation once the 'long' list of amendments had been refined and stakeholders had provided further feedback on the shortened list of policy measures.

5.1.1 Exploratory interviews

The aim of exploratory interviews was to identify the initial views of the stakeholders considered to be critical in the long-term success of the Directive and related necessary changes. Interviewees were asked to provide their views on an initial 'long' list of policy measures that were derived on the basis of the priorities laid out in the Inception Impact Assessment and reflecting further the outcomes of the ex-post evaluation. As many measures were mentioned by stakeholders without further specification, it was essential to explore them, including how they might be implemented in practice. Those initial explorations with stakeholders that would be active in the eventual implementation of the requirements of the revised Directive helped to reflect on the initial problem analysis and related policy measures.

The stakeholders that have been contacted during this exploratory engagement exercise are listed in Table 5-1. The participants selected are Europe-wide organisations – many of whom represent national or local interests of businesses and local public authorities and were able to provide feedback to help refine and shorten the 'long' list of policy measures.

These stakeholders were previously known to the project study team and were initially contacted using introductory emails and telephone calls. Of the 10 stakeholders contacted, 8 ultimately agreed to be interviewed or provided a written response on the 'long' list of policy measures. The same stakeholders were also invited to attend the Stakeholder Workshop; many of them did attend.

Table 5-1: Stakeholders contacted and interviewed as part of the exploratory interviews

Stakeholder	Contact	State of play
UITP (public transport)	Annika Stienen	UITP has provided written comments.
FEAD (municipal waste)	Margot Auvray	Declined as not involved in the CVD
ACEA (manufacturers)	Petr Dolejsi	Discussed the questions at an internal ACEA meeting on the 13th December; has provided a written response
T&E (Transport and Environment)	Greg Archer	Interviewed (2nd December)
Council of European Municipalities and the Regions (CEMR) (CCRE - francais)	Angelika Poth-Moegele (Dr)	Arthur ter Weeme of the Association of Netherlands Municipalities (VNG) was interviewed on behalf of CEMR on 12th January.
European Metropolitan Transport Authorities (EMTA)	Ruud van der Ploeg	No response
European Cities and Regions networking for innovative transport solutions (POLIS)	Nicolas Hauw	Interviewed (25th January)
EUROCITIES	Vanessa Holve	Interviewed (Jonas Ericson, City of Stockholm on behalf of Eurocities) (13th December)
Local governments for sustainability (ICLEI)	Simon Clement	Interviewed (12th December)
International Road Transport Union	Marc Billiet	IRU sought their members' views but received only one response - Duncan Buchanan from Road Haulage Association Ltd (UK, IRU member) was interviewed on 25th January.

Table 5-2: Overarching policy measures discussed during exploratory interviews - and how they could be implemented

Overarching policy amendments discussed during exploratory interviews	Implementation options
Expanding the scope of the Directive. These amendments focus on increasing the number of procurement decisions that involve transport vehicles, services or other contracts to which the Directive might apply. Currently the Directive only covers the ***purchase*** of road transport vehicles by contracting authorities, contracting entities and operators discharging public service obligations as defined by Regulation 1370/2007[16]. The way in which public authorities procure vehicles is changing with an increasing proportion of vehicles being leased, rented or indirectly procured through the procurement of services, e.g. bus or waste collection services. The existence of a threshold for service and supply contracts (of up to €414,000[17]), below which the Directive does not need to be applied, also limits its scope. Expanding the scope of the Directive would therefore ensure that it applies to a wider range of procurement options.	a) Remove the procurement threshold, thus ensuring that all vehicles purchased by public authorities are covered by the Directive. b) Extend the scope of the Directive to vehicles rented, leased and hire-purchased by public authorities[18]. c) Extend the scope of the Directive to private operators providing public services transporting passengers or goods. This might be considered to be extending the scope of the Directive to services that involve transport. d) Extend the scope of the Directive to all contracts that have a major transport element. These contracts are not for the procurement of transport vehicles, or even of transport services, but for contracts that have a separate activity as their main purpose, but which involve a significant transport element. An example of such a contract might be significant construction contracts.
Another policy measure concerns **including a definition of a clean vehicle** within the Directive, to give straightforward orientation to procurement processes.	a) Have ***tailpipe*** CO_2 emissions below a specified threshold. This would currently be difficult to define for heavy duty vehicles, as there is no consistent information available on their CO_2 emissions, although the development of the VECTO tool will provide such information over the next few years. b) Have ***lifecycle*** GHG emissions below a specified threshold. As above, this would currently be more difficult to define for heavy duty vehicles and would require an agreement on the well-to-tank factors to be used. c) Have real world air pollutant emissions below a specified threshold. For light duty vehicles, this is meaningful with reference to the RDE tests, but it is less meaningful for heavy duty vehicles as Euro VI vehicles deliver the anticipated emissions reductions for these vehicles.

[16] Article 3(b) of the CVD

[17] Article 3(b) of the CVD referring to Article 15(a) of Directive 2014/25

[18] Note that in the context of the public procurement Directives (Directives 2014/24 and 2014/25) a supply contract refers to contracts involving the purchase, lease, rental or hire-purchase of products.

Overarching policy amendments discussed during exploratory interviews	Implementation options
	d) Meet the ***broader criteria*** defined in the revised EU GPP criteria for transport. These are under review and take account of the issues mentioned in the previous two options, as well as a broader set of environmental criteria[19]. e) Use an alternative fuel, as defined by Article 2(1) of the Alternative Fuels Infrastructure Directive[20]. f) Have zero tailpipe emissions.
Options that consider how to implement the definition within the Directive; how the definition should be applied in the context of a ***mandate, which sets minimum requirements for procurers***.	a) Require public authorities to use the definition of a clean vehicle when procuring vehicles, but do not state how. This is in effect, no mandate. b) Require public authorities to ensure that at least a specified percentage of vehicles procured under each contract are clean vehicles. c) Require public authorities to ensure that at least a specified percentage of vehicles procured over a fixed time period are clean vehicles. d) Have a two-tiered definition of a clean vehicle, which could apply to different authorities depending on, for example, their level of need for clean vehicles. For example, public authorities in countries with stricter CO_2 reduction targets, as defined by the Effort Sharing Decision, or with air quality problems, e.g. cities that are in breach of current air quality limit values, might be required to procure cleaner vehicles than other public authorities.
Applying changes to the implementation mechanisms of the Directive.	a) Keep the existing implementation mechanisms (Article 5(3)(a) and (b)), but improve the monetisation methodology (see proposed revisions of the monetisation methodology, below). b) Remove the possibility to include energy and environmental considerations as a technical specification (Article 5(3)(a)), and improve the monetisation methodology (see proposed revisions of the monetisation methodology, below). c) Replace the current technical specification mechanism (Article 5(3)(a)) with a mandate requiring authorities to use the specified definition of a clean vehicle, but also retain an amended monetisation methodology (see proposed revisions of the monetisation methodology, below).

[19] http://susproc.jrc.ec.europa.eu/Transport/documents.html

[20] Directive 2014/94, which defines the following as alternative fuels: electricity, hydrogen, biofuels (as defined in Directive 2009/28), synthetic and paraffinic fuels, natural gas in compressed and liquefied forms and including biomethane, and LPG.

Overarching policy amendments discussed during exploratory interviews	Implementation options
	d) Introduce a mandate requiring authorities to use the specified definition of a clean vehicle, and remove all other implementation mechanisms including the monetisation methodology. e) Make the application of an improved monetisation methodology mandatory (see proposed revisions of the monetisation methodology, below), but DO NOT include a clean vehicle definition or an associated mandate. f) Include an improved monetisation methodology (see proposed revisions of the monetisation methodology, below) AND a definition of a clean vehicle, but leave the details of the implementation to Member States. g) Require the application of an improved monetisation methodology (see proposed revisions of the monetisation methodology, below) OR require authorities to use the specified definition of a clean vehicle. In this case, which option to apply could be left to: i. Member States ii. Public bodies doing the procuring.
Revision of the monetisation methodology.	a) Simplifying the current methodology b) Putting greater emphasis on reducing emissions of CO_2 c) Putting more emphasis on reducing emissions of pollutants. d) Enlarge the scope of environmental impacts covered (e.g. noise) e) Create more effective mechanisms for updates of the methodology
Introduction of an absolute definition of clean vehicles, while abandoning the monetisation methodology.	(see details of the implementation options definition of a clean vehicle and revisions to the monetisation methodology, above)
Combination of both measures with a mandatory choice for Member States.	(see details of the implementation options definition of a clean vehicle and revisions to the monetisation methodology, above)

Following exploratory interviews, the 'long' list of policy measures were shortened based on comments received and after discussions with DG MOVE.

5.1.2 Open Public Consultation

A 12-week Open Public Consultation (OPC) was launched by the Commission on 19th December 2016. The consultation activity ended on 24th March 2017 and a total of 130 responses were received (from across 20 Member States).

The public consultation ran in parallel to other activities with the aim of collecting stakeholder opinions. Analysis of qualitative feedback provided in free text comment boxes was carried out as and when it was received throughout the 12-week duration of the consultation.

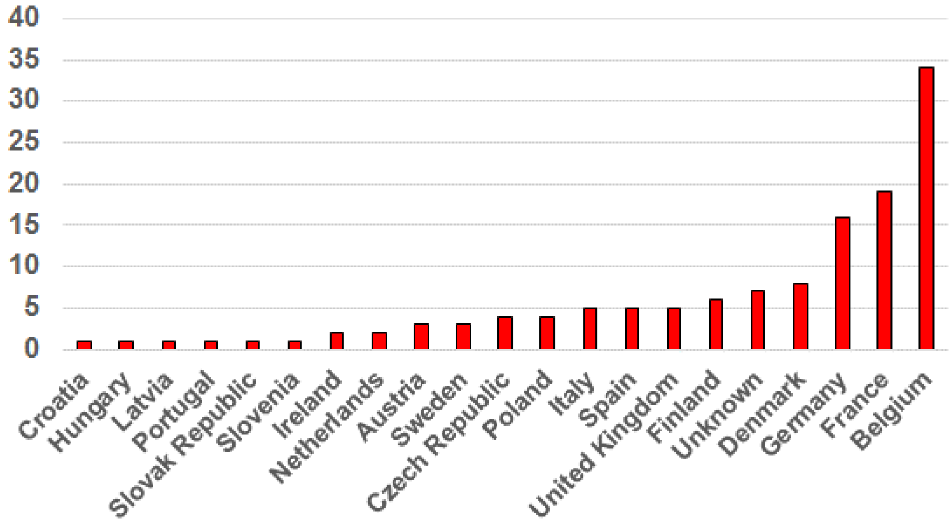
A full analysis of the responses to the public consultation have been included in the discussions within Section 5.2.2.

In terms of geographic coverage, 13 (10%) were from EU-13 Member States, 109 (85%) were from EU-15 Member States, and 8 (5%) were unknown. The highest number of responses came from respondents based in Belgium (34), followed by France (19) and Germany (16) (see Table 5-3). Based on the information received, EU-13 Member States were under-represented in response to the public consultation; this has been addressed later in the study within the spread of case studies and in attempts to reach more EU-13 named contacts when carrying out targeted stakeholder interviews.

Table 5-3: Responses by country of residence

Country of residence	No. of responses	Country of residence	No. of responses
Belgium	34	Austria	3
France	19	Sweden	3
Germany	16	Ireland	2
Denmark	8	Netherlands	2
Finland	6	Croatia	1
Not listed	8	Hungary	1
Italy	5	Latvia	1
Spain	5	Portugal	1
United Kingdom	5	Slovak Republic	1
Czech Republic	4	Slovenia	1
Poland	4	TOTAL	130

Figure 5-1: Responses by country of residence



The largest proportion of respondents stated that they were replying on behalf of a company (37), followed by public authorities (e.g. ministry, agency, or other form of public administration) (21). Non-governmental organisations accounted for (19), 17 participants representing themselves as an individual and 10 contracting authorities. 27 other responses were received, from respondents describing themselves as industry/trade associations, experts etc. (see Table 5-4).

Table 5-4: Response by type of respondent

Replying as a:	No. of responses
Company	37
Contracting authority (procurer)	10
Non-governmental organisation	29
Public authority (ministry, agency, other form of public administration, at national, regional or local level)	21
An individual in your personal capacity	17
Other (including industry/trade associations, experts etc.)	27
TOTAL	143

NOTE: 130 responses were received to the OPC. However, respondents were able to select more than one option describing the capacity in which they were responding (leading to 143 responses to this question).

Responses were received from a wide spread of stakeholders. However, public authorities were under-represented in the public consultation. This can be explained to a certain extent by the fact that contributions to the public consultation by city networks such as Eurocities or Polis were representative of a larger number of cities and regions that themselves abstained from contributing individually. Contributions from large member organisations were hence analysed and weighted carefully in the analysis of the overall contributions.

5.1.3 Targeted stakeholder interviews

A total of 144 stakeholders were directly contacted with the aim of carrying out targeted stakeholder interviews. Of these, a total of 13 stakeholders agreed to participate in telephone interviews. A wider perspective was sought from contractors and representatives of businesses likely to be affected by changes to the scope of the Directive and corroborated by interviews with EU level stakeholders and NGO's representing Cross-Europe interests.

The interviews with wider interest groups included three follow-up interviews with stakeholders who were involved in exploratory interviews (i.e. Eurocities, UITP and ICLEI) in order to explore further some of the issues that they raised. Additionally, these interviews were used to explore elements that might be part of an amended Directive, but which had not been covered in the exploratory interviews, such as differentiating the minimum requirements between Member States.

In order to access contacts within procurement units at the city-level, an initial list of stakeholders who had responded to the 2012 study and Ex-post Evaluation of the Directive was reduced to 144 highly relevant stakeholders. All highly relevant stakeholders were contacted and invited to participate in the study on more than one occasion. However, interviews were ultimately carried out with 6 city-level contacts; all of whom are stakeholders operating with procurement responsibilities within a public authority. A number of potential interviewees cited time constraints as a major drawback to participating but may have been able to contribute further if they had more time. Participating in the interviews can involve 1 – 3 hours of stakeholders' time, depending on their level of knowledge and interest. All respondents who were unable to take part in an interview due to time constraints were offered alternative options to share their views, such as participating in stakeholder workshops (see Section 5.1.6), or have been asked specific questions via email (see Section 5.1.5). In some cases, named contacts had moved on and a replacement within their organisation could not be identified.

Participants in the targeted interviews are outlined in Table 5-5. Two of the city-level contacts have provided their views and approved the transcript of their interview, but chosen to remain anonymous.

Table 5-5: Targeted stakeholder interviews – stakeholder type

Stakeholder type	Organisations interviewed
Procurement authorities (national, regional authorities, municipalities)	• Warsaw, Poland, EU13 • London, United Kingdom, EU15 • Municipality of Rijssen-Holten, The Netherlands, EU15 • City of Niort, France, EU15 • City, Sweden, EU15 • City, Ireland, EU15
Contractors (representative of EU-wide interests)	• Food Service Europe • DHL • GeoPost • Malta Post (members of EuropPost)
EU Level stakeholders or associations (including NGOs representing environmental interests, city networks, interest groups representing alternative fuel producers and retailers	• ICLEI • Eurocities • International Association of Public Transport (UITP)

In addition to interviews with procurement authorities and public sector stakeholders, it was also necessary to speak with representatives of other industries that could potentially be impacted by an expanded Directive to gain their insight into how any changes might impact on their tendering activities – and whether or not the capacity would exist to allow public procurement authorities to specify 'clean' vehicles and meet potentially more stringent targets and requirements.

5.1.4 Case Studies

A few national case studies have been conducted which include a detailed analysis to determine the numbers of procured vehicles under purchase, lease, rental, and hire in those MS. This has helped to support the existing data on the numbers of clean vehicles procured and support the overall robustness of the analysis. Stakeholder engagement during this activity has been minimal – with the main focus on accessing additional data. In order to understand the range of numbers of vehicles procured, the project team selected four MS covering different areas of Europe: Germany, Sweden, Italy and the Czech Republic; information from the UK, France and Spain was also sought.

At the same time, information was sought on specific policies and initiatives which have taken place in each of the case studies to present a cross section of the manner in which the CVD has been implemented in these Member States. Once publicly available data had been reviewed through web searches and desk-based research, stakeholders within those Member states were approached in order to obtain first-hand accounts from relevant stakeholders regarding public procurement activities and data about vehicle fleets and procurement activities as well as relevant national policy frameworks.

Member State stakeholders for each case study were contacted using an initial email which explained a rationale for the data sought and requested a follow-up telephone interview. During these follow-up interviews, stakeholders were asked directly for any supporting Member State level data on vehicle public procurement and for estimates of proportions of alternatively-fuelled vehicles procured. Six stakeholders provided additional information and data which has contributed to detailed analysis of procurement activities and trends within those Member States.

5.1.5 Questionnaire for Procurement authorities

It has been necessary to request supplementary data to help augment TED data on public authority procurement for the analysis. Consequently, an additional short questionnaire was sent to 51 contacts – including non-case study Member States – further, detailed information about this engagement is discussed in the next section. The information was requested in the form of a short, 4-question survey to be filled out and returned via email. A total of 51 named contacts received the request and 7 completed surveys were received from stakeholders. Unfortunately, due to time limitations of the study, it was not possible to follow-up with the remaining contacts to gain more information.

Questions were designed in order to help determine how reliable the information available from TED is – and to ascertain whether all tenders above €200k are listed on the portal – and if not, what level of discrepancy could be anticipated. The following questions were asked of stakeholders;

1. The average cost (per vehicle) procured by your department?
2. An indication (as a percentage) of the proportion of total vehicles procured that are actually covered by the requirements of the Directive?
3. Please indicate the proportion (as a percentage) of vehicles purchased by your department are considered to be 'clean' vehicles – and how do you determine that they are a 'clean' vehicle?
4. What types of vehicle are typically procured by your department?

Responses received and any additional data that was supplied by stakeholders has been discussed, in full in Section 5.4. This includes a discussion of how the information had influenced any assumptions made and how the analysis has benefitted from receiving this information.

5.1.6 Stakeholder workshops

Over the course of the Impact Assessment, a number of stakeholder workshops have been held to enable the Commission to discuss preliminary conclusions, potential policy measures and the consequences of those directly with stakeholders. Two public meetings were conducted in the course of this Impact Assessment.

- A stakeholder workshop (28th April);
- A meeting with city experts to analyse the Territorial Impacts with the use of the Quick Scan Methodology (co-organised by DG REGIO and DG MOVE).

In addition, DG MOVE organised two informal meetings with expert representatives of Member States on 8th February 2017 and 28th April 2017.

The stakeholder workshop brought together around 65 participants. It featured a discussion of the results and feedback from the public consultation, and the principal policy measures as outlined in the Inception Impact Assessment and the Public consultation. The workshop was informed by presentations from different public and private stakeholders. It provided an opportunity to exchange different views, which helped to validate assumptions and first findings in the context of the IA support study (see agenda and overview in the annex).

This territorial Impact Assessment workshop brought together around 20 stakeholders, mostly from public authorities or city networks to further engage in a preliminary analysis of the territorial impacts of the CVD review. Participants to the meeting concluded that the review of the Clean Vehicles Directive is not expected to have asymmetrical territorial impacts, requesting special attention to certain urban or regional entities.

Meetings with Member States enabled an early on informal exchange with expert representatives of Member States on the overall problem analysis and related principal policy measures. A recurrent issue in the discussions was the corroboration of the identified problem and the call for a much simplified, yet effective policy framework.

5.2 Analysis of the stakeholder input

5.2.1 Exploratory interviews; analysis of the results

Exploratory interviews were conducted early in the stakeholder engagement process during November 2016 – January 2017 in order to establish which areas to focus on in subsequent engagement activities. The following comments were given during exploratory interviews and provided a focus for targeted stakeholder interviews.

5.2.1.1 Expanding the scope of the Directive

During exploratory interviews, none of the stakeholders supported any repeal of Directive 2009/30/EC. Views diverged, however, about how far the scope should be deepened and widened.

The main consensus that can be observed from discussions is that a level of flexibility is essential. If implemented in a rigid way, all proposed options to expand the scope of the Directive can be refuted with examples of circumstances, contracts, or services that could not – or should not, be included within the scope of the Directive unless concessions or a tiered approach could be taken. Stakeholders suggested that examples of this include very small contracts – should the threshold be significantly reduced or entirely removed.

There was general support for expanding the scope to include vehicles leased, hired or rented with very little dissension. Expanding the scope of the Directive to contracts with a significant transport element was also not considered appropriate by three of the interviewed stakeholders. Commentators who did not rule out this option, all emphasised the need, again for a flexible approach – whereby contracts with a major transport element could be differentiated, would not all be included mandatorily – and that any exceptions/ inclusions would have to be very clearly defined (NGO and two city networks).

5.2.1.2 Revising the monetisation methodology

Close to all stakeholders agreed that the current monetisation methodology is not fit for purpose. Suggestions included:

1) Updating the methodology – with a caution that the addition of further environmental issues has the potential to complicate rather than simplify things, and;
2) Amending and simplifying the methodology - to put more emphasis on reducing emissions of pollutants with the suggestion that the methodology should not constrain the use of any methodology currently being utilised by procurement authorities and that it could be tailored in order to make it more relevant to urban areas.

5.2.1.3 Defining a clean vehicle

In terms of defining a 'clean' vehicle, there was not a coherent point of view among stakeholders. This takes into account differing national situations (technology levels, availability of the different types of 'clean' vehicle) and wider aspects – such as the main type of vehicle in use/ under procurement (e.g. buses). The views expressed during exploratory interviews are highlighted, below and demonstrate the level of disagreement from stakeholders over the definition, including varying support to different conceptual approaches based on WTW CO_2 emission, tailpipe CO_2 emissions, zero-emission vehicles or also on the need to include Euro VI for buses in any definition.

In addition, two out of the eight interviewed stakeholders were firm in the conviction that the definition needs to be tightened over time (city networks) – and one argued that local authorities should have the flexibility to apply criteria to their own procurement processes that could be more ambitious than any criteria included within an amended Directive.

Another opinion posited by two of the stakeholders that clear communication – or a centralised 'tool' for procurers to use to assess vehicles should be provided. The suggestion that vehicle weight should be taken into account when defining a clean vehicle was also made.

Further discussion of the implementation of any possible changes was held with stakeholders during targeted stakeholder interviews (see Section 5.2.3).

5.2.1.4 Link between defining a clean vehicle and minimum requirement

Stakeholders were asked about mandating the purchase of a clean vehicle during public procurement activities – and how this might be achieved, based on a set of different conceptual options.

All of the interviewees agreed that there should be a mandate to procure clean vehicles – however there were conflicting opinions about how it could be required. The risk of a mandate becoming too complex was highlighted often – with additional comments about how difficult a mandate would be to monitor if it applied over time – or as a proportion of all vehicle purchases.

With regard to how to implement a minimum requirement, stakeholders were asked to give their views on whether this could be achieved at an EU-level (by setting EU-wide targets) – or whether targets (either set by the Commission – or required by the Commission and set by Member States) should be differentiated by Member State. Again, this issue proved to be contentious with very little conformity in views. General comments included;

- Depends on the detail of the proposed approach to some extent; a two-tiered system has some advantages as it could be made more relevant to a wider range of circumstances. It could be Member State specific, e.g. linked to GDP or a country's CO_2 reduction requirements according to the Effort Sharing Decision.
- Should be based on the definition, and have an expanded scope. If monetisation methodology is retained it should be an optional add-on, not mandatory. The further use of award criteria to reflect better performance should be encouraged.
- Ambitious, simple definition needed that could be applicable across the EU, but not too strict that it limits competition. There needs to be a roadmap to help manufacturers and cities that want to be more ambitious. Use of the definition in the procurement of goods and services should be encouraged.
- Extension of the Directive with a mandate based on a definition of a clean vehicle, and with the monetisation methodology removed.

5.2.2 Open public consultation; analysis of the results

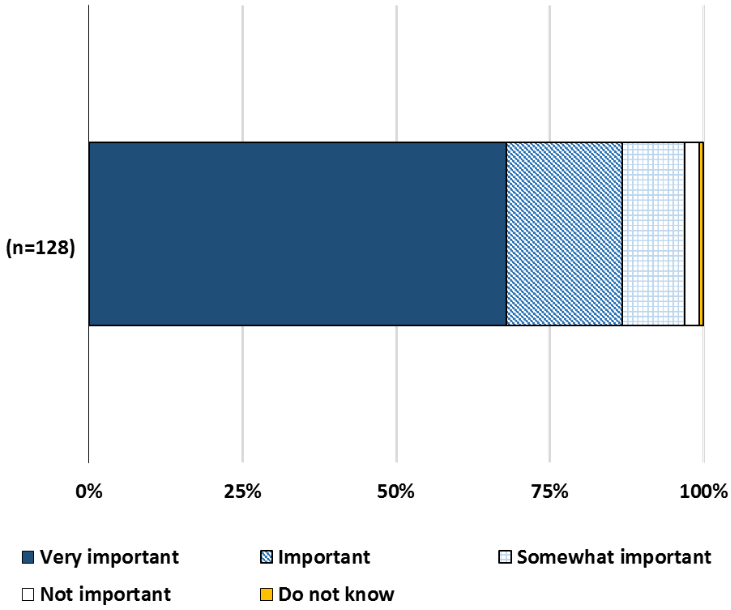
The following sections provide an overview of the analysis of the Open Public Consultation responses.

5.2.2.1 Understanding the problem at hand

The responses to the public consultation section on the general problem at hand and its root causes confirmed the principal relevance of the analysis underpinning the IA. Respondents were asked how important it is that public procurement is effectively used to stimulate the market for clean vehicles in the EU. 68% (87 respondents) agreed that it was very important (see Figure 5-2). This opinion is broadly supported when examining the responses by stakeholder group, but with slightly less importance placed on the Directive by Contracting Authorities[21].

[21] Contracting authorities had the smallest sample size – 6 respondents for this and all subsequent questions.

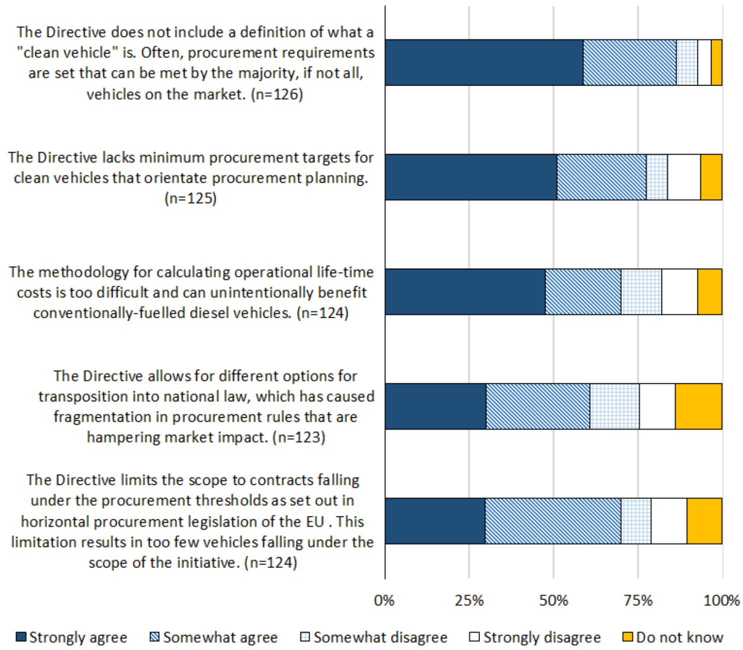
Figure 5-2: QB1. "In your view, how important is it that public procurement is effectively used to stimulate the market for clean vehicles in the EU?"



It has been acknowledged through the Ex-Post Evaluation that the Clean Vehicle Directive has a very limited effect on reducing CO_2 and other air pollutant emissions from publicly procured road transport vehicles. Respondents were asked to what extent they agreed with a range of potential root causes. Over 87% (109) agreed/somewhat agreed that the lack of a definition of a clean vehicle is a root cause of the problem. This was similar for each of the stakeholder groups with the exception of contracting authorities (100%, 6) and 'other' (96%, 23), who expressed a higher level of agreement.

There was a similarly high level of agreement that the lack of minimum procurement targets for clean vehicles are problematic, with only the Contracting authorities group having lower levels of agreement (50%, 3). Just under 75% (87) of respondents agreed that the methodology for calculating operational life-time costs is too difficult and can unintentionally benefit conventionally-fuelled diesel vehicles (a similar level of agreement was reached across all stakeholder groups). There was slightly less agreement amongst stakeholders that that transposition options are root causes of the problem (61%, 75), with lower levels of agreement from public authorities (42%, 8) and contracting authorities (33%, 2). Finally, around 70% (87) of stakeholders agreed/somewhat agreed that limited scope was a root cause. Lower levels of agreement were from contracting authorities (50%, 3) and public authorities (58%, 11), whereas NGOs (81%, 21) and 'other' (83%, 20) accounted for the high levels of agreement for this question (see Figure 5-3).

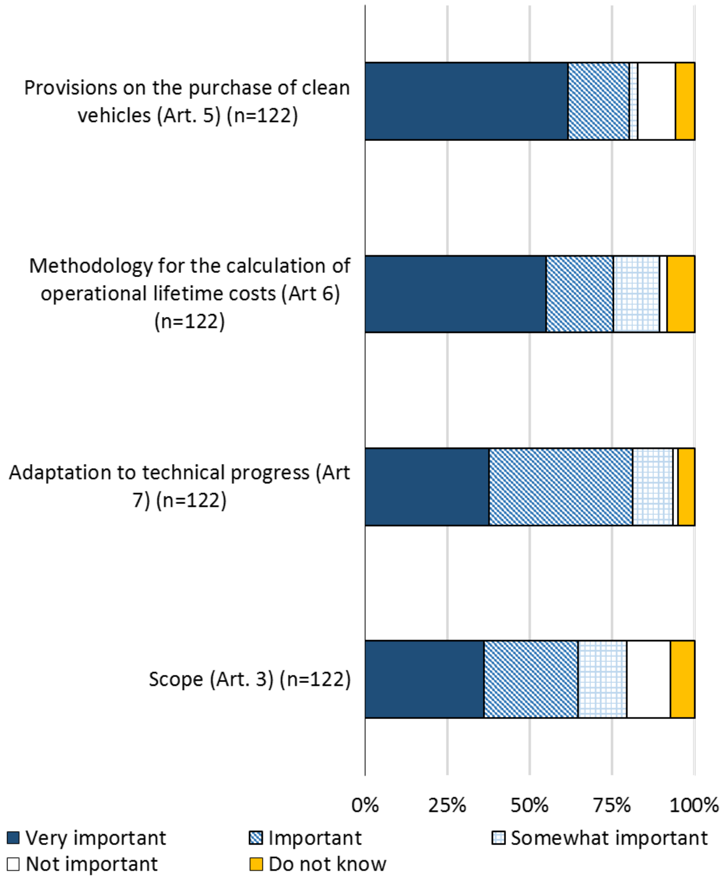
Figure 5-3: QB2: "Currently, the Clean Vehicle Directive has a very limited effect on reducing CO_2 and other air pollutant emissions from publicly procured road transport vehicles. To what extent do you agree with the following root causes?"



In terms of respondents' thoughts on how important it is to revise part of the Directive, the most support (strongly agree) was given to provisions on the purchase of clean vehicles (Article 5) (61%, 75 responses). Similar agreement was found amongst the majority of stakeholder groups, with the exception of contracting authorities (33% strongly agree). 55% (67) of respondents strongly agreed that it was important to revise the methodology for the calculation of operational lifetime costs. However, responses amongst stakeholder groups was more diverse, with 33% (2) of contracting authorities strongly agreeing, compared to 70% (19) of non-governmental organisations

However, high levels of support (including considered to be very important and important) were also given to adaptation to technical progress (Article 7) and Scope of the Directive (Article 3) (see Figure 5-4).

Figure 5-4: QC1. "In your opinion, how important is it to revise the following parts of the Clean Vehicle Directive?"



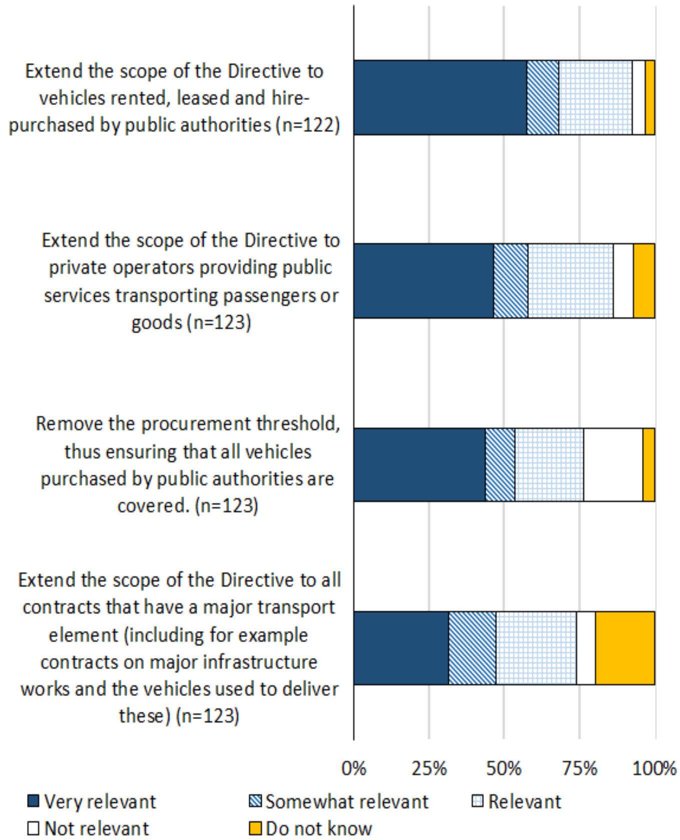
5.2.2.2 Expanding the scope of the Directive

The public consultation asked respondents for their views on the most appropriate extension to the scope of the Directive. The majority of respondents thought it was relevant or very relevant to revise the scope of the Directive (27% (33) and 32% (39) respectively) (see Figure 5-5). There was strong support (44% (54) - very relevant) for removing the current procurement threshold, thus ensuring that all vehicles purchased by public authorities are covered. However, it should be noted that those opposing the full removal of the threshold cited increased administration costs as one of the main reasons for retaining a threshold for procurement contracts, which could negatively affect smaller purchases. Support was higher amongst Individuals (65%, 11) and non-government organisations (67%, 18), with lowest support coming from contracting authorities (17%, 1) and public authorities (18%, 3).

The respondents voiced strong support for extending the scope of the Directive to vehicles rented, leased and hire-purchased by public authorities, with 54% (70 out of 122) stating it was very relevant and 23% (30 out of 122) relevant. Relevance was considered higher for Individuals (71%, 12) and NGOs (69%, 18), but lower for contracting authorities (33%, 2) (very relevant). Slightly less support was given, but still the majority, to the option of extending the scope of the Directive to private operators providing public services transporting passengers or goods (44%, 57 respondents - very relevant). Again, the higher levels of relevance was cited by individuals (64%, 11) and NGOs (59%, 16), but with lower levels of relevance being felt by public authorities (29%, 5) and contracting authorities (17%, 1) (very relevant). Respondents voiced their concern with regards to how this would be implemented in practice, particularly related to the potentially increased burden placed on public authorities in administering this option involving private operators.

Finally, 30% (39 out of 122, very relevant) of respondents supported expanding the scope of the Directive to all contracts that have a major transport element as a very relevant measure. However, out of all of the options it is important to note that there was also the highest level of uncertainty regarding this final option with 20% of respondents stating 'don't know' (see Figure 5-5). A similar level of response with regards to 'very relevant' was received across the stakeholder groups, with the exception of Individuals (53% (9) very relevant).

Figure 5-5: QC2. "In your opinion, how relevant are the following options for a possible expansion of the scope of the Clean Vehicles Directive?"

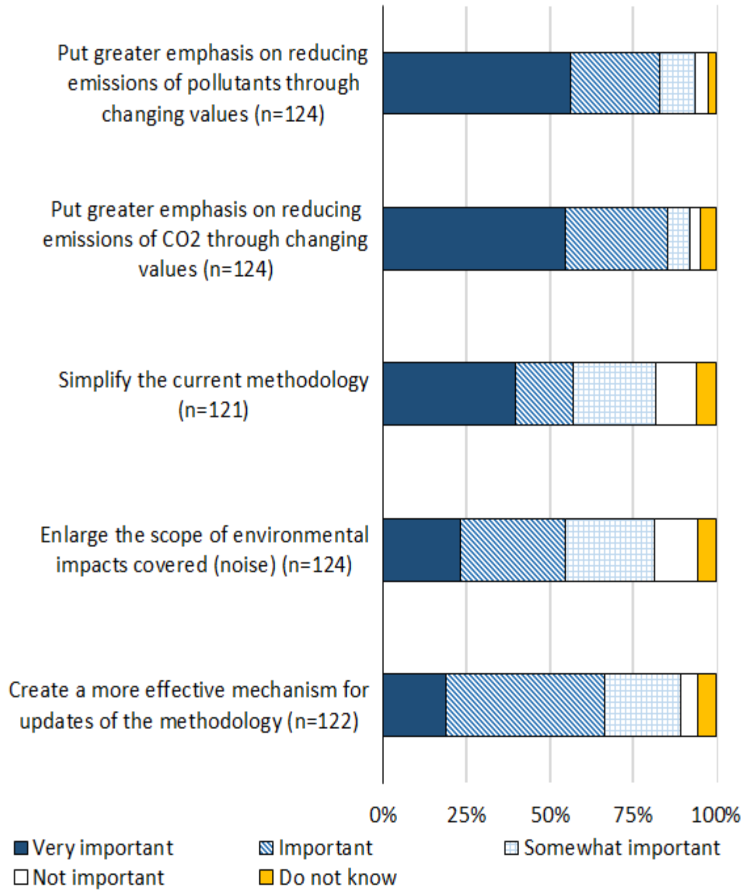


5.2.2.3 Revising the monetisation methodology

The public consultation asked how important various objectives for a potential revision of the methodology for calculating the operational lifetime costs were, including:

- Simplifying the current methodology
- Putting greater emphasis on reducing emissions of CO_2 through changing values
- Putting greater emphasis on reducing emissions of air pollutants through changing values
- Enlarging the scope of environmental impacts covered (noise) and
- Creating a more cost-effective mechanism for updates of the methodology (see Figure 5-6).

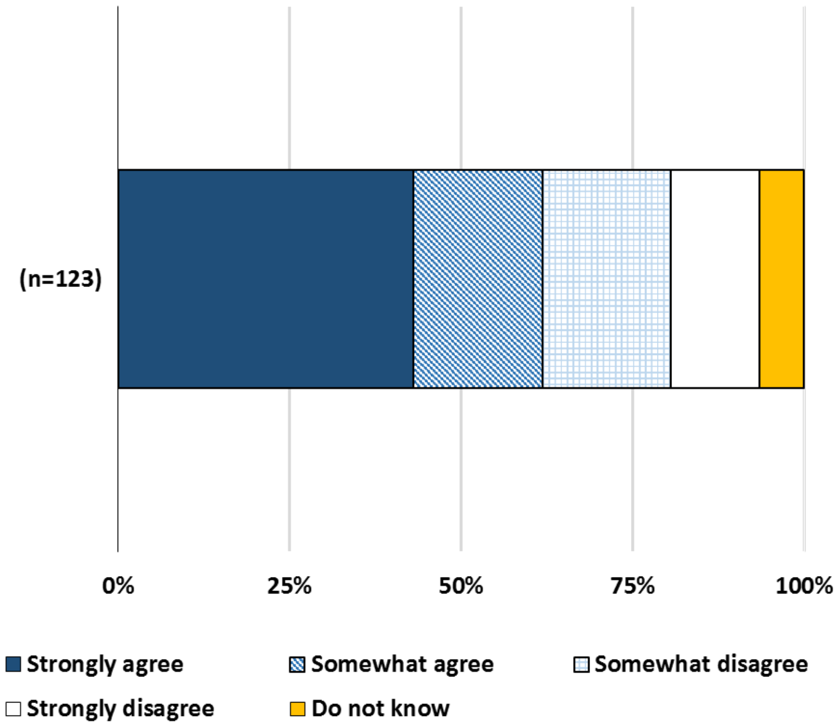
Figure 5-6: QC4. "From your point of view, how important are the following objectives for a potential revision of the methodology for calculating the operational lifetime cost?"



Greatest support was given to putting greater emphasis on reducing emissions of pollutants through changing values (56%, 70 out of 124 respondents - very important). Stakeholder views differed, with only 17% (1) of contracting authorities considering it to be very important compared with 70% (19) of NGOs and 71% (17) of 'other' respondents. 55% (68 out of 124) respondents considered reducing CO_2 emissions through changing values to be very important. Again, stakeholders differed in their opinions, with the lowest support coming from contracting authorities (33%, 2) and companies (42%, 14), compared with 67% (18) and 71% (17) of NGOs and 'other' stakeholders respectively.

There was very strong support for the requirement to follow the methodology for calculating operational life-time costs when using energy and environmental impacts as award criteria, with 43% (53 out of 123) strongly agreeing (see Figure 5-7). Only 17% (1) of contracting authorities strongly agreed, compared to 52% (14) of NGOs, with other stakeholders broadly the same level of response as the combined response.

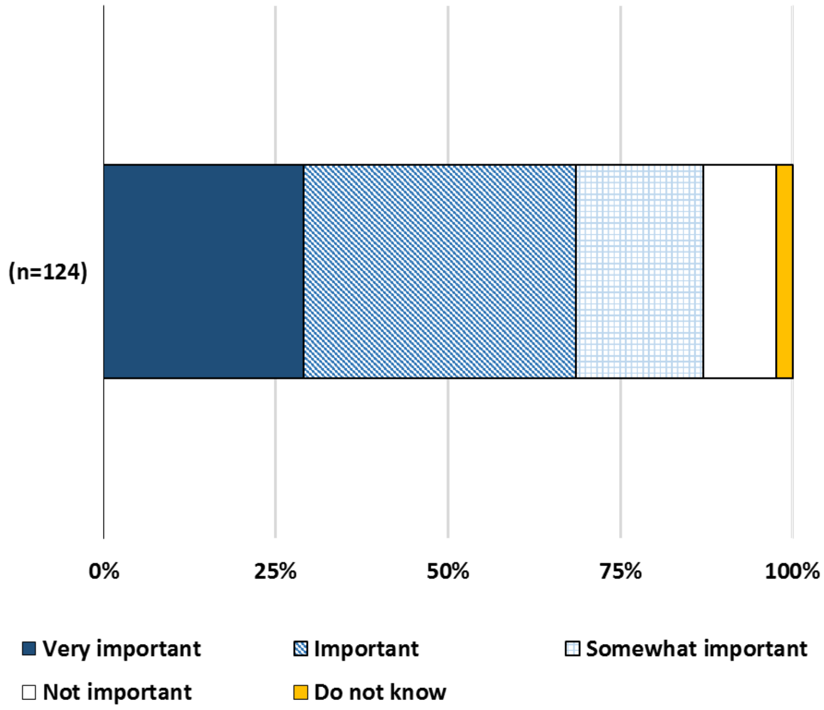
Figure 5-7: QC5. "In your view should there be a requirement to follow a methodology for calculating operational life-time costs when using energy and environmental impacts as award criteria?"



Respondents were also asked how the methodology should be best evaluated and updated. 29% (36 out of 124) of respondents stated that it was very important, and 40% (49 out of 124) stated it was important to require regular evaluation and updates of the methodology (see Figure 5-8). However, none of the contracting authorities considered it to be very important, compared to 48% (13) of the NGOs.

Where regular review and updating of the methodology was supported, suggestions for frequency were given (e.g. every two or more years), potentially consulting with stakeholders. This would provide the opportunity to review improvements in available technology and identify the latest research related to costs, making it an effective monetisation tool, Stakeholders agreed that it needs to be evaluated in terms of whether it is giving the best results in terms of cost and emissions. There was also a lot of support for simplifying the tool.

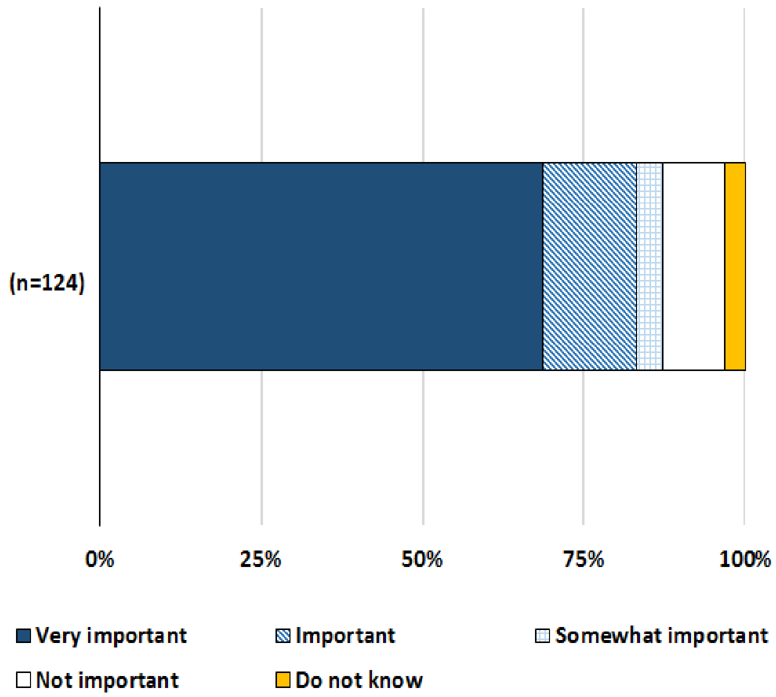
Figure 5-8: QC6. "In your view, how important is it to require a regular evaluation and update of the methodology?"



5.2.2.4 Defining a clean vehicle

Majority support was given for the introduction of a definition of a clean vehicle in a revised Directive, with 69% (85 out of 124) rating it as 'very important' (see Figure 5-9). When considering the different stakeholder groups, 82% (14) of Individual respondents, 79% (19) 'other' and 78% (21) NGOs considered this to be very important, compared to just 17% (1) contracting authorities.

Figure 5-9: QC8. "From your point of view, how important is it to introduce a definition of "clean vehicles" in the Clean Vehicle Directive?"



When asked to rate the adequacy of a range approaches to defining clean vehicle, there was a level of conflict between respondents when it came to the use of tailpipe emissions, with 52% (64 out of 122) stating it was completely or somewhat inadequate, and 46% (56 out of 122) stating it was completely or somewhat adequate (see Figure 5-10). Stakeholder groups displayed similar results, with the exception of contracting authorities, where 83% (5) thought it was somewhat or completely inadequate.

Those supporting the option pointed out that the data was available for the majority of vehicles (in comparison to LCA) and therefore an operational, ready-to use tool/solution could be used by public authorities when assessing 'clean' vehicles.

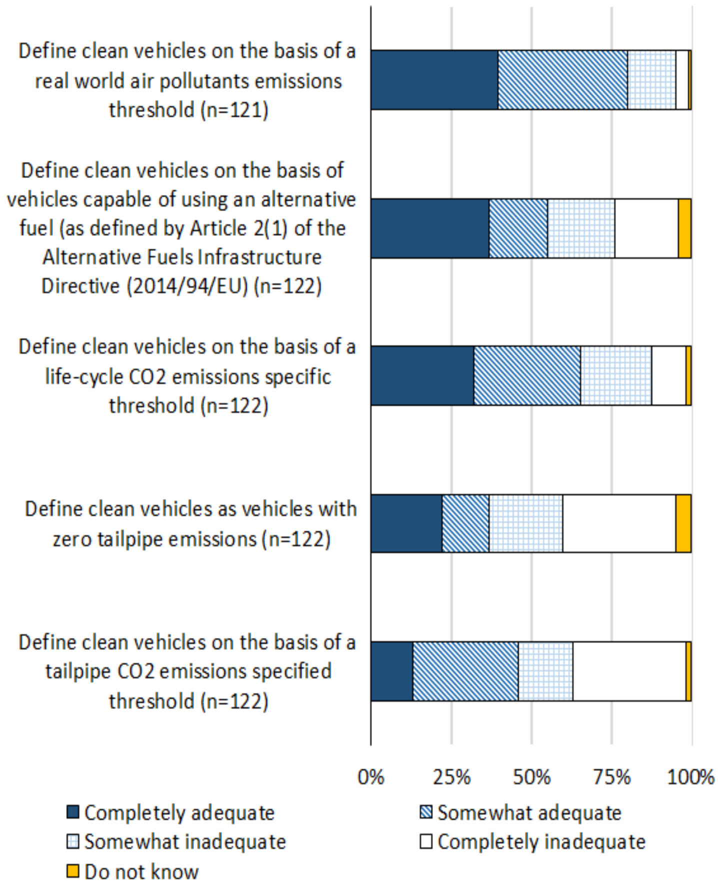
A larger percentage of respondents (66%, 80 out of 122) showed their support for the use of lifecycle emissions (somewhat or completely adequate). Again, similar levels of support were given across the stakeholder types with the exception of contracting authorities – only 17% (1) agreed that use of lifecycle emissions were completely or somewhat adequate. Respondents supporting the lifecycle approach stated that tailpipe emission approach could be misleading due to the omission of emissions related to power and vehicle production (and the large differences between technologies used). Respondents also felt that using lifecycle emissions rather than tailpipe ensures that a larger range of emissions could be adequately considered (e.g. local air pollutant, noise AND CO_2 emissions). This was not without acknowledging the difficulties in assessing lifecycle emissions for some vehicles. Others noted the lack of a widespread agreement on the methodology and information to be used, leading to complex and cumbersome legislative processes and to an increase in administrative burden for target groups.

55% (67) of respondents thought that a definition based on a vehicles' capability of using an alternative fuel was completely or somewhat adequate, compared to 41% (50 out of 122) who thought it completely or somewhat inadequate. Those supporting this option cited technology neutrality as a reason. Again, low support was given by contracting authorities, with just 17% (1) stating a definition based in alternative fuel use was completely or somewhat adequate.

Defining clean vehicles as vehicles with zero tailpipe emissions was considered a less preferable option. Only 37% (45 out of 122) of respondents indicating this definition was either somewhat or completely adequate, compared to 58% (71 out of 122) that thought this was completely or somewhat inadequate. However, those who did support this option also mentioned the air quality/noise benefits associated with zero emission vehicles, which are considered desirable. Considering the different stakeholder types, a greater proportion of contracting authorities (83%, 5) and companies (73%, 24) thought this was completely or somewhat inadequate.

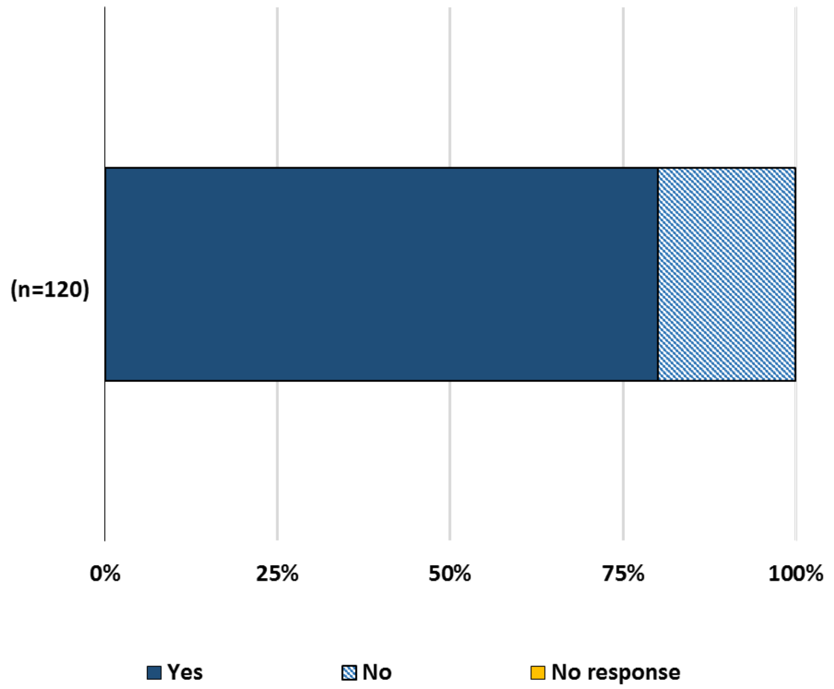
Others mentioned a range of definitions/flexibility, depending on the pollution being experienced within a location and recognising the difficulty of defining a 'clean' vehicle due to the range of different types/sizes of vehicles available.

Figure 5-10: QC9. "In terms of defining clean vehicles, different conceptual approaches could be considered. Please rate the adequacy of the following approaches:"



Whilst there were differing views on the adequacy of the possible clean vehicle definitions as set out above, there was strong support for combining approaches. This has to be understood as a general recommendation that any definition should not focus solely on one dimension, e.g. CO_2, but to combine approaches on GHG emission and air pollutant reduction (80%, 96 out of 120 agreed) in the case of an emission-oriented approach (see Figure 5-11). The need to combine approaches is not so relevant if the alternative fuels approach is chosen. Similar results were seen across the stakeholder groups, but with notable lower support from public authorities (52%, 11) and individuals (61%, 11).

Figure 5-11: QC11. "In your point of view, should elements of the above-mentioned approaches be combined in a definition of clean vehicles?"

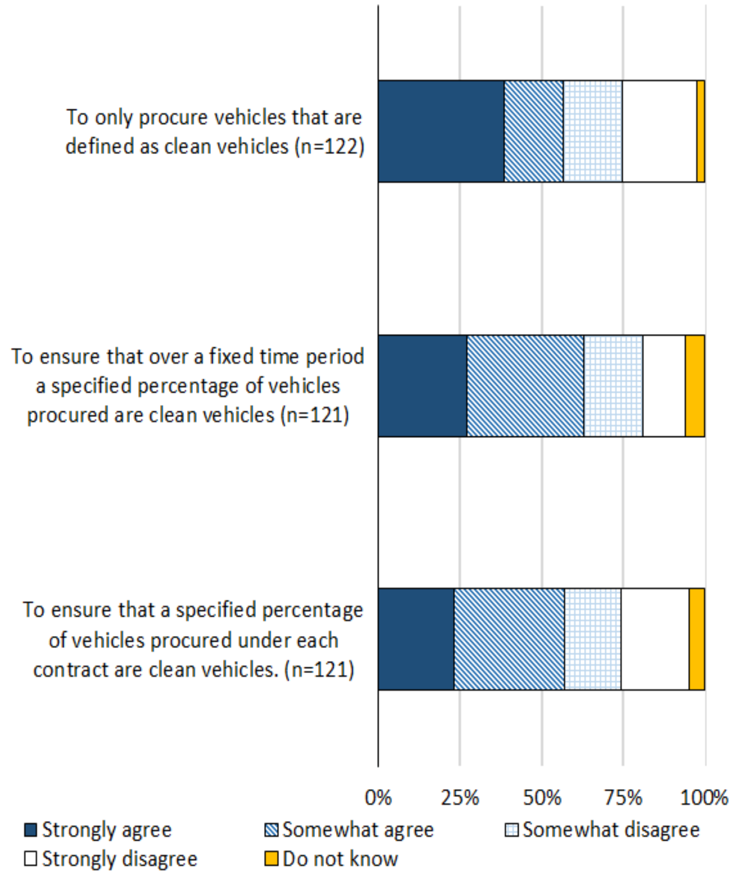


5.2.2.5 Link between defining a clean vehicle and minimum requirement

The consultation explored support for approaches for setting a minimum public procurement requirement, based on any definition of clean vehicles. The proposed approaches included:

- To only procure vehicles that are defined as clean vehicles
- Ensure that a specified percentage of vehicles procured under each contract are clean vehicles
- Ensure that over a fixed time period a specified percentage of vehicles procured are clean vehicles (see Figure 5-12).

Figure 5-12: QC13. "To what extent do you agree to these approaches for setting minimum procurement targets for public bodies (based on future definition of clean vehicles in the Directive)?"

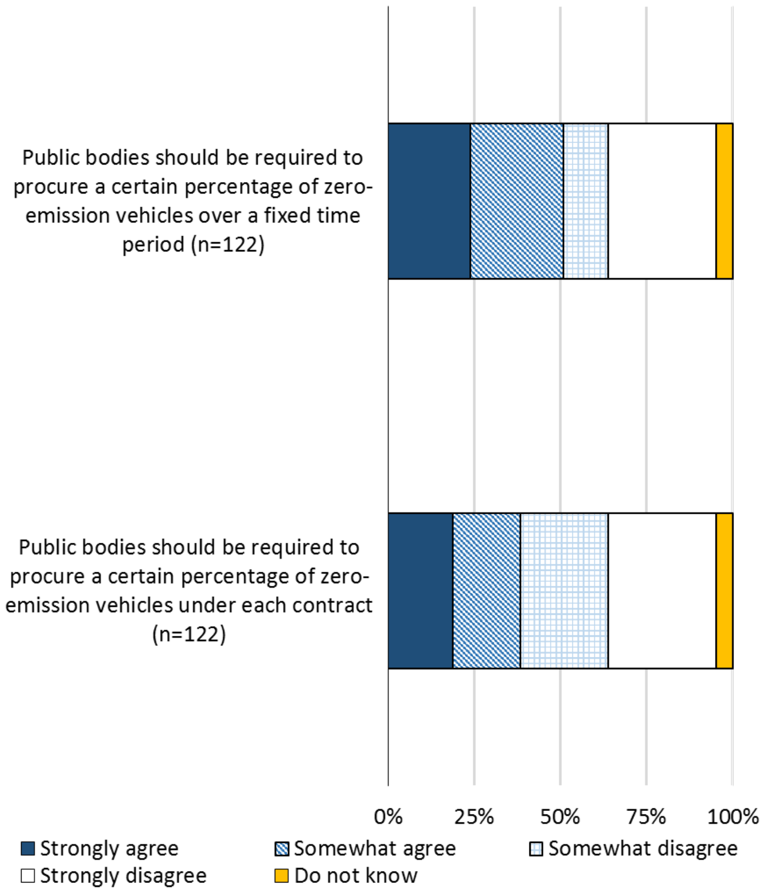


A similar level of agreement was gained for each of the options. The approach to 'ensure that over a fixed time period a specified percentage of vehicles procured are clean vehicles' was being slightly preferred (27% (33 out of 121) strongly agree and 36% (43 out of 121) somewhat agree). Similar results were obtained across the stakeholder groups with the exception of public authorities and NGOs, of which just 18% (3) and 11% (3) respectively stated that they strongly agreed.

In order to foster the transition to low-emission mobility and account for diverging levels of ambition by different public bodies, a minimum target for the procurement of zero-emission vehicles could be included in addition to the overall minimum procurement target as noted in the previous question. One option would be to require that public bodies procure a certain percentage of zero-emission vehicles **under each contract**. 31% (38 out of 122) of respondents strongly disagreed with this approach, and 25% (31 out of 122) somewhat disagreed (versus 39% somewhat/strongly agreeing). Stakeholder groups generally agreed with this opinion, with the exception of public authorities - 59% (10) somewhat disagreed.

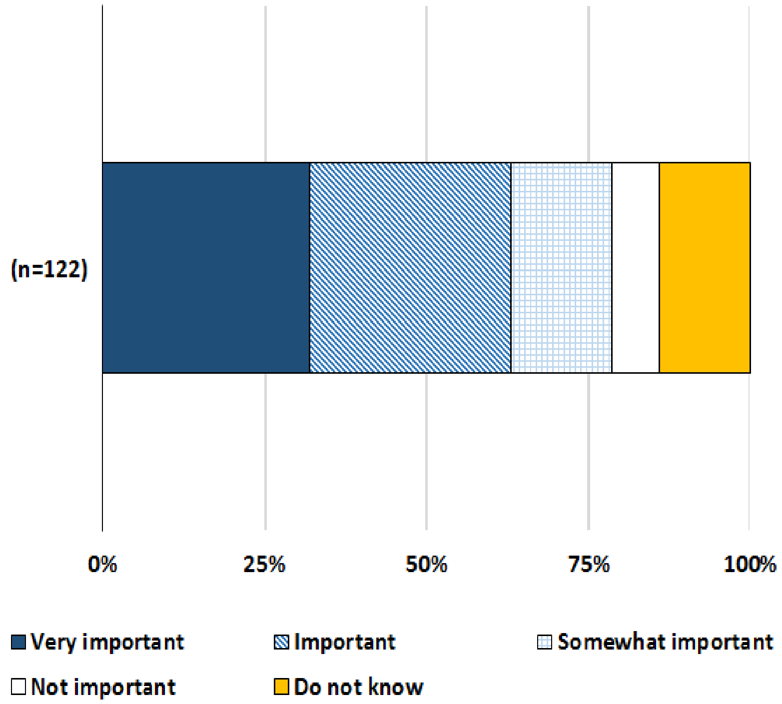
The second option would be to require that public bodies procure a certain percentage of zero-emission vehicles **over a fixed time period**. Whilst 44% (54 out of 122) of respondents disagreed (strongly and somewhat) with this approach, 51% (62 out of 122) agreed with it, indicating a level of conflict (see Figure 5-13). Again, stakeholder groups had broadly similar results, with the exception of Individuals, with 69% (11) agreeing.

Figure 5-13: QC14. In order to foster the transition to a low-emission mobility and account for diverging levels of ambition by different public bodies, a minimum target for the procurement of zero-emission vehicles could be included in addition to the overall minimum procurement target as noted in the previous question. To what extent do you agree with the approaches listed below?"



The majority of respondents indicated that it was important to require regular reporting by Member States on minimum procurement targets (32% (39 out of 122) very important and 21% (38 out of 122) important) (see Figure 5-14). However, opinions vary greatly depending on stakeholder type. 52% (14) of NGOs strongly agree that member states should undertake regular reporting on minimum procurement targets, followed by Individuals (47%, 7), 'other' (38%, 9), companies (21%, 7) and public authorities (12%, 2). No contracting authorities strongly agreed or agreed.

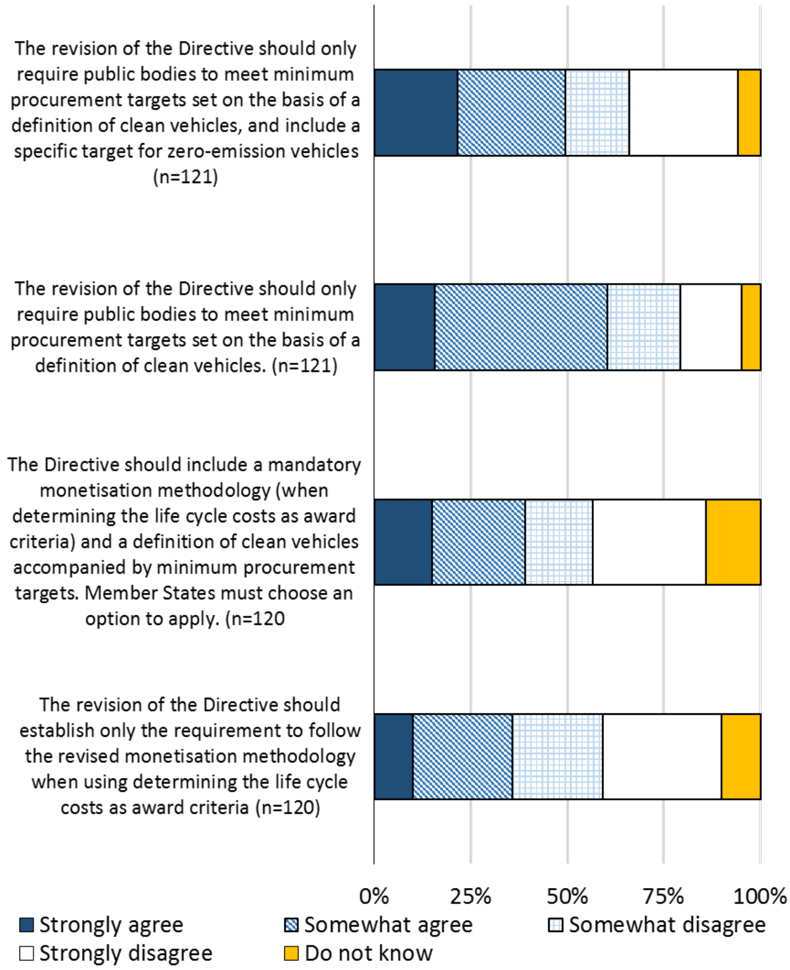
Figure 5-14 QC15. "In your view, how important is it to require a regular reporting by Member States on minimum procurement targets?"



Packages of policy measures were also considered in the consultation. The policy measure with the highest level of support from stakeholders was that the revision of the Directive should only require public bodies to meet minimum procurement targets set on the basis of a definition of clean vehicles (60% (73 out of 121) of respondents somewhat or strongly agree). Stakeholder groups had broadly the same views with the exception of NGOs and contracting authorities, with 74% (20) and 33% (2) agreeing respectively (strongly and somewhat).

Conversely, 54% (65 out of 120) of respondents disagreed (somewhat or strongly) with the approach for the revision of the Directive to establish only the requirement to follow the revised monetisation methodology when using determining the life cycle costs as award criteria (versus 36% (43 out of 120) somewhat / strongly agree) (see Figure 5-15). Again, stakeholder groups had broadly similar views, with the exception of NGOs, where 74% (20) of them disagreed (strongly or somewhat).

Figure 5-15: QC16. "The policy measures presented below are not mutually exclusive and could thus potentially be combined. To what extent do you agree with the following approaches?"

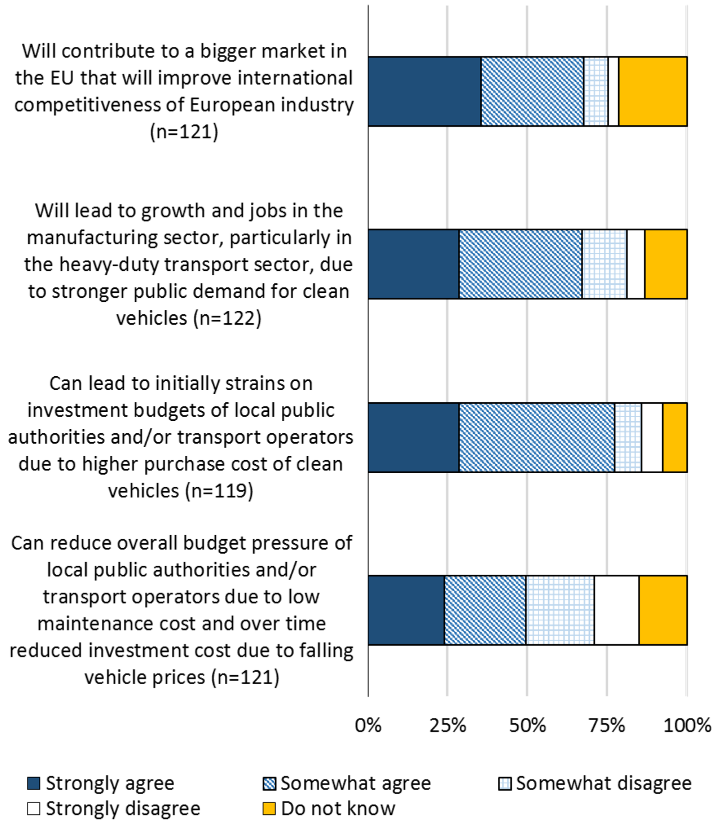


5.2.2.6 Impacts

Respondents were asked about the extent they agreed with a range of potential economic, environmental and administrative burden impacts the policy measures could have. There was a high level of concern (77% (92 out of 119) somewhat or strongly agreed) that the proposed policy measures will initially put a strain on investment budgets of local authorities due to the higher purchase costs of clean vehicles. Broadly similar views were displayed by all stakeholder groups. However, 94% (16) of public authorities, unsurprisingly, agreed with this potential impact.

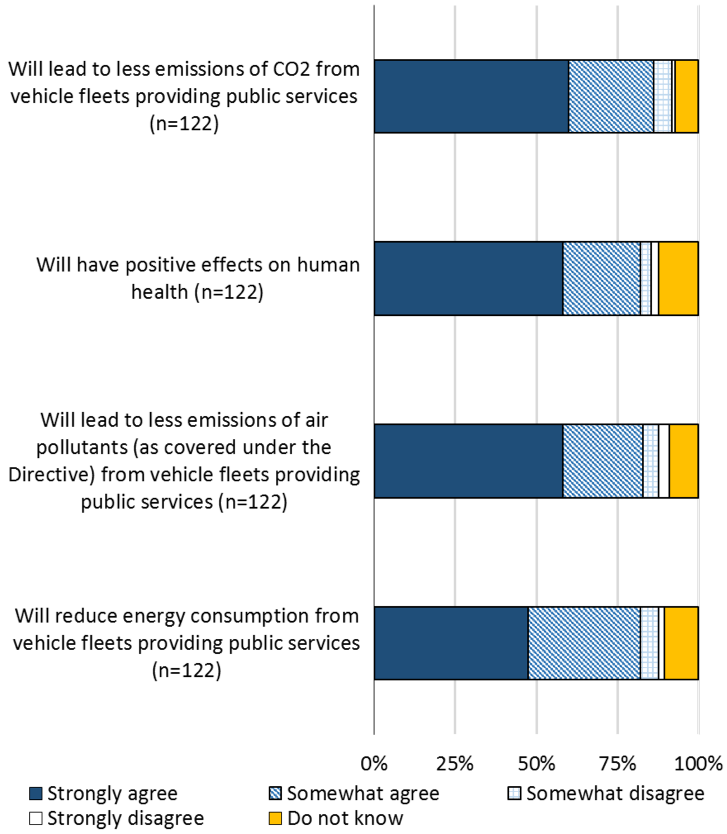
There were also high levels of agreement (68%, 82 out of 122, strongly/somewhat agree) that the policy measures would improve the competitiveness of European industry and lead to growth and jobs in the manufacturing sector due to the stronger demand for Clean Vehicles (see Figure 5-16). When considering the stakeholder groups, less agreement was achieved from contracting authorities (33%, 2) – although 33% also stated that they disagreed and 33% did not know.

Figure 5-16: QD1. "To what extent do you agree to the following statements on likely economic impacts?"



With regards to environmental impacts of policy measures, there was very high levels of agreement that the policy measures would have positive environmental impacts, including reduced CO_2 emissions, positive effects in human health, reduction in air pollutant emissions and reduced energy consumption (see Figure 5-17). This was the same across all stakeholder groups – with minimum 75% agreeing (strongly/somewhat) with the potential environmental impacts with the exception of contracting authorities on the issue of reducing energy consumption from vehicle fleets providing public services (66% (4) agreeing, with 33% (2) didn't know).

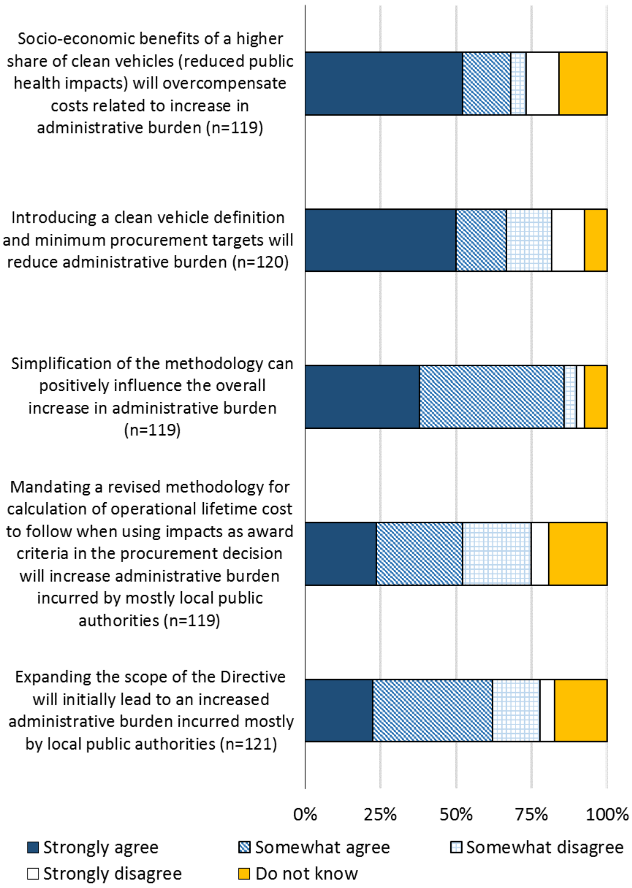
Figure 5-17: QD2. "To what extent do you agree to the following statements on environmental impacts?"



Respondents expressed agreement that socio-economic benefits of the policy measures will outweigh the costs related to the increase in administrative burden (52% (62) strongly agree). Similar results were received across the stakeholder groups with the exception of public authorities and contracting authorities, with only 24% and 17% of them strongly agreeing (respectively).

There was also agreement that simplifying the methodology will positively influence the increase in the administrative burden (50% (60 out of 120) strongly agree) (see Figure 5-18). Again, public authorities and contracting authorities displayed lower levels of agreement (24% (4) and 17% (1) respectively strongly agreeing), compared to high level of support from NGOs (70%, 19).

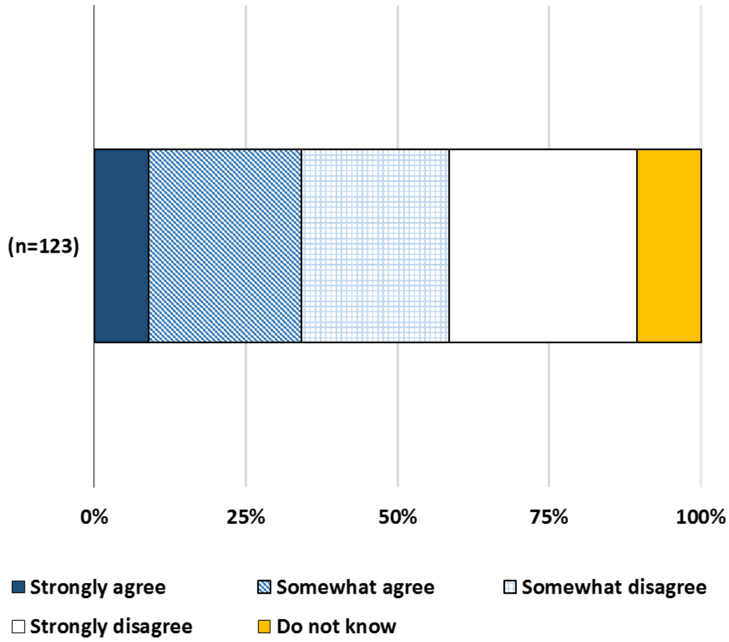
Figure 5-18: QD3. "To what extent do you agree to the following statements on administrative burden and simplification?"



5.2.2.7 Relevance of other action at European Level

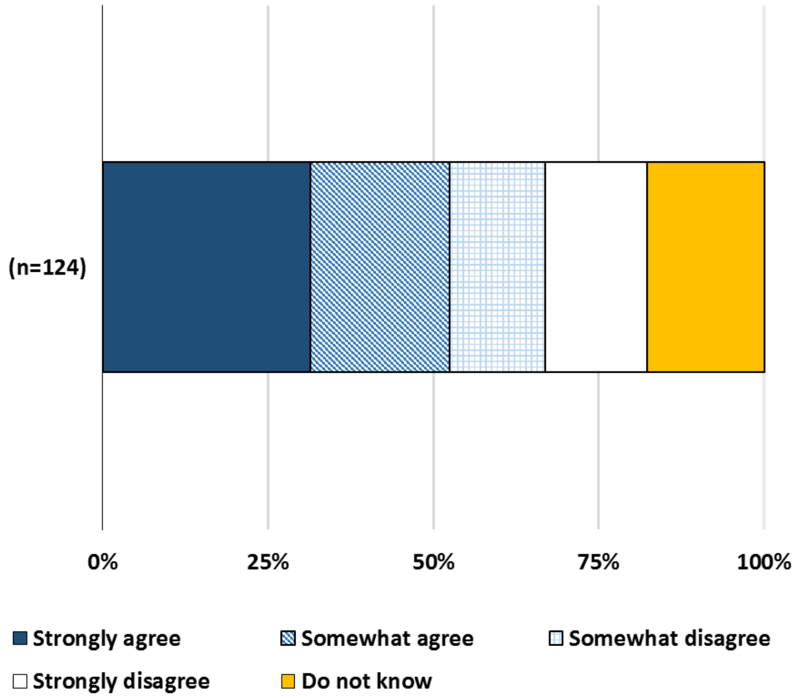
Respondents were asked whether the objectives that should be achieved through the revision of the Directive could be better achieved through the deployment of non-legislative tools (such as action based on voluntary green public procurement criteria, use of life-cycle cost tools etc.) based on guidance or recommendations by the Commission. The majority of respondents (55%, 68 out of 123) disagreed with this sentiment (somewhat and strongly disagree) (see Figure 5-19). Only 9% (11 out of 123) strongly agreed that objectives could be achieved through non-legislative tools. When looking at the responses of stakeholder groups the results are broadly similar, with the exception of contracting authorities – 83% (5) of contracting authorities agreed that the objectives could be achieved through deployment of non-legislative tools.

Figure 5-19: QE1: "From your point of view, could the objectives that should be achieved through the revision of the Directive be better accomplished through deployment of non-legislative tools based on guidance or recommendations by the Commission?"



Finally, respondents were asked whether the objectives as stated for the initiative could be achieved better if policy measures discussed for the revision of the Directive were implemented through a Clean Vehicles Regulation, replacing the current Clean Vehicles Directive (Note: Regulation would be directly applicable in Member States and does not need transposition into national law, which is required for Directives). Compared to the previous question, there was a much higher level of agreement that objectives could be better achieved with a Regulation (52% (65 out of 124) strong/somewhat agree) – (see Figure 5-20). However, around 18% (22 out of 124) of respondents stated "don't know". When considering the views of stakeholder groups, there is a very low level of support from contracting authorities and public authorities (0% (1) and 17% (3) strongly/somewhat agree).

Figure 5-20: QE3. "From your point of view, could the objectives as stated for this initiative be achieved better if policy measures discussed for the revision of the Directive were implemented through a Clean Vehicles Regulation that would replace the current Clean Vehicles Directive?



5.2.3 Targeted stakeholder interviews; analysis of the results

5.2.3.1 Expanding the scope of the Directive

In relation to ***extending the scope of the Directive***, interview participants all supported some sort of widening and broadening. They showed diverging preferences as to how this could be achieved.

The majority of stakeholders felt that the procurement threshold currently applied by the Directive should be removed altogether to ensure that all vehicle purchases would be included in the scope. Others highlighted that a threshold may enable some procurement authorities to divide contracts into smaller value procurement activities in order to avoid exceeding the threshold. Another suggested approach was to allow smaller value contracts to be subject to less stringent requirements. Only one stakeholder felt that the current threshold was appropriate and should remain.

With regards to extending the scope of the Directive to include rented, hired and leased vehicle fleets, all but one stakeholder supported such an inclusion. There was a suggestion that neglecting to include leased and hired vehicle fleets could push procurement activities towards rentals rather than face complex procedures. The lone stakeholder that did not agree with the others felt that the question was not relevant to their activities due to the small scale of vehicle rental contracts – and the danger that there would not be enough "clean" vehicles in a rental fleet.

During the course of these discussions, it was highlighted that catering services are considered by the Public Procurement Directives to be socially-important services, and therefore they are not subject to the full scope of these Directives. Consequently, it was argued that it would be inconsistent for catering services to be covered in the scope of an extended CVD. It was also noted that catering services are subject to separate Green

Public Procurement criteria, a voluntary instrument currently under development. There was some support from representatives of the postal and courier sector for an expansion of the scope of the Directive to these services.

The main benefits of being included in the Directive were seen to be the potential to speed up the market to deliver clean vehicles and to reduce costs to the business, as well as the benefits to a company from an image perspective.

Extending the scope to transport services procured by public authorities, such as bus services, was considered potentially useful option to explore. However, stakeholders cautioned that it would be incredibly difficult to apply and that transport services relating to social care may need to be excluded. This suggests that application of the Directive may need to be determined on a case by case basis. In the latter case, inconsistencies arising from extending the scope of the CVD to services that were not fully covered by the Public Procurement Directive (see below) was noted.

In addition, it has been highlighted that many of services which could fall under the scope of the Directive should all transport services procured by public authorities be included, would often be provided by SMEs who could find it more difficult to meet clean vehicle requirements.

Extending the scope to contracts with a major transport element could be challenging. Three participants endorsed this approach – while the remainder were in strong opposition due to complexity of applying this change and the intrusion in to existing processes. The risk that the overall objective of a contract could be complicated by the vehicles being used in the performance of the contract was also perceived to be an issue. It was highlighted that the transport element of a contract may be significant – yet could still represent a fraction of the cost and actual activities within the contract.

5.2.3.2 Revising the monetisation methodology

A few stakeholders stated that the monetisation methodology should be removed entirely rather than revised. Some of the interview participants noted that their organisations tend to use their own methodologies, and not the methodology prescribed by the Directive. In contrast, one stakeholder felt that it should be expanded to adequately take into account fuel efficiency and service intervals – with annual independent assessment to ensure relevance to emerging technologies and clean vehicle definitions.

If there were to be updates, stakeholders suggested addressing the inherent bias towards energy efficiency and hence diesel engine vehicles often topping the scale when the methodology is utilised. All agreed that any changes to the methodology should be reviewed regularly to keep up with emerging technologies.

It was suggested that where a methodology already exists, it should not be a requirement that the procurement authority adopt an official methodology given in the Directive – therefore this should be an option rather than a requirement. This was supported with the caution that businesses (specifically – in many cases), SMEs would be unable to fully understand or aim to comply with a monetisation methodology. Interview participants also pointed out that many of their activities relate to small-scale, local procurement contracts. The administrative burden of any radical – or too frequent changes to the monetisation methodology could entail excessive costs.

5.2.3.3 Defining a clean vehicle

None of the stakeholders interviewed supported an approach that would see Member States set their own targets and definitions of clean vehicles. There was a shared concern about fragmentation, as some may not be ambitious enough, leading to territorial inconsistency or a skewing of the market.

In addition, all of the stakeholders interviewed felt that none of the options for defining a clean vehicle presented in the interview pro-forma were ideal as a stand-alone option. This takes into account viewpoints arising from differing national conditions (e.g. fuel sources, wider power sources, manufacturing conditions and also *existing* criteria set by the national government). One local government stakeholder based in an EU15 Member State suggests that independent assessment, verification and reporting would reduce the risk of any inconsistency. All of the stakeholders recognised that the definition of a clean vehicle will potentially have a large impact on the effectiveness of the amended Directive – and on the procurement authorities and businesses affected by changes to the scope and definitions within the Directive.

However, it was pointed out that many of the factors that contribute to how "clean" a technology can be considered to be are far beyond the remit and/or control of a local government procurement authority – and may differ within a Member States, from city to city or between public authorities within a city.

There was strong support for a staggered approach in implementing the Directive; this applies to interplay of a possible threshold of a clean vehicles definition and the basis for a related minimum procurement mandate. As one stakeholder pointed out; "*Changes to the Directive that are* [initially] *too radical or far-reaching may result in objections from Member States – effectively delaying the process…"*

Whilst it was highlighted that introducing a definition of 'clean vehicles' into the CVD is considered extremely important in order to remove any ambiguity, there was a wide array of views with regard to what constitutes a 'clean' vehicle. In spite of this, all city contact stakeholders concurred that thresholds should become more stringent over time as technology advances.

How to set up such a distinction was another point of discussion. No stakeholder expressed a strong preference or dislike for using a labelling scheme to differentiate between "clean" vehicles and conventional vehicles. There was recognition that it is a known method (with the existing use of electrical appliance labelling). In contrast, some expressed concern that it may limit the criteria for defining a "clean" vehicle to only a few well recognised elements (e.g. powertrain of tailpipe emissions) that may become outdated within a relatively short period of time, neglect to take into account negative externalities (e.g. size/ weight of a vehicle, manufacture/disposal) which would all limit the effectiveness of such an approach.

5.2.3.4 Link between defining a clean vehicle and minimum requirement

In terms of how a ***minimum requirement might be applied***, each interviewee thought that it would not be practical to have a minimum requirement by contract. An annual requirement would also be too stringent. All stakeholders highlighted that this would be a very complex issue to tackle and suggested very different approaches.

One interviewee advised that different Member States should have different thresholds that had been determined based on their capabilities to meet the minimum requirement. Another stakeholder suggested that allowing Member States to meet EU-wide requirements at different times would increase fairness and make targets more achievable for less advanced Member States.

Consequently, there was sort of a consensus view that setting a minimum requirement over a longer time frame, for example four or five years, or having a target at the end of a longer time period would be more appropriate. It was recognised that monitoring such an approach would be challenging. However, the fact that it provides the market with an appropriate signal would arguably be an important achievement. The majority of respondents argued that applying a minimum requirement per fleet would be the best option, although it was recognised that this would no longer be targeting procurement directly.

There was general support for some type of differentiation between types of clean vehicle. It would signal an intention to procure the cleanest vehicles, although it was noted that there is also a risk that this would make the Directive too complex. It was also noted that differentiating the minimum requirements between Member States was considered important to adapt the Directive to the different context conditions in Member States. Some supported Member States setting national targets, while others considered that this would risk targets being set too low.

5.3 Case Studies

The case studies were conducted in order to undertake detailed analysis of several Member States to determine the numbers of procured vehicles under purchase, lease, rental, and hire in those MS. This has improved the existing database on the numbers of clean vehicles procured and supported the overall robustness of the analysis.

Given this focus, the consultation activities in the context of the case studies were primarily focused on collecting data in order to improve our understanding of the numbers and types of vehicles that are procured. The project team selected four MS covering different areas of Europe: Germany, Sweden, Italy and the Czech Republic. Although these four MS were the primary focus, additional data was also sought from the United Kingdom, France, and Spain.

In the course of examining Member State data in more detail for the purposes of the case studies, the following organisations were contacted and provided public procurement data;

- Consip (Italy)
- Kraftfahrt-Bundesamt (Germany)
- City of Stockholm (Sweden)
- The Swedish Bus & Coach Federation (Sweden)
- Sdružení Dopravních Podniků ČR (An association of the 19 biggest public city transport operators in the Czech Republic)
- ADEME (France)

The data collected from these organisations was assessed alongside the data collected from procurement authorities as discussed in the following section.

5.4 Questionnaire for Procurement authorities (Bilateral discussions)

During the course of stakeholder engagement activities, the study team identified a need to carry out a 'sense-check' of information available through the Commissions online Tenders Electronic Daily (TED) data resource. This was to ensure that any estimates for the potential impact of the different policy measures would take 'real-world' data into account.

Therefore, 51 city-level procurement authorities received a short list of emailed questions and 7 respondents provided additional data about the types and value of procurement activity within their department. The responses have mainly come from EU15 countries, with one city procurement officer from Poland representing EU13 responses. Only one of those respondents was able to provide extra information about forecast procurement activities and the capacity to incorporate cleaner vehicles into the existing publicly procured fleet due to a National incentive currently under implementation.

Questions asked of procurers were;

1. The average cost (per vehicle) procured by your department?
2. An indication (as a percentage) of the proportion of total vehicles procured that are actually covered by the requirements of the Directive?

3. Please indicate the proportion (as a percentage) of vehicles purchased by your department are considered to be 'clean' vehicles – and how do you determine that they are a 'clean' vehicle?
4. What types of vehicle are typically procured by your department?

Data collected during the case studies and via the questionnaire on the numbers of publicly procured vehicles was compared to the values gained from analysis of the TED database. This was done to check whether the numbers of publicly procured vehicles estimated via TED are in the right magnitude. As Table 5-6 below shows, the estimates from both sources are reasonably comparable for passenger cars and vans. Limited data for trucks and buses make comparisons less useful in those categories.

Table 5-6: Analysis of TED data versus information from case study questionnaire respondents

	Analysis of TED data	Analysis of case study data	
Vehicle type	Publicly procured vehicles as % of EU registrations[1]	Publicly procured vehicles as % of German registrations[3]	Publicly procured vehicles as % of Italian registrations[4]
Passenger Car	1.15%	0.90%	0.54%
Van	0.46%	1.83%	0.40%
Truck	6.71%	1.80%	No data
Bus	26.70%	No data	1.57%

1) TED database 2009-2015, EU REF2016+ 2009-2016 new registrations.
2) Public vehicle data source: German case study; total German new registrations source: ACEA - all values averaged 2009-2015.
3) Public vehicle data source: Italian case study; total Italian new registrations source: ACEA - all values averaged 2014-2016.

Furthermore, the case studies and questionnaire provided useful insights into the procurement process and decisions across different Member States. Table 5-7, below describes the datasets received and the potential to use this data to sense check our model assumptions.

Table 5-7: Additional data received during case studies and how it will be utilised

Data source	Description of data received	How the data will be used
Czech case study	Data on total public vehicle registrations in various sectors, however does not distinguish by vehicle type or type of ownership	Use values for the contract value and number of vehicles per contract
Swedish case study	The Swedish data includes the total number of vehicles registered by drive train	Compare data to the EU reference scenario on vehicle split by drivetrain
Italian case study	Number of publicly procured vehicles, leased and purchased, by drivetrain	Italian data could be used to analyse the split of vehicles by drivetrain and by ownership type

Data source	Description of data received	How the data will be used
Polish questionnaire	Polish data is very detailed and includes the model type and quantity of vehicles procured, average car lifespan, average mileage, % fleet (non-binding) could be converted to electric cars, number of passenger cars used by drivetrain (diesel, petrol, LPG)	Can use to develop the following modelling assumptions; - Mileage of vehicles - Survival rates - Number of passenger cars procured by drivetrain (including maximum number of EVs procured for double counting)
French case study	Includes the public procurement process in France. Has useful data on the costs considered and weighting applied to financial and environmental costs.	Can use to develop assumptions on weighting of monetisation method and to understand how procurers consider actual energy costs are considered (e.g. including taxes)

5.5 Stakeholder workshops

5.5.1 Public stakeholder workshop

Attendees represented a cross-section of stakeholders who would be directly impacted by any changes to requirements of the Directive, including Public Procurement Authorities, European cities, business interests, manufacturing and fuel producers. Discussions in the workshop focused on the three core elements of the revision, namely the extension of the scope of the Directive, the changes to the main implementation mechanisms and the changes to the main reporting mechanism.

Stakeholders reconfirmed that introducing a 'clean' vehicle" definition that was clear and easy to follow would have a principal value added – with the added comment that a very clear definition will help to reduce the administrative burden on local procurement units.

Diverging views were again expressed over how to define a 'clean' vehicle. A few stakeholders placed emphasis on a well-to-wheel approach to defining a clean vehicle. Several stakeholders noted, however, that no simple and widely agreed methodology exists that would allow procurers across Europe to adequately identify the 'cleanest' vehicle using a well-to-wheel approach – and that 'clean' vehicles defined using this approach can differ from region to region. A definition based on alternative fuels also came under discussion during the workshop – with stakeholders questioning whether vehicles that run on biogas could be safely assumed to be the cleanest as they could also be filled with natural gas. However, in a broader perspective including manufacturing, power supply and disposal as part of the definition similar problem arise for all kind of vehicles, other stakeholders argued.

None of the attendees disagreed that a revision of the Directive is necessary. Again, there were suggestions that any targets or requirements should become more stringent over time in order to keep pace with new and developing technologies as they enter the market. Finding the right balance between ambition and feasibility of implementation as well as simplicity was a recurrent issue.

Close to all workshop attendees agreed that the current monetisation methodology is too complicated. While some participants thought the methodology should be entirely removed, others felt that it should be refined and made clearer for procurement authorities and businesses tendering for contracts. There was general consensus that any new methodology approach within the Directive would have to be simple to follow and easy to implement and administer – otherwise the administrative burden on local authorities could interfere with the delivery of crucial services.

An additional question that was raised concerned the relevance of a second-hand vehicles market, particularly in case of rental, lease and hire-purchase.

None of the attendees suggested that a complete repeal of the Directive would be appropriate.

5.5.2 Territorial Impact Assessment workshop

A detailed account of the discussions during this workshop is being prepared by DG REGIO and consultants in charge of the workshop.

5.5.3 Feedback from informal meetings with expert representatives of Member States

Discussions with expert representatives of Member States yielded similar results and messages. Representatives called for a revision leading to a Directive that would be simpler to use. The value added of a clear, easy to use definition of a clean vehicle was stressed. There was general appreciation of the relevance of seeking to extend the scope of the Directive, with a clear-cut call to find solutions that are feasible and do not overly increase administrative burden. Stakeholders from Member States expressed different viewpoints on the adequacy of the different conceptual approaches to defining a clean vehicle and setting a related minimum procurement mandate.

5.6 Use of consultation results

Key messages from stakeholders include the relevance of providing clearer, long-term orientation, based on an approach that is simple to use and leaves a considerable amount of flexibility to the final target groups of the Directive, namely contracting authorities, entities and operators under the realm of the responsibility of the Directive.

Flexibility refers to acknowledging the many diverse procurement units that exist within the EU (in terms of size, remit, geographical coverage, whether they manage urban or rural public services and demographics), the businesses affected (some vehicles and/or essential services are primarily provided by SME's whilst others may be provided at source by manufacturer or larger companies) and the processes already in place.

Following stakeholder engagement activities – alongside analysis of procurement and vehicle data within the EU, the analysis and results have been used to take forward and confirm screening of policy measures and development of policy options for the Impact Assessment.

Annex 6 CASE STUDIES

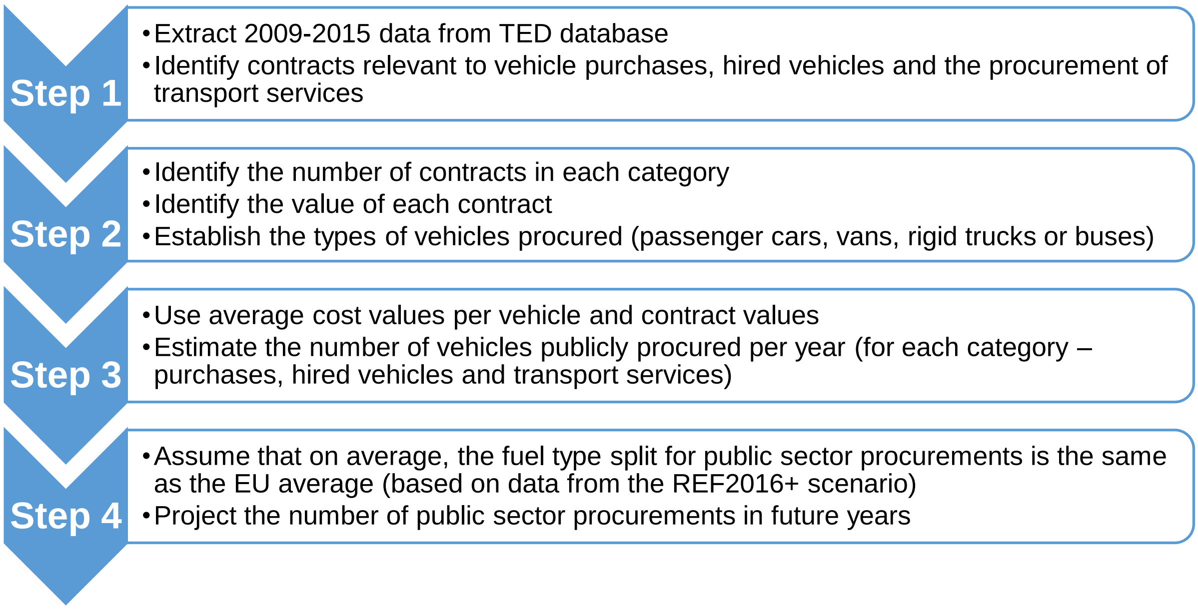
One of the key steps for assessing the impacts of the Clean Vehicles Directive is to determine the number of vehicles procured by public authorities in the EU, per year. However, there is no single European database (or set of databases that could be combined) that report new registrations (or vehicle stock) by type of owner. As a result, a precise picture of the number and type of new public-sector vehicles cannot be directly obtained. In spite of this, the number of publicly procured vehicles has been estimated based on a combination of desk research (covering both EU-level and national-level data sources) and stakeholder inputs from Member States (case studies). These case studies were designed to support the overall robustness of the analysis – however inconsistencies in data aggregation, differing definitions of a 'clean' vehicle between the different Member States, and presentation of the data has created challenges when making a comparison with data from other sources during data quality checks.

Member State case studies selected for this study included Sweden, Czech Republic, Italy and Germany. Data pertinent to the public procurement activities of vehicles in these countries was investigated in detail. Desk based research was also supplemented by stakeholder engagement with key individuals within the case study countries (e.g. public authority procurement officers, Associations, key businesses). Additionally, a list of 4 short questions were sent to an extra 51 stakeholders in order to further examine the accuracy of desk-based research findings. The following Annex provides details of the information sought and found, alongside an analysis of Case Study and stakeholder data compared to information obtained from the EU's public tender platform (Tenders Electronic Daily – TED) database.

6.1 Methodology

The EU's public tender platform (TED) is a database that publishes public procurement notices from across the EU. All procurements that fall under the procurement procedures set out in Directives 2014/24/EU and 2014/25/EU are required to be published in TED. Typically, these are procurements that exceed a threshold value of just over €200,000 (€135,000 in the case of central government authorities). Similar criteria make application of CVD requirements mandatory for vehicle procurement contracts. Therefore, it can be generally assumed that procurement contracts published in the TED database should include all procurements to which authorities are required to apply the clean vehicle criteria, as set out in the CVD. A baseline estimate on the number of publicly procured vehicles in Europe that fall under the scope of the CVD can thus be developed by extracting relevant information from the TED database. However, there are limitations to using this approach. Data available in TED does not typically include information on the number of vehicles procured. Instead, the information includes the monetary value of the awarded contract. The methodology to estimate the number of public procurements per year from TED data is therefore summarised in Figure 6-1, below.

Figure 6-1: Estimating public procurement of vehicles across Europe using TED data



A number of assumptions and estimates had to be made in order to understand the average cost of certain types of vehicles across Europe, the type of contract that procurement related to and types of vehicle procured. The following organisations provided additional procurement data;

- Consip (Italy)
- Kraftfahrt-Bundesamt (Germany)
- City of Stockholm (Sweden)
- The Swedish Bus & Coach Federation (Sweden)
- Sdružení Dopravních Podniků ČR (An association of the 19 biggest public city transport operators in the Czech Republic)
- ADEME (France)

Table 6-1: Data received during case study, additional investigations and questions, below describes the datasets received through case study and additional stakeholder engagement activities - and the potential to use the data to sense check modelling assumptions.

Table 6-1: Data received during case study, additional investigations and questions

Activity	Source of data	Description of data received
Case study	Kraftfahrt-Bundesamt (**Germany**)	**National** details of new registrations across Germany for Passenger cars, HGV's, LGV's from 2009 – 2015. Data does not distinguish type of owner.
	Consip (**Italy**)	**National** data on the number of publicly procured vehicles, leased and purchased, by drivetrain.

Activity	Source of data	Description of data received
	City of Stockholm and The Swedish Bus & Coach Federation (**Sweden**)	Swedish data includes the total number of vehicles registered by drive train – however this information relates solely to the **City of Stockholm** and does not exactly represent National vehicle procurement data.
	Sdružení Dopravních Podniků ČR (An association of the 19 biggest public city transport operators in the **Czech Republic**)	**National** data on total public vehicle registrations and the tender procedure used in various sectors. However, the data **does not distinguish by vehicle type or type of ownership** (e.g. owned, rented, leased etc).
Data received from stakeholders during additional investigations	ADEME (**France**)	Includes the public procurement process in France. Has useful data on the costs considered and weighting applied to financial and environmental costs. No vehicle procurement data.
	Kraftfahrt-Bundesamt (**Germany**)	Information provided has concerned the Federal and municipal incentive schemes and funding available to increase the up-take of 'clean' vehicles within Germany. Figures for the number of buses registered as of January 2016 are; 1,422 natural gas buses, 321 hybrid buses, 137 electro buses and 8 liquid gas buses (data from Statista.com).
	Public Procurement Bulletin **(Czech Republic)**	Data from the Sdružení Dopravních Podniků ČR which is an association of the 19 biggest public city transport operators in the Czech Republic. Data relates to the number of buses of different types registered in the Czech Republic in 2015 this information shows that the average age of uses registered in various different cities is 7.68 years.
Responses to additional questions	Infrastructure Department of Warsaw City Hall - Economic Unit (**Poland**)	Polish data is very detailed and includes the model type and quantity of vehicles procured, average car lifespan, average mileage, % fleet (non-binding) could be converted to electric cars, number of passenger cars used by drivetrain (diesel, petrol, LPG). Information provided relates solely to the **City of Warsaw**.
	Arriva Italia – passenger transport providers (**Italy**)	Responses to additional questions which provide a view of vehicle procurement data from the level of a local authority or municipality.
	Transport for London (**United Kingdom**)	

Activity	Source of data	Description of data received
	Public Procurement and Logistics Directorate (DCPL) City of Niort (**France**)	The following tables (Table 6-10 to Table 6-14).describe responses from public procurement authorities – at a city/ municipal level and exclude the response from Poland (summarised above).
	City Office for waste disposal, road cleaning and vehicle fleet (**Germany**)	
	County Council, Mechanical Section (Water Services Dept.) (**Ireland**)	

6.2 *Case study data*

Sweden

Data was obtained for Sweden on vehicle registrations and fleet size in 2015 through consultation with the City of Stockholm. This data included information both on vehicle fuel type, and whether the vehicles fall under Sweden's national definition of a "clean vehicle". This data is shown in Table 6-2 and Table 6-3.

Information on vehicle registrations and fleet size in 2015 was obtained in consultation with the City of Stockholm. In Sweden, a national definition for clean vehicles was introduced in 2005, which has been gradually refined and is used for clean vehicle procurement. A vehicle must be below a certain maximum CO2 emissions given its weight and fuel type. In 2010, a joint public and private national procurement of EVs and PHEVs was conducted, with a target of 6,000 vehicles. This was done through a two-stage bidding process in which an invitation to participate was issued with a prequalification stage for bidders which included gCO2/km and maximum cost per vehicle. The aim of this venture was to create demand and signal demand to national and international vehicle retailers (GPP, n.d).

Stockholm city authority agreed a definition of a clean vehicle as early as 2002 which was used for policies including reduced parking charges and company car taxation, as well as for procurement (Ricardo 2012). In Stockholm, all light duty vehicles procured by the city authority with the exception of specialist vehicles comply with the national clean vehicle definition. Stockholm also has its own clean vehicle for heavy duty vehicles in the absence of a national definition. The city has seen annual reduction of 300,000 tonnes of CO2 and 80 tonnes of NOx.

It was stated in the stakeholder interview that this information is not recorded specifically for public procurement, as public procurement represents such a low proportion of the total fleet. Therefore, data from Sweden has limited use for comparison against the figures obtained from TED. This is because the data does not differentiate between public procurement and other procurement activities. In addition, it solely represents the information provided by the City of Stockholm and therefore is unrepresentative of the country as a whole – giving evidence of only 1% of the market.

Table 6-2. New Vehicle Registrations in Sweden, 2015

Vehicle Type	Clean Vehicle	Fuel Type	Number
Car	Clean	CNG	5182
Car	Clean	Ethanol	1257

Vehicle Type	Clean Vehicle	Fuel Type	Number
Car	Clean	Electric	8522
Car	Clean	Electric hybrid	7523
Car	Clean	Mean Gasoline	20
Car	Clean	Efficient Diesel	38217
Car	Non Clean	CNG	38
Car	Non Clean	Ethanol	115
Car	Non Clean	Electric	135
Car	Non Clean	Electric hybrid	1097
Car	Non Clean	Petrol	131072
Car	Non Clean	Diesel	167070
Bus	Clean	Biodiesel	454
Bus	Clean	CNG	70
Bus	Clean	Electric	10
Bus	Clean	Electric diesel hybrid	21
Bus	Non Clean	Diesel	867
LGV	Clean	CNG	566
LGV	Clean	Electric	402
LGV	Clean	Electric hybrid	7
LGV	Clean	Efficient Diesel	
LGV	Non Clean	Petrol	1221
LGV	Non Clean	Diesel	43360
LGV	Non Clean	CNG	146
LGV	Non Clean	Ethanol	51
LGV	Non Clean	Electric	3
HGVs	Clean	CNG	61
HGVs	Clean	Ethanol	5
HGVs	Clean	Electric Hybrid	1
HGVs	Clean	Biodiesel	87
HGVs	Non Clean	Petrol	20
HGVs	Non Clean	Diesel	6131
Taxis	Clean	CNG	796
Taxis	Clean	Ethanol	2
Taxis	Clean	Electric	29
Taxis	Clean	Electric hybrid	371

Vehicle Type	Clean Vehicle	Fuel Type	Number
Taxis	Clean	Efficient Diesel	801
Taxis	Non Clean	CNG	1
Taxis	Non Clean	Electric Hybrid	1
Taxis	Non Clean	Petrol	20
Taxis	Non Clean	Diesel	1147

Table 6-3. Existing fleet composition in Sweden, 2015

Vehicle Type	Clean Vehicle	Fuel Type	Number
Car	Clean	CNG	40810
Car	Clean	Ethanol	216394
Car	Clean	Electric	14243
Car	Clean	Electric hybrid	36151
Car	Clean	Mean Gasoline	98699
Car	Clean	Efficient Diesel	309499
Car	Non Clean	CNG	2111
Car	Non Clean	Ethanol	11780
Car	Non Clean	Electric	306
Car	Non Clean	Electric hybrid	6632
Car	Non Clean	Petrol	2860114
Car	Non Clean	Diesel	1072317
Bus	Clean	Biodiesel	731
Bus	Clean	CNG	2385
Bus	Clean	Ethanol	591
Bus	Clean	Electric	20
Bus	Clean	Electric diesel hybrid	65
Bus	Clean	Hybrid electric	15
Bus	Non Clean	Diesel	10178
Bus	Non Clean	Petrol	33
LGV	Clean	CNG	4893
LGV	Clean	Ethanol	757
LGV	Clean	Electric	1177
LGV	Clean	Electric hybrid	43
LGV	Clean	Mean gasoline	36
LGV	Clean	Efficient Diesel	1378
LGV	Non Clean	Petrol	56673

Vehicle Type	Clean Vehicle	Fuel Type	Number
LGV	Non Clean	Diesel	447690
LGV	Non Clean	CNG	2432
LGV	Non Clean	Ethanol	1025
LGV	Non Clean	Electric	54
LGV	Non Clean	Electric hybrid	7
LGV	Non Clean	Other propellants	3
HGVs	Clean	CNG	814
HGVs	Clean	Ethanol	38
HGVs	Clean	Electric Hybrid	23
HGVs	Clean	Biodiesel	80
HGVs	Clean	varav methane diesel	155
HGVs	Non Clean	Petrol	1102
HGVs	Non Clean	Diesel	77980
HGVs	Non Clean	Other	9
Taxis	Clean	CNG	4208
Taxis	Clean	Ethanol	194
Taxis	Clean	Electric	63
Taxis	Clean	Electric hybrid	1745
Taxis	Clean	Efficient Diesel	2746
Taxis	Clean	Mean gasoline	1
Taxis	Non Clean	CNG	130
Taxis	Non Clean	Electric Hybrid	15
Taxis	Non Clean	Petrol	280
Taxis	Non Clean	Diesel	6893
Taxis	Non Clean	Ethanol	14
Taxis	Non Clean	Electric	5

Italy

In Italy, criteria are set for public procurement of light duty vehicles based on CO2 emissions, and heavy-duty vehicles must be fitted with fuel consumption indicators (2016 GPP, 2016). Table 6-4 provides National information on the number of vehicles ordered by public authorities in Italy from 2014 - 2016 with a breakdown according to contract type (leased/ purchased/ hired) and vehicle type.

Data received from CONSIP, the central purchasing body, suggests that TED derived estimates for the value of Bus purchases in 2015 were significantly higher than National data suggests – with bus purchases totalling €3,790,746 in National data compared to €227,514,757 reported in TED. Car purchases, demonstrate the opposite extreme, with €103,090,053 worth of car purchases according to national data while TED reports only

€13,789,787. Even when excluding cars that have been rented (according to national data) and those that have been purchased (presumably) by the military for territorial protection, national data still suggests a difference of over €65 Million. This suggests that the purchases reported to TED may not include a large number of vehicle purchases that relate indirectly to the core purpose of the contract. A large number of car purchases in the TED data indicates that the majority of small vehicles purchased by municipalities fall well below the threshold limit – which may suggest further evidence of the limitations of the existing Directive remit.

Table 6-4: National vehicle procurement figures by public authority for 2015

Tender	Description of the lot	Number of vehicles procured	Value (€)
BUS PURCHASE 2	SMALL SIZE BUSES	7	
	MEDIUM SIZE BUSES	13	
	LARGE SIZE BUSES	5	
	Total for the initiative	**25**	**3,790,746.01**
CAR PURCHASE 7	CITY CARS	1,757	
	SMALL SALOON CARS	292	
	CITY CARS GPL	47	
	CITY CARS NATURAL GAS	70	
	SMALL 4X4 CARS	118	
	MEDIUM SIZE 4X4 CARS FOR PUBLIC SECURITY	195	
	LARGE SIZE 4X4 CARS FOR PUBLIC SECURITY	14	
	MINIVANS, VANS AND MINIBUS	617	
	PICK UP 4X4	169	
	Total for the initiative	**3,279**	**54,495,061.60**
CAR PURCHASE 8	COMPACT CITY CARS	70	
	CITY CARS	50	
	SMALL SALOON CARS	7	
	CITY CARS NATURAL GAS	2	
	SMALL 4X4 CARS	15	
	MEDIUM SIZE 4X4 CARS FOR PUBLIC SECURITY	390	

Tender	Description of the lot	Number of vehicles procured	Value (€)
	LARGE SIZE 4X4 CARS FOR PUBLIC SECURITY	20	
	MINIVANS, VANS AND MINIBUS	29	
	PICK UP 4X4	13	
	Total for the initiative	**596**	**12,091,006.33**
CAR PURCHASE FOR TERRITORIAL PROTECTION 1	CARS FOR TERRITORIAL PROTECTION	782	
	Total for the initiative	**782**	**19,708,917.92**
CAR PURCHASE 10 BIS	ELECTRIC AND FOSSIL FUELED OPERATIVE CARS	484	
	ELECTRIC AND FOSSIL FUELED MEDIUM SIZE CARS	300	
	ELECTRIC AND FOSSIL FUELED COMMERCIAL CARS	0	
	BIFUEL CAR GPL/GASOLINE	0	
	BIFUEL CAR NATURAL GAS/GASOLINE	0	
	Total for the initiative	**784**	**12,634,914.12**
CAR RENT 11	OPERATIVE CARS	4	
	COMMERCIAL CARS	28	
	BIFUEL CAR GPL/GASOLINE	272	
	Total for the initiative	**304**	**4,160,153.40**
Total Car			
Total for 2015		**5,770**	**106,880,799.38**

Germany

In the case of Germany, publicly available data exists on publicly procured vehicles, published by Kraftfahrt-Bundesamt (KBA) (See Table 6-5). In this data, with the exception of the latest 2015 data, HGVs and LGVs are grouped together. In Table 6-5, estimates of LGVs and HGVs in the years 2001-2014 have been produced by assuming the same ratio of LGVs to HGVs as 2015.

From 2009 the Federal government have supported electro mobility with two programs ("Modellregionen Elektromobilität", "Schaufenster Elektromobilität"). This support has particularly been provided for public authorities with the aim of promoting cleaner vehicles across Germany through local action. The Directive on Electro mobility (Förderrichtlinie Elektromobilität, Bundesministerium für Verkehr und digitale Infrastruktur) regulates flagship projects and research and innovation. In the German Action Plan on Sustainability, average CO2 emissions of new cars in the public fleet are proposed at 95 gCO2/km for 2020, reflecting the EU wide target (GPP, 2016). The Federal Ministries of Germany have also agreed that 10% of newly purchased vehicles by authorities and bodies of the federal administration must have 50 gCo2/km or lower. In addition to this, several low emission zones have been introduced in German cities, requiring the marking of vehicles with stickers based on their emissions.

In January 2016, 1.422 natural gas buses, 321 hybrid buses, 137 electro buses and 8 liquid gas were registered (Statista.com). As with Sweden, there is no separate information about the same vehicle registration figures for publicly procured vehicles, limiting the effectiveness of any comparisons with TED derived figures.

Table 6-5. New Registrations of Public Vehicles in Germany (KBA, 2015).

	2001	2002	2003	2004	2005	2006	2007	2008	2009
Passenger cars	19,481	21,792	19,864	22,341	24,211	26,129	26,036	30,418	31,038
HGVs + LGVs	4,298	4,055	3,653	3,830	4,161	3,943	4,130	5,348	5,236
LGVs	3,441	3,246	2,925	3,066	3,331	3,157	3,306	4,282	4,192
HGVs	857	809	728	764	830	786	824	1,066	1,044

	2010	2011	2012	2013	2014	2015
Passenger cars	30,019	27,918	28,635	27,910	27,515	27,533
HGVs + LGVs	4,774	4,966	4,854	4,974	4,633	4,809
LGVs	3,822	3,976	3,886	3,982	3,709	3,850
HGVs	952	990	968	992	924	959

Czech Republic

Data for the Czech Republic comes from Sdružení Dopravních Podniků ČR which is an association of the 19 biggest public city transport operators in the Czech Republic. The Statistics are based on data published in the Public Procurement Bulletin that have been validated and verified. The data relates to the number of buses of different types registered by contracting authorities in the Czech Republic in 2015 and 2014 – however no other vehicle type data was available for comparison.

Table 6-6: Number of bus registrations by public procurement authority in the Czech Republic

Year	No. of registrations
2014	6876
2015	5972

COMPARISONS OF CASE STUDY DATA WITH TED

Table 6-7 provides a brief comparison of the data obtained from the Commissions TED database against the information obtained during Case Study activities and stakeholder engagement. Where National data at the level of breakdown required is not available, city-level data received from contacts has been used in the comparison. Clearly City-level information may not be reflective of the National situation as a whole – however, in these instances stakeholders have pointed out that the nationally available data tends to be aggregated and/ or unavailable.

Table 6-7: Percentage of publically procured vehicles in EU case study countries compared to EU figures used to extract data from TED

Vehicle type	% of EU registrations*	% of EU registrations (new values) *	% of German registrations**	% of Italian registrations***
Passenger Car	1.15%	0.41%	0.90%	0.54%
Van	0.46%	1.61%	1.83%	0.40%
Truck	6.71%	27.43%	1.64%	No data
Bus	26.70%	26.97%	No data	1.23%

** Public vehicle data source; estimated from TED, total registrations source; EU reference scenario 2016 - all values averaged 2009-2015*

*** Public vehicle data source; German case study, total registrations source; ACEA data - all values averaged 2009-2015*

**** Public vehicle data source; Italian case study, total registrations source; ACEA data - all values averaged 2014-2016*

Data from the Czech Republic and Sweden are comparable for Table 6-7 – data has been aggregated for the Czech Republic and covers only 9 months each of two years (2014 and 2015). Furthermore, the information is not available by vehicle type – and given the range in vehicle values (as demonstrated in Table 6-8), it would not be helpful for this comparative analysis to try to compare the information received from the Czech Republic with data available through TED.

Table 6-8: Average contract values per vehicles for purchase, hire and vehicle services in Euros

Vehicle	Purchase (Euros) [1]
Cars	24,603
LCVs	22,769
Trucks (excl. waste collection)	136,371
Buses/coaches	252,806
Waste collection vehicles	172,604

Source: [1] EC (2015a)

SUPPLEMENTARY CASE STUDY INFORMATION

During the course of Impact Assessment activities, the study team identified a need to carry out a more detailed 'sense-check' of information – in addition to analysis of TED data, and investigation of case study countries. Therefore, an additional 51 city-level procurement authorities received a short list of emailed questions seeking more detail about their processes. Six respondents provided additional data about the types and value of procurement activity within their department. The responses have mainly come from EU15 countries, with one city procurement officer from Poland giving responses that represent EU13 MS. Additional questions for public procurement stakeholders were;

5. The average cost (per vehicle) procured by your department?
6. An indication (as a percentage) of the proportion of total vehicles procured that are actually covered by the requirements of the Directive?
7. Please indicate the proportion (as a percentage) of vehicles purchased by your department are considered to be 'clean' vehicles – and how do you determine that they are a 'clean' vehicle?
8. What types of vehicle are typically procured by your department?

Only the representative of a Polish city was able to provide detailed information about forecast procurement activities and the capacity to incorporate cleaner vehicles into the existing publicly procured fleet. Data concerning the City of Warsaw was only available was due to a National incentive currently under implementation which proposes to support e-mobility using financial incentives. The city currently owns 160 electric, hybrid and CNG/LNG vehicles (although 52 of these particular vehicles are not used on public roads, only for internal purposes), including 20 electric, 4 hybrid and 35 LNG buses. The focus on "clean" vehicles in Poland remains on EV's, hybrid and CNG/LNG vehicles. In Poland, since LPG does not offer any improved environmental performance, while pure biofuels remain scarce in the country. As part of preparations for the national incentive, procurers in Warsaw were asked what percentage of their current fleet they would be willing to convert to electric vehicles should the proposed National incentive be introduced. Table 6-9 demonstrates that there is significant capacity to convert to cleaner vehicles where National support is provided – however electric and hybrid cars form the basis of the majority of vehicle fleets.

Table 6-9: Proportion of the current fleet that could be converted to "clean" vehicles using the proposed e-mobility incentive in the City of Warsaw

Proportion of fleet that could be converted to a "clean" vehicle using the E-initiative	Number of public purchasing authorities with the capability to convert proportion of their fleet to "clean" vehicles
0%	2
5 – 25%	8
26 – 50%	6
51 – 75%	3
76 – 100%	6

The following tables describe responses from public procurement authorities – at a city/ municipal level and exclude the response from Poland (summarised above).

Table 6-10: Q1 - Could you provide an estimate/ example of the average cost (per vehicle) procured by your department?

Procurement Department	Contact	MS	Q1: Could you provide an estimate/ example of the average cost (per vehicle) procured by your department?
Public Procurement and Logistics Directorate (DCPL)	Ville de Niort	FR	Ville de Niort currently use the calculation methodology for all the vehicles for which emissions data is available. Car/light vehicle: €10k – 11k (all taxes included) Mini vans: €13k – 15k (all taxes included) Vans: €17.5k - €20k (all taxes included)
Mechanical section (Water Services Dept.)	South Dublin	IE	€ 21,784
Engineering and Procurement Director	Arriva Italia	IT	The average price paid is around €200k for standard 12 metre interurban buses with air conditioning, handicap accessibility, display and automatic engine fire switch off.
Principal Analyst (Vehicles)	London	UK	At TfL, the main vehicles that we procure are buses, for London bus operations, and specially adapted (for disabled passengers) small buses for the Dial-a-Ride service. For the main service bus operations, the average costs depend on the technology. For a standard diesel bus, around £170k for a single deck, £210k for a double deck. However, we only procure new hybrid double decks at around £290k, so the prices are £170k for single decks and £290K for double decks.
Office for waste disposal, road cleaning and vehicle fleet	Stadt Regensburg	DE	We are procuring passenger cars from the small car segment for around €15k, but also special vehicles such as hoist trucks, container tipper trucks, bulk sweepers, refuse collection vehicles, etc. A hybrid collecting vehicle costs about €500k.

The information provided in The following tables describe responses from public procurement authorities – at a city/ municipal level and exclude the response from Poland (summarised above).

Table 6-10 provides a sense check for the figures used in Step 3 of the TED data public procurement estimates (see Figure 6-1). The information provided by stakeholders is somewhat reflective of the figures used during the analysis of TED data to estimate vehicle procurement figures – particularly those figures for buses – however this is further complicated by the diversity of vehicle type procured by public authorities. Table 6-11, below shows only the vehicle types for which figures have been provided by stakeholders. The figures show that the vehicle purchase price for the stakeholders may be lower than that given by the TED database – although it is important to note that the calculations on the basis of the TED database do not take into account the powertrain (some of which will be more expensive than others) and the type of vehicle. The only exception to this relates to bus purchases which show higher vehicle price than the TED database. It may be that this can be explained by the more expensive 'cleaner' technologies that procurement authorities seek when making new bus purchases.

Table 6-11: Vehicle cost assumptions used for modelling TED data

Vehicle type	Purchase cost - 2016	Stakeholder provided values
Passenger cars	€ 24,603	€ 10,000 - €15,000
Vans	€ 22,769	€13,000 - €15,000
Buses	€ 252,806	€170,000 - €200,000
Hybrid Buses	No data	€290,000

Table 6-12: Q2 - Can you indicate (as a percentage) of the proportion of total vehicles procured that are actually covered by the requirements of the Directive (please include all purchased/ leased/ rented/ hire-purchased vehicles procured by your department)?

Procurement Department	Contact	MS	Q2: Can you indicate (as a percentage) of the proportion of total vehicles procured that are actually covered by the requirements of the Directive (please include all purchased/ leased/ rented/ hire-purchased vehicles procured by your department)?
Public Procurement and Logistics Directorate (DCPL)	Ville de Niort	FR	Since 2016, 100 % of our purchases of light vehicles and vans (<3.5 t). NB: All heavy trucks (>3.5 t) and Non-Road Mobile Machinery are excluded from this calculation.
Mechanical section (Water Services Dept.)	South Dublin	IE	0%, i.e. all vehicles are under the €414k. We have a marking scheme in our tenders for fuel efficiency and gCO2/km or gCO2/hour depending upon the vehicle type being procured.
Engineering and Procurement Director		IT	Currently 100% of the vehicles procured are covered by the requirements expressed in the Directive 2009/33/EC. The methodology proposed by the EC is used in every public tender as a criterion for determining lifecycle cost in terms of fuel and emissions.

Principal Analyst (Vehicles)	London	UK	All of the above vehicles would be covered by the requirements of the Directive and are procured on a contract basis where bus companies fulfil a contract to operate a particular route using a specified vehicle type.
Office for waste disposal, road cleaning and vehicle fleet	Stadt Regensburg	DE	No data

Comments from stakeholders shown in Table 6-12 demonstrate that some procurement authorities voluntarily apply the requirements of the CVD to all vehicle procurement activities. However, this does not help to clarify how many vehicles are procured across the EU. With more time, this information would have been sought and discussed with stakeholders to determine whether the assumptions used for the analysis were satisfactory.

Table 6-13: Q3 - Please estimate the proportion (as a percentage) of vehicles purchased by your department are considered to be 'clean' vehicles – and how do you determine that they are a 'clean' vehicle?

Procurement Department	Contact	MS	Q3: Please estimate the proportion (as a percentage) of vehicles purchased by your department are considered to be 'clean' vehicles – and how do you determine that they are a 'clean' vehicle?
Public Procurement and Logistics Directorate (DCPL)	Ville de Niort	FR	We have 8 electric vehicles and 3 hybrids ones, but hybrid vehicles are not considered as "clean" in France.
Mechanical section (Water Services Dept.)	South Dublin	IE	0%, i.e. no electric vehicles. We have a marking scheme in our tenders for fuel efficiency and gCO2/km or gCO2/hour depending upon the vehicle type being procured.
Engineering and Procurement Director		IT	Since we consider all the vehicles procured following the indications of Directive 2009/33/EC as 'clean' vehicles, again 100% of the vehicles procured are regarded as 'clean'.
Principal Analyst (Vehicles)	London	UK	We would consider that all vehicles purchased since 2014 are 'clean' being Euro VI specification. A large proportion are hybrids too, which means that CO2 emissions are roughly halved.
Office for waste disposal, road cleaning and vehicle fleet	Stadt Regensburg	DE	No data

Responses to Question 3 (in Table 6-13) help to highlight the difficulty in defining a 'clean' vehicle across Europe. Stakeholders have clearly stated conflicting views of what constitutes a 'clean'; vehicle. This is reflective of the feedback received during wider stakeholder consultation activities. This supports a suggestion that having a clear definition of a clean vehicle will allow greater consistency in purchasing activities – and potentially in reporting purchasing activities.

Table 6-14: Q4 - What types of vehicle are typically procured by your department?

Procurement Department	Contact	MS	Q4: What types of vehicle are typically procured by your department?
Public Procurement and Logistics Directorate (DCPL)	Ville de Niort	FR	Passengers cars and LCVs (mini-vans and transit vans)
Mechanical section (Water Services Dept.)	South Dublin	IE	Small & large vans, pickup trucks (3.5T & 7.5T), small trucks (14T), large trucks (18T), jetvac trucks (32T), Tractors (80Hp), Tractors (130Hp), Ride on Mowers (20-30Hp)
Engineering and Procurement Director		IT	Approximately 150 buses are procured every year, whereas the most standard type of vehicle procured is the 12-metre interurban bus.
Principal Analyst (Vehicles)	London	UK	At TfL the main vehicles that we procure are buses, for London bus operations, and specially adapted (for disabled passengers) small buses for the Dial-a-Ride service. For the main service bus operations, the average costs depend on the technology. For a standard diesel bus, around £170k for a single deck, £210k for a double deck. However, we only procure new hybrid double decks at around £290k, so the prices are £170k for single decks and £290K for double decks. We led the way with Euro VI, with all new vehicles entering the contracted bus fleet since 2014 meeting that standard. The vast majority of new single deck and all new double decks are certified as low carbon vehicles. Over 20% of the fleet is Euro VI. We are planning on a retrofit programme to bring the entire fleet to a Euro VI standard by the end of 2020.
Office for waste disposal, road cleaning and vehicle fleet	Stadt Regensburg	DE	Passenger cars, hoist trucks, container tipper trucks, bulk sweepers, refuse collection vehicles (and other specialised vehicles).

Data collected during the case studies and via the questionnaire on the numbers of publicly procured vehicles was compared to the values gained from analysis of the TED database. This was done to check whether the numbers of publicly procured vehicles estimated via TED are in the right magnitude. However, limited data for trucks and buses make comparisons less useful in those categories. Additionally, data for public procurement by type of procurement (purchased, leased, rented or hire purchased) are not generally available at the National level. In addition, the number (and frequency) of vehicle procurement activities that take place below the threshold is unknown. As a result – and without the time to investigate the figures in more detail, some of the case study data cannot be said to verify estimates derived from TED data.

Annex 7 CALCULATION OF VEHICLES BY POLICY OPTION

7.1 Introduction

The measures included in the policy options have different implications in terms of the types of vehicles that should be selected by authorities as a result of the procurement process. In this annex, we present the approach followed for each policy option to estimate the share and number of conventional (petrol/diesel) and clean vehicles for each vehicle category and the results of this analysis, namely the impact of each policy option on the number and share of clean vehicles procured.

7.2 Policy option 1 – Repeal

Under Policy Option 1, the CVD will not apply to any vehicle procured by authorities for the period under examination. Any requirements set at national level will not be a result of EU legislation. In terms of the number of clean vehicles procured, we expect that the baseline scenario will apply, on the basis that the impact of the CVD has, so far, been very limited. However, it is also possible that, in the absence of any requirements, some authorities will remove the environmental criteria currently used from the procurement process. Table 7-1 and Table 7-2 summarise the distribution of vehicles by powertrain type under PO1 for the Baseline and the Alternative baseline scenario.

Table 7-1: Policy option PO1: Number and share of vehicles procured (building on the Baseline scenario)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Passenger cars	Petrol	37,474 (44%)	37,660 (43%)	37,847 (43%)	38,034 (42%)	38,221 (42%)	38,408 (41%)	38,401 (41%)	38,395 (40%)	38,389 (40%)	38,383 (39%)	38,377 (39%)	38,426 (39%)	38,476 (39%)	38,525 (39%)	38,575 (39%)	38,624 (38%)
Passenger cars	Diesel	40,133 (47%)	40,771 (47%)	41,408 (47%)	42,045 (47%)	42,683 (46%)	43,320 (46%)	43,280 (46%)	43,241 (45%)	43,201 (45%)	43,162 (44%)	43,122 (44%)	43,067 (44%)	43,011 (43%)	42,956 (43%)	42,900 (43%)	42,845 (43%)
Passenger cars	PHEV Petrol	1,017 (1%)	1,245 (1%)	1,472 (2%)	1,700 (2%)	1,927 (2%)	2,155 (2%)	2,315 (2%)	2,474 (3%)	2,634 (3%)	2,794 (3%)	2,953 (3%)	2,975 (3%)	2,996 (3%)	3,017 (3%)	3,038 (3%)	3,060 (3%)
Passenger cars	PHEV Diesel	994 (1%)	1,264 (1%)	1,535 (2%)	1,805 (2%)	2,076 (2%)	2,346 (2%)	2,611 (3%)	2,876 (3%)	3,140 (3%)	3,405 (3%)	3,670 (4%)	3,820 (4%)	3,969 (4%)	4,119 (4%)	4,269 (4%)	4,419 (4%)
Passenger cars	LPG	2,884 (3%)	2,935 (3%)	2,986 (3%)	3,036 (3%)	3,087 (3%)	3,137 (3%)	3,251 (3%)	3,365 (4%)	3,479 (4%)	3,593 (4%)	3,706 (4%)	3,682 (4%)	3,659 (4%)	3,635 (4%)	3,611 (4%)	3,587 (4%)
Passenger cars	CNG	1,445 (2%)	1,472 (2%)	1,499 (2%)	1,527 (2%)	1,554 (2%)	1,581 (2%)	1,625 (2%)	1,670 (2%)	1,714 (2%)	1,758 (2%)	1,803 (2%)	1,798 (2%)	1,794 (2%)	1,790 (2%)	1,786 (2%)	1,782 (2%)
Passenger cars	E85	173 (0%)	193 (0%)	212 (0%)	231 (0%)	251 (0%)	270 (0%)	278 (0%)	285 (0%)	292 (0%)	299 (0%)	306 (0%)	312 (0%)	318 (0%)	324 (0%)	330 (0%)	336 (0%)
Passenger cars	Electric	770 (1%)	1,074 (1%)	1,378 (2%)	1,682 (2%)	1,985 (2%)	2,289 (2%)	2,604 (3%)	2,919 (3%)	3,234 (3%)	3,549 (4%)	3,864 (4%)	4,016 (4%)	4,169 (4%)	4,322 (4%)	4,475 (4%)	4,627 (5%)
Passenger cars	Fuel Cell	46 (0%)	106 (0%)	166 (0%)	227 (0%)	287 (0%)	347 (0%)	414 (0%)	480 (1%)	547 (1%)	614 (1%)	680 (1%)	812 (1%)	943 (1%)	1,074 (1%)	1,205 (1%)	1,336 (1%)
Vans	Petrol	441 (4%)	446 (4%)	451 (4%)	457 (4%)	462 (4%)	467 (4%)	467 (4%)	467 (4%)	467 (4%)	466 (4%)	466 (4%)	462 (3%)	457 (3%)	453 (3%)	449 (3%)	444 (3%)
Vans	Diesel	10,842 (94%)	10,954 (93%)	11,066 (92%)	11,178 (91%)	11,290 (90%)	11,403 (90%)	11,374 (89%)	11,345 (88%)	11,316 (87%)	11,287 (86%)	11,258 (85%)	11,280 (85%)	11,302 (85%)	11,324 (85%)	11,346 (85%)	11,369 (84%)
Vans	PHEV_Petrol	6 (0%)	9 (0%)	12 (0%)	15 (0%)	17 (0%)	20 (0%)	23 (0%)	26 (0%)	29 (0%)	32 (0%)	35 (0%)	35 (0%)	36 (0%)	37 (0%)	37 (0%)	38 (0%)
Vans	PHEV_Diesel	181 (2%)	262 (2%)	342 (3%)	422 (3%)	502 (4%)	582 (5%)	667 (5%)	751 (6%)	835 (6%)	920 (7%)	1,004 (8%)	1,040 (8%)	1,075 (8%)	1,111 (8%)	1,146 (9%)	1,182 (9%)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Vans	LPG	7 (0%)	9 (0%)	11 (0%)	13 (0%)	15 (0%)	17 (0%)	17 (0%)	18 (0%)	19 (0%)	20 (0%)	21 (0%)	21 (0%)	21 (0%)	21 (0%)	21 (0%)	21 (0%)
Vans	CNG	8 (0%)	11 (0%)	13 (0%)	16 (0%)	19 (0%)	21 (0%)	23 (0%)	24 (0%)	26 (0%)	27 (0%)	28 (0%)	29 (0%)	29 (0%)	30 (0%)	30 (0%)	30 (0%)
Vans	Electric	61 (1%)	92 (1%)	123 (1%)	154 (1%)	185 (1%)	216 (2%)	245 (2%)	275 (2%)	304 (2%)	333 (3%)	363 (3%)	360 (3%)	356 (3%)	353 (3%)	350 (3%)	347 (3%)
Vans	Fuel Cell	3 (0%)	5 (0%)	7 (0%)	9 (0%)	11 (0%)	13 (0%)	16 (0%)	19 (0%)	22 (0%)	25 (0%)	28 (0%)	33 (0%)	37 (0%)	41 (0%)	45 (0%)	49 (0%)
Rigid trucks	Diesel	10,800 (85%)	10,760 (83%)	10,719 (81%)	10,678 (79%)	10,638 (77%)	10,597 (76%)	10,606 (74%)	10,615 (73%)	10,625 (72%)	10,634 (70%)	10,643 (69%)	10,598 (68%)	10,553 (67%)	10,508 (67%)	10,464 (66%)	10,419 (65%)
Rigid trucks	Diesel Hybrid	1,675 (13%)	1,913 (15%)	2,152 (16%)	2,391 (18%)	2,630 (19%)	2,869 (21%)	3,076 (22%)	3,283 (23%)	3,491 (24%)	3,698 (24%)	3,906 (25%)	4,014 (26%)	4,123 (26%)	4,231 (27%)	4,340 (27%)	4,449 (28%)
Rigid trucks	LPG	1 (0%)	2 (0%)	2 (0%)	2 (0%)	3 (0%)	3 (0%)	4 (0%)	5 (0%)	6 (0%)	6 (0%)	7 (0%)	8 (0%)	9 (0%)	10 (0%)	11 (0%)	12 (0%)
Rigid trucks	CNG	195 (2%)	261 (2%)	327 (2%)	392 (3%)	458 (3%)	524 (4%)	594 (4%)	664 (5%)	734 (5%)	803 (5%)	873 (6%)	920 (6%)	968 (6%)	1,015 (6%)	1,063 (7%)	1,110 (7%)
Rigid trucks	Electric	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Rigid trucks	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Buses	Diesel	11,360 (89%)	11,341 (87%)	11,323 (85%)	11,304 (84%)	11,286 (82%)	11,267 (80%)	11,230 (79%)	11,193 (78%)	11,156 (77%)	11,119 (77%)	11,082 (76%)	11,018 (75%)	10,953 (75%)	10,889 (74%)	10,825 (74%)	10,761 (73%)
Buses	Diesel Hybrid	833 (7%)	1,033 (8%)	1,233 (9%)	1,432 (11%)	1,632 (12%)	1,832 (13%)	1,967 (14%)	2,103 (15%)	2,238 (16%)	2,374 (16%)	2,509 (17%)	2,574 (18%)	2,638 (18%)	2,703 (18%)	2,767 (19%)	2,832 (19%)
Buses	LPG	265 (2%)	296 (2%)	327 (2%)	358 (3%)	389 (3%)	420 (3%)	432 (3%)	445 (3%)	457 (3%)	469 (3%)	481 (3%)	482 (3%)	483 (3%)	484 (3%)	485 (3%)	486 (3%)
Buses	LNG	304 (2%)	316 (2%)	328 (2%)	339 (3%)	351 (3%)	363 (3%)	361 (3%)	360 (3%)	359 (2%)	357 (2%)	356 (2%)	361 (2%)	366 (2%)	372 (3%)	377 (3%)	382 (3%)
Buses	Electric	21 (0%)	44 (0%)	66 (0%)	88 (1%)	111 (1%)	133 (1%)	153 (1%)	172 (1%)	192 (1%)	211 (1%)	231 (2%)	235 (2%)	239 (2%)	242 (2%)	246 (2%)	250 (2%)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Buses	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (0%)	1 (0%)	1 (0%)	1 (0%)
Passenger cars	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Passenger cars	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Table 7-2: Policy option PO1: Number and share of vehicles procured (building on the Alternative baseline scenario)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Passenger cars	Petrol	37,474 (44%)	37,660 (43%)	37,847 (43%)	38,034 (42%)	38,221 (42%)	38,408 (41%)	38,401 (41%)	38,395 (40%)	38,389 (40%)	38,383 (39%)	38,377 (39%)	38,426 (39%)	38,476 (39%)	38,525 (39%)	38,575 (39%)	38,624 (38%)
Passenger cars	Diesel	40,133 (47%)	40,771 (47%)	41,408 (47%)	42,045 (47%)	42,683 (46%)	43,320 (46%)	43,280 (46%)	43,241 (45%)	43,201 (45%)	43,162 (44%)	43,122 (44%)	43,067 (44%)	43,011 (43%)	42,956 (43%)	42,900 (43%)	42,845 (43%)
Passenger cars	PHEV Petrol	1,017 (1%)	1,245 (1%)	1,472 (2%)	1,700 (2%)	1,927 (2%)	2,155 (2%)	2,315 (2%)	2,474 (3%)	2,634 (3%)	2,794 (3%)	2,953 (3%)	2,975 (3%)	2,996 (3%)	3,017 (3%)	3,038 (3%)	3,060 (3%)
Passenger cars	PHEV Diesel	994 (1%)	1,264 (1%)	1,535 (2%)	1,805 (2%)	2,076 (2%)	2,346 (2%)	2,611 (3%)	2,876 (3%)	3,140 (3%)	3,405 (3%)	3,670 (4%)	3,820 (4%)	3,969 (4%)	4,119 (4%)	4,269 (4%)	4,419 (4%)
Passenger cars	LPG	2,884 (3%)	2,935 (3%)	2,986 (3%)	3,036 (3%)	3,087 (3%)	3,137 (3%)	3,251 (3%)	3,365 (4%)	3,479 (4%)	3,593 (4%)	3,706 (4%)	3,682 (4%)	3,659 (4%)	3,635 (4%)	3,611 (4%)	3,587 (4%)
Passenger cars	CNG	1,445 (2%)	1,472 (2%)	1,499 (2%)	1,527 (2%)	1,554 (2%)	1,581 (2%)	1,625 (2%)	1,670 (2%)	1,714 (2%)	1,758 (2%)	1,803 (2%)	1,798 (2%)	1,794 (2%)	1,790 (2%)	1,786 (2%)	1,782 (2%)
Passenger cars	E85	173 (0%)	193 (0%)	212 (0%)	231 (0%)	251 (0%)	270 (0%)	278 (0%)	285 (0%)	292 (0%)	299 (0%)	306 (0%)	312 (0%)	318 (0%)	324 (0%)	330 (0%)	336 (0%)
Passenger cars	Electric	770 (1%)	1,074 (1%)	1,378 (2%)	1,682 (2%)	1,985 (2%)	2,289 (2%)	2,604 (3%)	2,919 (3%)	3,234 (3%)	3,549 (4%)	3,864 (4%)	4,016 (4%)	4,169 (4%)	4,322 (4%)	4,475 (4%)	4,627 (5%)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Passenger cars	Fuel Cell	46 (0%)	106 (0%)	166 (0%)	227 (0%)	287 (0%)	347 (0%)	414 (0%)	480 (1%)	547 (1%)	614 (1%)	680 (1%)	812 (1%)	943 (1%)	1,074 (1%)	1,205 (1%)	1,336 (1%)
Vans	Petrol	441 (4%)	446 (4%)	451 (4%)	457 (4%)	462 (4%)	467 (4%)	467 (4%)	467 (4%)	467 (4%)	466 (4%)	466 (4%)	462 (3%)	457 (3%)	453 (3%)	449 (3%)	444 (3%)
Vans	Diesel	10,842 (94%)	10,954 (93%)	11,066 (92%)	11,178 (91%)	11,290 (90%)	11,403 (90%)	11,374 (89%)	11,345 (88%)	11,316 (87%)	11,287 (86%)	11,258 (85%)	11,280 (85%)	11,302 (85%)	11,324 (85%)	11,346 (85%)	11,369 (84%)
Vans	PHEV_Petrol	6 (0%)	9 (0%)	12 (0%)	15 (0%)	17 (0%)	20 (0%)	23 (0%)	26 (0%)	29 (0%)	32 (0%)	35 (0%)	35 (0%)	36 (0%)	37 (0%)	37 (0%)	38 (0%)
Vans	PHEV_Diesel	181 (2%)	262 (2%)	342 (3%)	422 (3%)	502 (4%)	582 (5%)	667 (5%)	751 (6%)	835 (6%)	920 (7%)	1,004 (8%)	1,040 (8%)	1,075 (8%)	1,111 (8%)	1,146 (9%)	1,182 (9%)
Vans	LPG	7 (0%)	9 (0%)	11 (0%)	13 (0%)	15 (0%)	17 (0%)	17 (0%)	18 (0%)	19 (0%)	20 (0%)	21 (0%)	21 (0%)	21 (0%)	21 (0%)	21 (0%)	21 (0%)
Vans	CNG	8 (0%)	11 (0%)	13 (0%)	16 (0%)	19 (0%)	21 (0%)	23 (0%)	24 (0%)	26 (0%)	27 (0%)	28 (0%)	29 (0%)	29 (0%)	30 (0%)	30 (0%)	30 (0%)
Vans	Electric	61 (1%)	92 (1%)	123 (1%)	154 (1%)	185 (1%)	216 (2%)	245 (2%)	275 (2%)	304 (2%)	333 (3%)	363 (3%)	360 (3%)	356 (3%)	353 (3%)	350 (3%)	347 (3%)
Vans	Fuel Cell	3 (0%)	5 (0%)	7 (0%)	9 (0%)	11 (0%)	13 (0%)	16 (0%)	19 (0%)	22 (0%)	25 (0%)	28 (0%)	33 (0%)	37 (0%)	41 (0%)	45 (0%)	49 (0%)
Rigid trucks	Diesel	10,800 (85%)	10,760 (83%)	10,719 (81%)	10,678 (79%)	10,638 (77%)	10,597 (76%)	10,606 (74%)	10,615 (73%)	10,625 (72%)	10,634 (70%)	10,643 (69%)	10,598 (68%)	10,553 (67%)	10,508 (67%)	10,464 (66%)	10,419 (65%)
Rigid trucks	Diesel Hybrid	1,675 (13%)	1,913 (15%)	2,152 (16%)	2,391 (18%)	2,630 (19%)	2,869 (21%)	3,076 (22%)	3,283 (23%)	3,491 (24%)	3,698 (24%)	3,906 (25%)	4,014 (26%)	4,123 (26%)	4,231 (27%)	4,340 (27%)	4,449 (28%)
Rigid trucks	LPG	1 (0%)	2 (0%)	2 (0%)	2 (0%)	3 (0%)	3 (0%)	4 (0%)	5 (0%)	6 (0%)	6 (0%)	7 (0%)	8 (0%)	9 (0%)	10 (0%)	11 (0%)	12 (0%)
Rigid trucks	CNG	195 (2%)	261 (2%)	327 (2%)	392 (3%)	458 (3%)	524 (4%)	594 (4%)	664 (5%)	734 (5%)	803 (5%)	873 (6%)	920 (6%)	968 (6%)	1,015 (6%)	1,063 (7%)	1,110 (7%)
Rigid trucks	Electric	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Rigid trucks	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Buses	Diesel	9,142 (72%)	8,877 (68%)	8,612 (65%)	8,348 (62%)	8,083 (59%)	7,818 (56%)	7,500 (53%)	7,182 (50%)	6,864 (48%)	6,546 (45%)	6,228 (42%)	6,196 (42%)	6,165 (42%)	6,133 (42%)	6,101 (42%)	6,070 (41%)
Buses	Diesel Hybrid	1,016 (8%)	1,162 (9%)	1,307 (10%)	1,453 (11%)	1,599 (12%)	1,745 (12%)	1,845 (13%)	1,946 (14%)	2,046 (14%)	2,146 (15%)	2,247 (15%)	2,280 (16%)	2,313 (16%)	2,346 (16%)	2,379 (16%)	2,412 (16%)
Buses	LPG	132 (1%)	148 (1%)	163 (1%)	179 (1%)	194 (1%)	210 (1%)	216 (2%)	222 (2%)	228 (2%)	235 (2%)	241 (2%)	241 (2%)	242 (2%)	242 (2%)	242 (2%)	243 (2%)
Buses	LNG	1,151 (9%)	1,198 (9%)	1,245 (9%)	1,292 (10%)	1,340 (10%)	1,387 (10%)	1,374 (10%)	1,361 (10%)	1,349 (9%)	1,336 (9%)	1,323 (9%)	1,326 (9%)	1,330 (9%)	1,333 (9%)	1,337 (9%)	1,340 (9%)
Buses	Electric	1,209 (9%)	1,463 (11%)	1,716 (13%)	1,970 (15%)	2,224 (16%)	2,478 (18%)	2,769 (20%)	3,060 (21%)	3,351 (23%)	3,642 (25%)	3,933 (27%)	3,937 (27%)	3,942 (27%)	3,947 (27%)	3,951 (27%)	3,956 (27%)
Buses	Fuel Cell	133 (1%)	182 (1%)	231 (2%)	279 (2%)	328 (2%)	377 (3%)	439 (3%)	501 (4%)	563 (4%)	625 (4%)	687 (5%)	688 (5%)	688 (5%)	689 (5%)	689 (5%)	690 (5%)
Passenger cars	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Passenger cars	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

7.3 Policy option 2 – Light revision

Under Policy Option 2, Member States will be required to choose between the use of the updated monetisation methodology (based on values from the 2014 Handbook) or the use of a clean vehicle definition where a certain share of vehicles procured will need to be clean vehicles. The choice of approach will be made at the national level, which means that procurement authorities will be constrained as to which approach they may choose. National plans will also set targets for the share of clean vehicles to be met by 2025 and 2030 in the case they follow the second option.

We have followed the steps described below in order to calculate the number of vehicles affected under PO2.

Step 1: We have made an assumption concerning the extent that the monetisation methodology will be used. We assumed that the share of vehicles procured based on the monetisation methodology will be at a level similar to that indicated among respondents to the procurers' survey performed as part of the ex-post evaluation (11%). For the remaining 89% of vehicles procured we assumed that the clean vehicle definition will be used. This is a somewhat arbitrary figure since we do not have input from national authorities as to what would be their choice if they had to select one of the two options. Currently, most national authorities (25 out of 28) have kept all options available as provided in Article 2 of the Directive available.

Step 2: In the case of vehicles procured using the monetisation methodology, we have calculated the total costs (internal and external) and identified the least expensive powertrain for each vehicle type[22]. We calculated these costs in 5 year intervals starting in 2020 up to 2035 that largely correspond with the stage approach followed in the case of Policy Options 3 and 4 (see below). We then assumed that authorities will select the vehicles with the least internal and external costs. This is the only option available on the basis of very limited information currently available on the possible choice of authorities when faced with higher total costs and possible supply constraints. It is also in line with the approach adopted in the 2007 IA study (PWC, 2007) .[23]

In practice, we do not expect that public bodies will purchase only one type of vehicle and, similarly, a complete shift from petrol/diesel to LPG/CNG/electrical is unlikely. This is particularly the case for certain types of vehicles (e.g. rigid trucks) where there are currently no electric trucks in the market and, according to the baseline scenario, electric or fuel cell trucks are also not expected to be available in the market before 2030. Thus, in order to avoid what are considered to be extremely unlikely scenarios we removed from the list of options those powertrains which, according to the REF2016+ scenario, are not expected to have more than 1% market share by 2030.

The results of this analysis are presented in Table 7-3 below. The detailed calculation that led to the ranking is presented in Annex 8. As shown below, petrol passenger cars still appear to be the cheapest up to 2030, once all cost have been considered, whilst post-2030 electric is the cheapest. In the case of vans, LPG fuelled vehicles are the cheapest up to 2030; however, considering the availability of drivetrains (e.g. with market share

[22] A detailed presentation of the calculations made is provided in Annex 8.

[23] As explained, the assumption was that, when pushed from demand, automotive industry will adapt its new products to the best performances required from the market. Thus, the more likely effect would be a shift in demand between different models of the same technology which would be consistent with the technology-neutral nature of the internalizing lifetime external cost policy. Thus, the methodology of the study focused on a shift of performances instead of a shift of technologies.

more than 1% by 2030) petrol is the cheapest up to 2030 and electric post-2030.For both trucks and buses, electric vehicles are identified as the cheapest, however in the case of rigid trucks diesel hybrid is the cheapest available drivetrain up to 2030, followed by diesel post-2030.

Table 7-3: Ranking of vehicles by powertrain on the basis of total costs (internal and external) calculated using the monetisation methodology (1st: cheapest available technology in bold; unavailable powertrains below 1% in red)

Vehicle Type	2020	2025	2030	2035
Passenger cars	**1-Petrol** 2-E85 3-LPG 4-CNG 5-Diesel 6-PHEV Petrol 7-Electric 8-PHEV Diesel 9-Fuel Cell	**1-Petrol** 2-Electric 3-E85 4-PHEV Petrol 5-LPG 6-CNG 7-Diesel 8-PHEV Diesel 9-Fuel Cell	**1-Electric** 2-Petrol 3-PHEV Petrol 4-E85 5-LPG 6-CNG 7-PHEV Diesel 8-Diesel 9-Fuel Cell	**1-Electric** 2-Petrol 3-PHEV Petrol 4-E85 5-LPG 6-PHEV Diesel 7-CNG 8-Diesel 9-Fuel Cell
Vans	1-LPG **2-Petrol** 3-CNG 4-PHEV Petrol 5-Electric 6-Diesel 7-PHEV Diesel 8-Fuel Cell	1-LPG 2-PHEV Petrol **3-Petrol** 4-CNG 5-Electric 6-PHEV Diesel 7-Diesel 8-Fuel Cell	1-PHEV Petrol 2-LPG **3-Electric** 4-Petrol 5-CNG 6-PHEV Diesel 7-Diesel 8-Fuel Cell	1-PHEV Petrol **2-Electric** 3-LPG 4-CNG 5-PHEV Diesel 6-Petrol 7-Fuel Cell 8-Diesel
Rigid trucks	1-Electric 2-Fuel Cell 3-LPG **4-Diesel Hybrid** 5-LNG 6-Diesel	1-Electric 2-Fuel Cell **3-Diesel Hybrid** 4-Diesel 5-LNG 6-LPG	1-Electric 2-Fuel Cell **3-Diesel** 4-Diesel Hybrid 5-LNG 6-LPG	1-Electric 2-Fuel Cell **3-Diesel** 4-LNG 5-Diesel Hybrid 6-LPG
Buses	**1-Electric** 2-Fuel Cell 3-Diesel Hybrid 4-Diesel 5-LPG 6-CNG	**1-Electric** 2-Fuel Cell 3-Diesel Hybrid 4-Diesel 5-LPG 6-CNG	**1-Electric** 2-Fuel Cell 3-Diesel Hybrid 4-Diesel 5-LPG 6-CNG	**1-Electric** 2-Fuel Cell 3-Diesel Hybrid 4-Diesel 5-LPG 6-CNG

The disadvantage of this approach is that it is not possible to provide a detailed breakdown of vehicles actually procured by powertrain, although it is still possible to indicate whether conventional or alternative fuelled vehicles will be purchased.

Step 3: In the case of vehicles procured on the basis of the clean vehicle definition, we have used information on the fuel type to assess whether a certain vehicle type complies with the criteria set for PO2. Furthermore, we have assumed a share of clean vehicles in the total number of vehicles procured according to the different national targets set for the period 2025-2030 and 2030 onwards.

The description of PO2 does not introduce any requirements in relation to the targets that Member States should set and how these will be implemented in practice. Thus, there is great uncertainty in terms of the level of ambition at national level. Similar experience from AFID suggests that some Member States may set rather unambitious targets. The proposed option does also not include any mechanism through which the Commission can force Member States to adapt their national plans if they are not considered ambitious enough. Thus, for the purposes of the analysis and quantification of impact, we needed to make assumptions about the targets set that would allow us to assess the impact on the demand for clean vehicles under Policy Option 2. In line with the overall logic that the option represents a light revision to the CVD, we have assumed 2030 targets that are less ambitious to those set in Options 3 and 4. More specifically, we have assumed for all vehicles the targets of 35% for Luxembourg and Sweden, 17% for Romania, with the requirements for other Member States scaled in between. Further details on these are presented in Annex 4.

Prior to 2030, according to PO2 there will not be any mandatory national targets concerning the use of clean vehicles in procurement and, as a result, we have assumed that the baseline scenario will apply[24].

We have used the above targets together with the relative share of each Member State's vehicle registrations to calculate an EU average target that has been used to estimate the share of publicly procured vehicles affected at EU level.

Finally, we have used Baseline scenario projections on the expected relative share of vehicles by powertrain and applied them to estimate the share of each of the powertrains that meet the clean vehicle definition. For the remaining share (i.e. above the minimum requirement of clean vehicles) we have assumed that only conventional vehicles (petrol/diesel) will be procured. As the baseline is used to inform the expected share of vehicles procured under the clean vehicle definition, two sensitivities were determined for buses (i.e. using the baseline scenario and the alternative baseline scenario) for all policy options where this procurement method is used (Policy Options 2-4).

A second important point is that where the baseline demonstrated a greater update of clean vehicles than the policy option, no impact was assumed to occur from the policy option. This was the case in PO2 post 2030 for buses procured under the clean vehicle definition option when the alternative baseline was assumed. 30% of clean buses were procured post 2030, whereas the alternative baseline demonstrated 42% clean buses.

Step 4: Finally, on the basis of the data from the baseline on the total volume of vehicles purchased, the actual number of vehicles by powertrain was estimated for the period 2020-2035.

Table 7-4 and Table 7-5 present the results of the analysis by vehicle type and powertrain indicating the numbers of vehicles and share of vehicles by drivetrain for each vehicle type and for the baseline scenarios.

[24] in the case of vehicles procured using the monetisation methodology, the updated values for calculating the total costs are expected to be used from the first year of the adoption of the proposed measure (2020).

Table 7-4: Policy option PO2: Number and share of vehicles procured (building on the Baseline scenario)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Passenger cars	Petrol	41,437 (49%)	41,757 (48%)	42,077 (48%)	42,397 (47%)	42,717 (46%)	43,038 (46%)	43,109 (45%)	43,181 (45%)	43,252 (45%)	43,324 (44%)	28,789 (29%)	28,919 (29%)	29,049 (29%)	29,179 (29%)	29,310 (29%)	29,441 (29%)
Passenger cars	Diesel	36,782 (43%)	37,366 (43%)	37,950 (43%)	38,534 (43%)	39,118 (42%)	39,702 (42%)	39,666 (42%)	39,630 (41%)	39,594 (41%)	39,558 (41%)	32,349 (33%)	32,411 (33%)	32,473 (33%)	32,535 (33%)	32,596 (33%)	32,657 (32%)
Passenger cars	PHEV_Petrol	933 (1%)	1,141 (1%)	1,350 (2%)	1,558 (2%)	1,767 (2%)	1,975 (2%)	2,121 (2%)	2,268 (2%)	2,414 (2%)	2,560 (3%)	6,432 (7%)	6,279 (6%)	6,139 (6%)	6,010 (6%)	5,890 (6%)	5,779 (6%)
Passenger cars	PHEV_Diesel	911 (1%)	1,159 (1%)	1,407 (2%)	1,655 (2%)	1,902 (2%)	2,150 (2%)	2,393 (3%)	2,636 (3%)	2,878 (3%)	3,121 (3%)	7,992 (8%)	8,064 (8%)	8,134 (8%)	8,205 (8%)	8,276 (8%)	8,346 (8%)
Passenger cars	LPG	2,643 (3%)	2,690 (3%)	2,736 (3%)	2,783 (3%)	2,829 (3%)	2,875 (3%)	2,980 (3%)	3,084 (3%)	3,188 (3%)	3,293 (3%)	2,780 (3%)	2,771 (3%)	2,762 (3%)	2,753 (3%)	2,744 (3%)	2,734 (3%)
Passenger cars	CNG	1,324 (2%)	1,349 (2%)	1,374 (2%)	1,399 (2%)	1,424 (2%)	1,449 (2%)	1,490 (2%)	1,530 (2%)	1,571 (2%)	1,612 (2%)	1,352 (1%)	1,353 (1%)	1,355 (1%)	1,356 (1%)	1,357 (1%)	1,358 (1%)
Passenger cars	E85	159 (0%)	176 (0%)	194 (0%)	212 (0%)	230 (0%)	248 (0%)	254 (0%)	261 (0%)	268 (0%)	274 (0%)	667 (1%)	659 (1%)	652 (1%)	646 (1%)	641 (1%)	635 (1%)
Passenger cars	Electric	706 (1%)	984 (1%)	1,263 (1%)	1,541 (2%)	1,820 (2%)	2,098 (2%)	2,387 (3%)	2,675 (3%)	2,964 (3%)	3,252 (3%)	16,638 (17%)	16,738 (17%)	16,838 (17%)	16,939 (17%)	17,040 (17%)	17,142 (17%)
Passenger cars	Fuel Cell	42 (0%)	97 (0%)	152 (0%)	208 (0%)	263 (0%)	318 (0%)	379 (0%)	440 (0%)	501 (1%)	563 (1%)	1,482 (2%)	1,713 (2%)	1,932 (2%)	2,139 (2%)	2,336 (2%)	2,523 (3%)
Vans	Petrol	1,387 (12%)	1,412 (12%)	1,437 (12%)	1,461 (12%)	1,486 (12%)	1,511 (12%)	1,519 (12%)	1,527 (12%)	1,535 (12%)	1,543 (12%)	346 (3%)	343 (3%)	341 (3%)	338 (3%)	335 (2%)	333 (2%)
Vans	Diesel	9,919 (86%)	10,021 (85%)	10,124 (84%)	10,227 (83%)	10,329 (83%)	10,432 (82%)	10,405 (81%)	10,379 (80%)	10,352 (80%)	10,326 (79%)	8,354 (63%)	8,386 (63%)	8,418 (63%)	8,450 (63%)	8,482 (63%)	8,514 (63%)
Vans	PHEV_Petrol	6 (0%)	8 (0%)	11 (0%)	13 (0%)	16 (0%)	19 (0%)	21 (0%)	24 (0%)	26 (0%)	29 (0%)	81 (1%)	81 (1%)	81 (1%)	81 (1%)	81 (1%)	81 (1%)
Vans	PHEV_Diesel	166 (1%)	239 (2%)	313 (3%)	386 (3%)	459 (4%)	533 (4%)	610 (5%)	687 (5%)	764 (6%)	841 (6%)	2,347 (18%)	2,383 (18%)	2,419 (18%)	2,454 (18%)	2,488 (19%)	2,522 (19%)
Vans	LPG	6 (0%)	8 (0%)	10 (0%)	12 (0%)	13 (0%)	15 (0%)	16 (0%)	17 (0%)	18 (0%)	19 (0%)	16 (0%)	16 (0%)	16 (0%)	16 (0%)	16 (0%)	16 (0%)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Vans	CNG	7 (0%)	10 (0%)	12 (0%)	15 (0%)	17 (0%)	20 (0%)	21 (0%)	22 (0%)	23 (0%)	25 (0%)	21 (0%)	21 (0%)	22 (0%)	22 (0%)	22 (0%)	23 (0%)
Vans	Electric	56 (0%)	84 (1%)	112 (1%)	141 (1%)	169 (1%)	198 (2%)	224 (2%)	251 (2%)	278 (2%)	305 (2%)	1,972 (15%)	1,953 (15%)	1,935 (15%)	1,918 (14%)	1,902 (14%)	1,887 (14%)
Vans	Fuel Cell	2 (0%)	4 (0%)	6 (0%)	8 (0%)	10 (0%)	12 (0%)	15 (0%)	18 (0%)	20 (0%)	23 (0%)	66 (1%)	75 (1%)	83 (1%)	90 (1%)	98 (1%)	105 (1%)
Rigid trucks	Diesel	9,946 (78%)	9,908 (77%)	9,871 (75%)	9,833 (73%)	9,796 (71%)	9,759 (70%)	9,767 (68%)	9,776 (67%)	9,784 (66%)	9,792 (65%)	10,798 (70%)	10,785 (69%)	10,772 (69%)	10,759 (68%)	10,746 (68%)	10,732 (67%)
Rigid trucks	Diesel Hybrid	2,544 (20%)	2,785 (22%)	3,026 (23%)	3,267 (24%)	3,508 (26%)	3,749 (27%)	3,962 (28%)	4,176 (29%)	4,390 (30%)	4,604 (30%)	3,515 (23%)	3,619 (23%)	3,725 (24%)	3,830 (24%)	3,936 (25%)	4,042 (25%)
Rigid trucks	LPG	1 (0%)	1 (0%)	2 (0%)	2 (0%)	2 (0%)	3 (0%)	4 (0%)	4 (0%)	5 (0%)	6 (0%)	9 (0%)	10 (0%)	11 (0%)	12 (0%)	13 (0%)	13 (0%)
Rigid trucks	CNG	179 (1%)	240 (2%)	301 (2%)	361 (3%)	422 (3%)	483 (3%)	547 (4%)	611 (4%)	676 (5%)	740 (5%)	1,107 (7%)	1,126 (7%)	1,145 (7%)	1,164 (7%)	1,183 (7%)	1,202 (8%)
Rigid trucks	Electric	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Rigid trucks	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Buses	Diesel	10,545 (82%)	10,528 (81%)	10,511 (79%)	10,493 (78%)	10,476 (76%)	10,459 (75%)	10,425 (74%)	10,390 (73%)	10,356 (72%)	10,321 (71%)	8,712 (59%)	8,664 (59%)	8,617 (59%)	8,570 (58%)	8,523 (58%)	8,475 (58%)
Buses	Diesel Hybrid	774 (6%)	959 (7%)	1,144 (9%)	1,330 (10%)	1,515 (11%)	1,700 (12%)	1,826 (13%)	1,952 (14%)	2,078 (14%)	2,203 (15%)	1,972 (13%)	2,024 (14%)	2,076 (14%)	2,127 (14%)	2,179 (15%)	2,231 (15%)
Buses	LPG	246 (2%)	275 (2%)	303 (2%)	332 (2%)	361 (3%)	390 (3%)	401 (3%)	413 (3%)	424 (3%)	436 (3%)	1,318 (9%)	1,310 (9%)	1,303 (9%)	1,295 (9%)	1,288 (9%)	1,281 (9%)
Buses	LNG	283 (2%)	293 (2%)	304 (2%)	315 (2%)	326 (2%)	337 (2%)	335 (2%)	334 (2%)	333 (2%)	332 (2%)	973 (7%)	980 (7%)	987 (7%)	994 (7%)	1,001 (7%)	1,008 (7%)
Buses	Electric	937 (7%)	975 (7%)	1,013 (8%)	1,052 (8%)	1,090 (8%)	1,129 (8%)	1,156 (8%)	1,183 (8%)	1,211 (8%)	1,238 (9%)	1,683 (11%)	1,689 (12%)	1,696 (12%)	1,702 (12%)	1,709 (12%)	1,715 (12%)
Buses	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (0%)	1 (0%)	1 (0%)	2 (0%)	2 (0%)	2 (0%)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Passenger cars	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Passenger cars	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Table 7-5: Policy option PO2: Number and share of vehicles procured (building on the Alternative baseline scenario)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Passenger cars	Petrol	41,437 (49%)	41,757 (48%)	42,077 (48%)	42,397 (47%)	42,717 (46%)	43,038 (46%)	43,109 (45%)	43,181 (45%)	43,252 (45%)	43,324 (44%)	28,789 (29%)	28,919 (29%)	29,049 (29%)	29,179 (29%)	29,310 (29%)	29,441 (29%)
Passenger cars	Diesel	36,782 (43%)	37,366 (43%)	37,950 (43%)	38,534 (43%)	39,118 (42%)	39,702 (42%)	39,666 (42%)	39,630 (41%)	39,594 (41%)	39,558 (41%)	32,349 (33%)	32,411 (33%)	32,473 (33%)	32,535 (33%)	32,596 (33%)	32,657 (32%)
Passenger cars	PHEV_Petrol	933 (1%)	1,141 (1%)	1,350 (2%)	1,558 (2%)	1,767 (2%)	1,975 (2%)	2,121 (2%)	2,268 (2%)	2,414 (2%)	2,560 (3%)	6,432 (7%)	6,279 (6%)	6,139 (6%)	6,010 (6%)	5,890 (6%)	5,779 (6%)
Passenger cars	PHEV_Diesel	911 (1%)	1,159 (1%)	1,407 (2%)	1,655 (2%)	1,902 (2%)	2,150 (2%)	2,393 (3%)	2,636 (3%)	2,878 (3%)	3,121 (3%)	7,992 (8%)	8,064 (8%)	8,134 (8%)	8,205 (8%)	8,276 (8%)	8,346 (8%)
Passenger cars	LPG	2,643 (3%)	2,690 (3%)	2,736 (3%)	2,783 (3%)	2,829 (3%)	2,875 (3%)	2,980 (3%)	3,084 (3%)	3,188 (3%)	3,293 (3%)	2,780 (3%)	2,771 (3%)	2,762 (3%)	2,753 (3%)	2,744 (3%)	2,734 (3%)
Passenger cars	CNG	1,324 (2%)	1,349 (2%)	1,374 (2%)	1,399 (2%)	1,424 (2%)	1,449 (2%)	1,490 (2%)	1,530 (2%)	1,571 (2%)	1,612 (2%)	1,352 (1%)	1,353 (1%)	1,355 (1%)	1,356 (1%)	1,357 (1%)	1,358 (1%)
Passenger cars	E85	159 (0%)	176 (0%)	194 (0%)	212 (0%)	230 (0%)	248 (0%)	254 (0%)	261 (0%)	268 (0%)	274 (0%)	667 (1%)	659 (1%)	652 (1%)	646 (1%)	641 (1%)	635 (1%)
Passenger cars	Electric	706 (1%)	984 (1%)	1,263 (1%)	1,541 (2%)	1,820 (2%)	2,098 (2%)	2,387 (3%)	2,675 (3%)	2,964 (3%)	3,252 (3%)	16,638 (17%)	16,738 (17%)	16,838 (17%)	16,939 (17%)	17,040 (17%)	17,142 (17%)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Passenger cars	Fuel Cell	42 (0%)	97 (0%)	152 (0%)	208 (0%)	263 (0%)	318 (0%)	379 (0%)	440 (0%)	501 (1%)	563 (1%)	1,482 (2%)	1,713 (2%)	1,932 (2%)	2,139 (2%)	2,336 (2%)	2,523 (3%)
Vans	Petrol	1,387 (12%)	1,412 (12%)	1,437 (12%)	1,461 (12%)	1,486 (12%)	1,511 (12%)	1,519 (12%)	1,527 (12%)	1,535 (12%)	1,543 (12%)	346 (3%)	343 (3%)	341 (3%)	338 (3%)	335 (2%)	333 (2%)
Vans	Diesel	9,919 (86%)	10,021 (85%)	10,124 (84%)	10,227 (83%)	10,329 (83%)	10,432 (82%)	10,405 (81%)	10,379 (80%)	10,352 (80%)	10,326 (79%)	8,354 (63%)	8,386 (63%)	8,418 (63%)	8,450 (63%)	8,482 (63%)	8,514 (63%)
Vans	PHEV_Petrol	6 (0%)	8 (0%)	11 (0%)	13 (0%)	16 (0%)	19 (0%)	21 (0%)	24 (0%)	26 (0%)	29 (0%)	81 (1%)	81 (1%)	81 (1%)	81 (1%)	81 (1%)	81 (1%)
Vans	PHEV_Diesel	166 (1%)	239 (2%)	313 (3%)	386 (3%)	459 (4%)	533 (4%)	610 (5%)	687 (5%)	764 (6%)	841 (6%)	2,347 (18%)	2,383 (18%)	2,419 (18%)	2,454 (18%)	2,488 (19%)	2,522 (19%)
Vans	LPG	6 (0%)	8 (0%)	10 (0%)	12 (0%)	13 (0%)	15 (0%)	16 (0%)	17 (0%)	18 (0%)	19 (0%)	16 (0%)	16 (0%)	16 (0%)	16 (0%)	16 (0%)	16 (0%)
Vans	CNG	7 (0%)	10 (0%)	12 (0%)	15 (0%)	17 (0%)	20 (0%)	21 (0%)	22 (0%)	23 (0%)	25 (0%)	21 (0%)	21 (0%)	22 (0%)	22 (0%)	22 (0%)	23 (0%)
Vans	Electric	56 (0%)	84 (1%)	112 (1%)	141 (1%)	169 (1%)	198 (2%)	224 (2%)	251 (2%)	278 (2%)	305 (2%)	1,972 (15%)	1,953 (15%)	1,935 (15%)	1,918 (14%)	1,902 (14%)	1,887 (14%)
Vans	Fuel Cell	2 (0%)	4 (0%)	6 (0%)	8 (0%)	10 (0%)	12 (0%)	15 (0%)	18 (0%)	20 (0%)	23 (0%)	66 (1%)	75 (1%)	83 (1%)	90 (1%)	98 (1%)	105 (1%)
Rigid trucks	Diesel	9,946 (78%)	9,908 (77%)	9,871 (75%)	9,833 (73%)	9,796 (71%)	9,759 (70%)	9,767 (68%)	9,776 (67%)	9,784 (66%)	9,792 (65%)	10,798 (70%)	10,785 (69%)	10,772 (69%)	10,759 (68%)	10,746 (68%)	10,732 (67%)
Rigid trucks	Diesel Hybrid	2,544 (20%)	2,785 (22%)	3,026 (23%)	3,267 (24%)	3,508 (26%)	3,749 (27%)	3,962 (28%)	4,176 (29%)	4,390 (30%)	4,604 (30%)	3,515 (23%)	3,619 (23%)	3,725 (24%)	3,830 (24%)	3,936 (25%)	4,042 (25%)
Rigid trucks	LPG	1 (0%)	1 (0%)	2 (0%)	2 (0%)	2 (0%)	3 (0%)	4 (0%)	4 (0%)	5 (0%)	6 (0%)	9 (0%)	10 (0%)	11 (0%)	12 (0%)	13 (0%)	13 (0%)
Rigid trucks	CNG	179 (1%)	240 (2%)	301 (2%)	361 (3%)	422 (3%)	483 (3%)	547 (4%)	611 (4%)	676 (5%)	740 (5%)	1,107 (7%)	1,126 (7%)	1,145 (7%)	1,164 (7%)	1,183 (7%)	1,202 (8%)
Rigid trucks	Electric	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Rigid trucks	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Buses	Diesel	8,486 (66%)	8,240 (63%)	7,995 (60%)	7,749 (57%)	7,503 (54%)	7,258 (52%)	6,962 (49%)	6,667 (47%)	6,372 (44%)	6,077 (42%)	5,781 (39%)	5,752 (39%)	5,723 (39%)	5,693 (39%)	5,664 (39%)	5,634 (38%)
Buses	Diesel Hybrid	943 (7%)	1,078 (8%)	1,214 (9%)	1,349 (10%)	1,484 (11%)	1,620 (12%)	1,713 (12%)	1,806 (13%)	1,899 (13%)	1,993 (14%)	2,086 (14%)	2,116 (14%)	2,147 (15%)	2,178 (15%)	2,208 (15%)	2,239 (15%)
Buses	LPG	123 (1%)	137 (1%)	152 (1%)	166 (1%)	180 (1%)	195 (1%)	201 (1%)	206 (1%)	212 (1%)	218 (1%)	224 (2%)	224 (2%)	224 (2%)	225 (2%)	225 (2%)	225 (2%)
Buses	LNG	1,068 (8%)	1,112 (9%)	1,156 (9%)	1,200 (9%)	1,244 (9%)	1,287 (9%)	1,276 (9%)	1,264 (9%)	1,252 (9%)	1,240 (9%)	1,228 (8%)	1,231 (8%)	1,234 (8%)	1,238 (8%)	1,241 (8%)	1,244 (8%)
Buses	Electric	2,039 (16%)	2,292 (18%)	2,546 (19%)	2,799 (21%)	3,052 (22%)	3,305 (24%)	3,584 (25%)	3,864 (27%)	4,143 (29%)	4,423 (30%)	4,702 (32%)	4,707 (32%)	4,712 (32%)	4,717 (32%)	4,722 (32%)	4,728 (32%)
Buses	Fuel Cell	124 (1%)	169 (1%)	214 (2%)	259 (2%)	305 (2%)	350 (2%)	407 (3%)	465 (3%)	523 (4%)	580 (4%)	638 (4%)	639 (4%)	639 (4%)	640 (4%)	640 (4%)	641 (4%)
Passenger cars	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Passenger cars	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

7.4 Policy option 3 – Clean vehicle definition based on tailpipe emissions

In the case of the Policy Option 3, light duty vehicles (LDVs) (e.g. passenger cars and vans) are treated separately to heavy duty vehicles (HDVs) (e.g. rigid trucks and buses).

For LDVs a clean vehicle definition based on tailpipe emissions is used. Thus, we have used available information on CO_2 and air pollutant emissions to identify the powertrains that meet the criteria set under the two options under consideration. We have then assumed that a certain share of vehicles procured will need to meet the criteria set under the low ambition (3a) and high ambition (3b) scenarios, both of which will be applied in a stepwise process in 2025 and 2030 as described in Section 4.

For HDVs no requirements are introduced because there are currently no CO_2 standards available for HGVs. This makes it very difficult for procurers to verify compliant low emission vehicles that meet a carbon based clean vehicle definition, and similarly for enforcement authorities to monitor compliance. As a result, in the case of option 3, the distribution of vehicles according to the baseline scenario has been assumed. Table 7-6and Table 7-7 below present the results of the analysis for PO3a the two alternative scenarios and Table 7-8 and Table 7-9 for PO3b. A first point is that there is an increase in the number of vehicles procured on the basis of the CVD, as a result of the extension of the scope. A total increase of 28% in the number of vehicles procured is expected as a result of this change of scope of the Directive. It is smaller in the case of passenger cars (21%), but higher in the case of trucks (51%) and buses (63%).

For cars and vans, the adoption of set thresholds in 2025 is expected to lead a significant increase in the share of clean vehicles, particularly in the case of the more ambitious scenario (3b). However, as a result of the definition of the scenario, in 2030 there is a possible decrease in the share of clean passenger cars and vans since the requirement is based only on the share of zero emission vehicles. Thus, while there is an expected increase in the share of electric and fuel cells vehicles up to the set threshold, the remaining vehicles can possibly be conventional vehicles.

Table 7-6: Policy option PO3a: Number and share of vehicles procured (building on the Baseline scenario)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Passenger cars	Petrol	37,474 (44%)	37,660 (43%)	37,847 (43%)	38,034 (42%)	38,221 (42%)	20,808 (22%)	20,982 (22%)	21,156 (22%)	21,330 (22%)	21,503 (22%)	21,675 (22%)	21,806 (22%)	21,937 (22%)	22,068 (22%)	22,200 (22%)	22,332 (22%)
Passenger cars	Diesel	40,133 (47%)	40,771 (47%)	41,408 (47%)	42,045 (47%)	42,683 (46%)	23,469 (25%)	23,648 (25%)	23,826 (25%)	24,004 (25%)	24,180 (25%)	24,356 (25%)	24,439 (25%)	24,523 (25%)	24,606 (25%)	24,689 (25%)	24,771 (25%)
Passenger cars	PHEV_Petrol	1,017 (1%)	1,245 (1%)	1,472 (2%)	1,700 (2%)	1,927 (2%)	15,008 (16%)	14,876 (16%)	14,784 (15%)	14,722 (15%)	14,685 (15%)	14,667 (15%)	14,463 (15%)	14,270 (14%)	14,087 (14%)	13,914 (14%)	13,749 (14%)
Passenger cars	PHEV_Diesel	994 (1%)	1,264 (1%)	1,535 (2%)	1,805 (2%)	2,076 (2%)	16,339 (17%)	16,780 (18%)	17,182 (18%)	17,553 (18%)	17,899 (18%)	18,226 (19%)	18,572 (19%)	18,908 (19%)	19,233 (19%)	19,549 (20%)	19,856 (20%)
Passenger cars	LPG	2,884 (3%)	2,935 (3%)	2,986 (3%)	3,036 (3%)	3,087 (3%)	1,700 (2%)	1,776 (2%)	1,854 (2%)	1,933 (2%)	2,013 (2%)	2,093 (2%)	2,090 (2%)	2,086 (2%)	2,082 (2%)	2,078 (2%)	2,074 (2%)
Passenger cars	CNG	1,445 (2%)	1,472 (2%)	1,499 (2%)	1,527 (2%)	1,554 (2%)	857 (1%)	888 (1%)	920 (1%)	952 (1%)	985 (1%)	1,018 (1%)	1,021 (1%)	1,023 (1%)	1,025 (1%)	1,028 (1%)	1,030 (1%)
Passenger cars	E85	173 (0%)	193 (0%)	212 (0%)	231 (0%)	251 (0%)	1,458 (2%)	1,333 (1%)	1,235 (1%)	1,157 (1%)	1,092 (1%)	1,039 (1%)	1,004 (1%)	973 (1%)	945 (1%)	920 (1%)	897 (1%)
Passenger cars	Electric	770 (1%)	1,074 (1%)	1,378 (2%)	1,682 (2%)	1,985 (2%)	12,344 (13%)	12,508 (13%)	12,663 (13%)	12,813 (13%)	12,958 (13%)	13,101 (13%)	12,906 (13%)	12,737 (13%)	12,588 (13%)	12,457 (12%)	12,342 (12%)
Passenger cars	Fuel Cell	46 (0%)	106 (0%)	166 (0%)	227 (0%)	287 (0%)	1,871 (2%)	1,987 (2%)	2,084 (2%)	2,168 (2%)	2,241 (2%)	2,307 (2%)	2,608 (3%)	2,880 (3%)	3,127 (3%)	3,354 (3%)	3,563 (4%)
Vans	Petrol	441 (4%)	446 (4%)	451 (4%)	457 (4%)	462 (4%)	251 (2%)	253 (2%)	255 (2%)	258 (2%)	260 (2%)	263 (2%)	261 (2%)	259 (2%)	257 (2%)	255 (2%)	253 (2%)
Vans	Diesel	10,842 (94%)	10,954 (93%)	11,066 (92%)	11,178 (91%)	11,290 (90%)	6,124 (48%)	6,167 (48%)	6,210 (48%)	6,252 (48%)	6,295 (48%)	6,338 (48%)	6,367 (48%)	6,396 (48%)	6,426 (48%)	6,455 (48%)	6,484 (48%)
Vans	PHEV_Petrol	6 (0%)	9 (0%)	12 (0%)	15 (0%)	17 (0%)	142 (1%)	143 (1%)	144 (1%)	145 (1%)	146 (1%)	146 (1%)	145 (1%)	143 (1%)	142 (1%)	140 (1%)	139 (1%)
Vans	PHEV_Diesel	181 (2%)	262 (2%)	342 (3%)	422 (3%)	502 (4%)	4,087 (32%)	4,117 (32%)	4,147 (32%)	4,177 (32%)	4,207 (32%)	4,237 (32%)	4,257 (32%)	4,277 (32%)	4,297 (32%)	4,317 (32%)	4,336 (32%)
Vans	LPG	7 (0%)	9 (0%)	11 (0%)	13 (0%)	15 (0%)	9 (0%)	9 (0%)	10 (0%)	11 (0%)	11 (0%)	12 (0%)	12 (0%)	12 (0%)	12 (0%)	12 (0%)	12 (0%)
Vans	CNG	8 (0%)	11 (0%)	13 (0%)	16 (0%)	19 (0%)	11 (0%)	12 (0%)	13 (0%)	14 (0%)	15 (0%)	16 (0%)	16 (0%)	17 (0%)	17 (0%)	17 (0%)	17 (0%)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Vans	Electric	61 (1%)	92 (1%)	123 (1%)	154 (1%)	185 (1%)	1,991 (16%)	1,997 (16%)	2,004 (16%)	2,013 (15%)	2,022 (15%)	2,033 (15%)	2,018 (15%)	2,003 (15%)	1,989 (15%)	1,974 (15%)	1,959 (15%)
Vans	Fuel Cell	3 (0%)	5 (0%)	7 (0%)	9 (0%)	11 (0%)	123 (1%)	133 (1%)	141 (1%)	148 (1%)	154 (1%)	159 (1%)	183 (1%)	207 (2%)	231 (2%)	255 (2%)	279 (2%)
Rigid trucks	Diesel	10,800 (85%)	10,760 (83%)	10,719 (81%)	10,678 (79%)	10,638 (77%)	10,597 (76%)	10,606 (74%)	10,615 (73%)	10,625 (72%)	10,634 (70%)	10,643 (69%)	10,598 (68%)	10,553 (67%)	10,508 (67%)	10,464 (66%)	10,419 (65%)
Rigid trucks	Diesel Hybrid	1,675 (13%)	1,913 (15%)	2,152 (16%)	2,391 (18%)	2,630 (19%)	2,869 (21%)	3,076 (22%)	3,283 (23%)	3,491 (24%)	3,698 (24%)	3,906 (25%)	4,014 (26%)	4,123 (26%)	4,231 (27%)	4,340 (27%)	4,449 (28%)
Rigid trucks	LPG	1 (0%)	2 (0%)	2 (0%)	2 (0%)	3 (0%)	3 (0%)	4 (0%)	5 (0%)	6 (0%)	6 (0%)	7 (0%)	8 (0%)	9 (0%)	10 (0%)	11 (0%)	12 (0%)
Rigid trucks	CNG	195 (2%)	261 (2%)	327 (2%)	392 (3%)	458 (3%)	524 (4%)	594 (4%)	664 (5%)	734 (5%)	803 (5%)	873 (6%)	920 (6%)	968 (6%)	1,015 (6%)	1,063 (7%)	1,110 (7%)
Rigid trucks	Electric	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Rigid trucks	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Buses	Diesel	11,360 (89%)	11,341 (87%)	11,323 (85%)	11,304 (84%)	11,286 (82%)	11,267 (80%)	11,230 (79%)	11,193 (78%)	11,156 (77%)	11,119 (77%)	11,082 (76%)	11,018 (75%)	10,953 (75%)	10,889 (74%)	10,825 (74%)	10,761 (73%)
Buses	Diesel Hybrid	833 (7%)	1,033 (8%)	1,233 (9%)	1,432 (11%)	1,632 (12%)	1,832 (13%)	1,967 (14%)	2,103 (15%)	2,238 (16%)	2,374 (16%)	2,509 (17%)	2,574 (18%)	2,638 (18%)	2,703 (18%)	2,767 (19%)	2,832 (19%)
Buses	LPG	265 (2%)	296 (2%)	327 (2%)	358 (3%)	389 (3%)	420 (3%)	432 (3%)	445 (3%)	457 (3%)	469 (3%)	481 (3%)	482 (3%)	483 (3%)	484 (3%)	485 (3%)	486 (3%)
Buses	LNG	304 (2%)	316 (2%)	328 (2%)	339 (3%)	351 (3%)	363 (3%)	361 (3%)	360 (3%)	359 (2%)	357 (2%)	356 (2%)	361 (2%)	366 (2%)	372 (3%)	377 (3%)	382 (3%)
Buses	Electric	21 (0%)	44 (0%)	66 (0%)	88 (1%)	111 (1%)	133 (1%)	153 (1%)	172 (1%)	192 (1%)	211 (1%)	231 (2%)	235 (2%)	239 (2%)	242 (2%)	246 (2%)	250 (2%)
Buses	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (0%)	1 (0%)	1 (0%)	1 (0%)
Passenger cars	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Passenger cars	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Table 7-7: Policy option PO3a: Number and share of vehicles procured (building on the Alternative baseline scenario)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Passenger cars	Petrol	37,474 (44%)	37,660 (43%)	37,847 (43%)	38,034 (42%)	38,221 (42%)	20,808 (22%)	20,982 (22%)	21,156 (22%)	21,330 (22%)	21,503 (22%)	21,675 (22%)	21,806 (22%)	21,937 (22%)	22,068 (22%)	22,200 (22%)	22,332 (22%)
Passenger cars	Diesel	40,133 (47%)	40,771 (47%)	41,408 (47%)	42,045 (47%)	42,683 (46%)	23,469 (25%)	23,648 (25%)	23,826 (25%)	24,004 (25%)	24,180 (25%)	24,356 (25%)	24,439 (25%)	24,523 (25%)	24,606 (25%)	24,689 (25%)	24,771 (25%)
Passenger cars	PHEV_Petrol	1,017 (1%)	1,245 (1%)	1,472 (2%)	1,700 (2%)	1,927 (2%)	15,008 (16%)	14,876 (16%)	14,784 (15%)	14,722 (15%)	14,685 (15%)	14,667 (15%)	14,463 (15%)	14,270 (14%)	14,087 (14%)	13,914 (14%)	13,749 (14%)
Passenger cars	PHEV_Diesel	994 (1%)	1,264 (1%)	1,535 (2%)	1,805 (2%)	2,076 (2%)	16,339 (17%)	16,780 (18%)	17,182 (18%)	17,553 (18%)	17,899 (18%)	18,226 (19%)	18,572 (19%)	18,908 (19%)	19,233 (19%)	19,549 (20%)	19,856 (20%)
Passenger cars	LPG	2,884 (3%)	2,935 (3%)	2,986 (3%)	3,036 (3%)	3,087 (3%)	1,700 (2%)	1,776 (2%)	1,854 (2%)	1,933 (2%)	2,013 (2%)	2,093 (2%)	2,090 (2%)	2,086 (2%)	2,082 (2%)	2,078 (2%)	2,074 (2%)
Passenger cars	CNG	1,445 (2%)	1,472 (2%)	1,499 (2%)	1,527 (2%)	1,554 (2%)	857 (1%)	888 (1%)	920 (1%)	952 (1%)	985 (1%)	1,018 (1%)	1,021 (1%)	1,023 (1%)	1,025 (1%)	1,028 (1%)	1,030 (1%)
Passenger cars	E85	173 (0%)	193 (0%)	212 (0%)	231 (0%)	251 (0%)	1,458 (2%)	1,333 (1%)	1,235 (1%)	1,157 (1%)	1,092 (1%)	1,039 (1%)	1,004 (1%)	973 (1%)	945 (1%)	920 (1%)	897 (1%)
Passenger cars	Electric	770 (1%)	1,074 (1%)	1,378 (2%)	1,682 (2%)	1,985 (2%)	12,344 (13%)	12,508 (13%)	12,663 (13%)	12,813 (13%)	12,958 (13%)	13,101 (13%)	12,906 (13%)	12,737 (13%)	12,588 (13%)	12,457 (12%)	12,342 (12%)
Passenger cars	Fuel Cell	46 (0%)	106 (0%)	166 (0%)	227 (0%)	287 (0%)	1,871 (2%)	1,987 (2%)	2,084 (2%)	2,168 (2%)	2,241 (2%)	2,307 (2%)	2,608 (3%)	2,880 (3%)	3,127 (3%)	3,354 (3%)	3,563 (4%)
Vans	Petrol	441 (4%)	446 (4%)	451 (4%)	457 (4%)	462 (4%)	251 (2%)	253 (2%)	255 (2%)	258 (2%)	260 (2%)	263 (2%)	261 (2%)	259 (2%)	257 (2%)	255 (2%)	253 (2%)
Vans	Diesel	10,842 (94%)	10,954 (93%)	11,066 (92%)	11,178 (91%)	11,290 (90%)	6,124 (48%)	6,167 (48%)	6,210 (48%)	6,252 (48%)	6,295 (48%)	6,338 (48%)	6,367 (48%)	6,396 (48%)	6,426 (48%)	6,455 (48%)	6,484 (48%)
Vans	PHEV_Petrol	6 (0%)	9 (0%)	12 (0%)	15 (0%)	17 (0%)	142 (1%)	143 (1%)	144 (1%)	145 (1%)	146 (1%)	146 (1%)	145 (1%)	143 (1%)	142 (1%)	140 (1%)	139 (1%)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Vans	PHEV_Diesel	181 (2%)	262 (2%)	342 (3%)	422 (3%)	502 (4%)	4,087 (32%)	4,117 (32%)	4,147 (32%)	4,177 (32%)	4,207 (32%)	4,237 (32%)	4,257 (32%)	4,277 (32%)	4,297 (32%)	4,317 (32%)	4,336 (32%)
Vans	LPG	7 (0%)	9 (0%)	11 (0%)	13 (0%)	15 (0%)	9 (0%)	9 (0%)	10 (0%)	11 (0%)	11 (0%)	12 (0%)	12 (0%)	12 (0%)	12 (0%)	12 (0%)	12 (0%)
Vans	CNG	8 (0%)	11 (0%)	13 (0%)	16 (0%)	19 (0%)	11 (0%)	12 (0%)	13 (0%)	14 (0%)	15 (0%)	16 (0%)	16 (0%)	17 (0%)	17 (0%)	17 (0%)	17 (0%)
Vans	Electric	61 (1%)	92 (1%)	123 (1%)	154 (1%)	185 (1%)	1,991 (16%)	1,997 (16%)	2,004 (16%)	2,013 (15%)	2,022 (15%)	2,033 (15%)	2,018 (15%)	2,003 (15%)	1,989 (15%)	1,974 (15%)	1,959 (15%)
Vans	Fuel Cell	3 (0%)	5 (0%)	7 (0%)	9 (0%)	11 (0%)	123 (1%)	133 (1%)	141 (1%)	148 (1%)	154 (1%)	159 (1%)	183 (1%)	207 (2%)	231 (2%)	255 (2%)	279 (2%)
Rigid trucks	Diesel	10,800 (85%)	10,760 (83%)	10,719 (81%)	10,678 (79%)	10,638 (77%)	10,597 (76%)	10,606 (74%)	10,615 (73%)	10,625 (72%)	10,634 (70%)	10,643 (69%)	10,598 (68%)	10,553 (67%)	10,508 (67%)	10,464 (66%)	10,419 (65%)
Rigid trucks	Diesel Hybrid	1,675 (13%)	1,913 (15%)	2,152 (16%)	2,391 (18%)	2,630 (19%)	2,869 (21%)	3,076 (22%)	3,283 (23%)	3,491 (24%)	3,698 (24%)	3,906 (25%)	4,014 (26%)	4,123 (26%)	4,231 (27%)	4,340 (27%)	4,449 (28%)
Rigid trucks	LPG	1 (0%)	2 (0%)	2 (0%)	2 (0%)	3 (0%)	3 (0%)	4 (0%)	5 (0%)	6 (0%)	6 (0%)	7 (0%)	8 (0%)	9 (0%)	10 (0%)	11 (0%)	12 (0%)
Rigid trucks	CNG	195 (2%)	261 (2%)	327 (2%)	392 (3%)	458 (3%)	524 (4%)	594 (4%)	664 (5%)	734 (5%)	803 (5%)	873 (6%)	920 (6%)	968 (6%)	1,015 (6%)	1,063 (7%)	1,110 (7%)
Rigid trucks	Electric	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Rigid trucks	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Buses	Diesel	9,142 (72%)	8,877 (68%)	8,612 (65%)	8,348 (62%)	8,083 (59%)	7,818 (56%)	7,500 (53%)	7,182 (50%)	6,864 (48%)	6,546 (45%)	6,228 (42%)	6,196 (42%)	6,165 (42%)	6,133 (42%)	6,101 (42%)	6,070 (41%)
Buses	Diesel Hybrid	1,016 (8%)	1,162 (9%)	1,307 (10%)	1,453 (11%)	1,599 (12%)	1,745 (12%)	1,845 (13%)	1,946 (14%)	2,046 (14%)	2,146 (15%)	2,247 (15%)	2,280 (16%)	2,313 (16%)	2,346 (16%)	2,379 (16%)	2,412 (16%)
Buses	LPG	132 (1%)	148 (1%)	163 (1%)	179 (1%)	194 (1%)	210 (1%)	216 (2%)	222 (2%)	228 (2%)	235 (2%)	241 (2%)	241 (2%)	242 (2%)	242 (2%)	242 (2%)	243 (2%)
Buses	LNG	1,151 (9%)	1,198 (9%)	1,245 (9%)	1,292 (10%)	1,340 (10%)	1,387 (10%)	1,374 (10%)	1,361 (10%)	1,349 (9%)	1,336 (9%)	1,323 (9%)	1,326 (9%)	1,330 (9%)	1,333 (9%)	1,337 (9%)	1,340 (9%)
Buses	Electric	1,209 (9%)	1,463 (11%)	1,716 (13%)	1,970 (15%)	2,224 (16%)	2,478 (18%)	2,769 (20%)	3,060 (21%)	3,351 (23%)	3,642 (25%)	3,933 (27%)	3,937 (27%)	3,942 (27%)	3,947 (27%)	3,951 (27%)	3,956 (27%)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Buses	Fuel Cell	133 (1%)	182 (1%)	231 (2%)	279 (2%)	328 (2%)	377 (3%)	439 (3%)	501 (4%)	563 (4%)	625 (4%)	687 (5%)	688 (5%)	688 (5%)	689 (5%)	689 (5%)	690 (5%)
Passenger cars	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Passenger cars	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Table 7-8: Policy option PO3b: Number and share of vehicles procured (building on the Baseline Scenario)

Vehicle type	Powertrain/ fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Passenger cars	Petrol	37,474 (44%)	37,660 (43%)	37,847 (43%)	38,034 (42%)	38,221 (42%)	20,808 (22%)	20,982 (22%)	21,156 (22%)	21,330 (22%)	21,503 (22%)	26,883 (27%)	26,995 (27%)	27,107 (27%)	27,218 (27%)	27,330 (27%)	27,442 (27%)
Passenger cars	Diesel	40,133 (47%)	40,771 (47%)	41,408 (47%)	42,045 (47%)	42,683 (46%)	23,469 (25%)	23,648 (25%)	23,826 (25%)	24,004 (25%)	24,180 (25%)	30,207 (31%)	30,255 (31%)	30,302 (31%)	30,349 (30%)	30,395 (30%)	30,440 (30%)
Passenger cars	PHEV_Petrol	1,017 (1%)	1,245 (1%)	1,472 (2%)	1,700 (2%)	1,927 (2%)	15,008 (16%)	14,876 (16%)	14,784 (15%)	14,722 (15%)	14,685 (15%)	2,069 (2%)	2,090 (2%)	2,111 (2%)	2,132 (2%)	2,153 (2%)	2,174 (2%)
Passenger cars	PHEV_Diesel	994 (1%)	1,264 (1%)	1,535 (2%)	1,805 (2%)	2,076 (2%)	16,339 (17%)	16,780 (18%)	17,182 (18%)	17,553 (18%)	17,899 (18%)	2,571 (3%)	2,683 (3%)	2,797 (3%)	2,910 (3%)	3,024 (3%)	3,139 (3%)
Passenger cars	LPG	2,884 (3%)	2,935 (3%)	2,986 (3%)	3,036 (3%)	3,087 (3%)	1,700 (2%)	1,776 (2%)	1,854 (2%)	1,933 (2%)	2,013 (2%)	2,596 (3%)	2,587 (3%)	2,578 (3%)	2,568 (3%)	2,558 (3%)	2,549 (3%)
Passenger cars	CNG	1,445 (2%)	1,472 (2%)	1,499 (2%)	1,527 (2%)	1,554 (2%)	857 (1%)	888 (1%)	920 (1%)	952 (1%)	985 (1%)	1,263 (1%)	1,263 (1%)	1,264 (1%)	1,265 (1%)	1,265 (1%)	1,266 (1%)
Passenger cars	E85	173 (0%)	193 (0%)	212 (0%)	231 (0%)	251 (0%)	1,458 (2%)	1,333 (1%)	1,235 (1%)	1,157 (1%)	1,092 (1%)	2,078 (2%)	2,008 (2%)	1,945 (2%)	1,890 (2%)	1,840 (2%)	1,795 (2%)
Passenger cars	Electric	770 (1%)	1,074 (1%)	1,378 (2%)	1,682 (2%)	1,985 (2%)	12,344 (13%)	12,508 (13%)	12,663 (13%)	12,813 (13%)	12,958 (13%)	26,201 (27%)	25,812 (26%)	25,473 (26%)	25,176 (25%)	24,915 (25%)	24,685 (25%)
Passenger cars	Fuel Cell	46 (0%)	106 (0%)	166 (0%)	227 (0%)	287 (0%)	1,871 (2%)	1,987 (2%)	2,084 (2%)	2,168 (2%)	2,241 (2%)	4,614 (5%)	5,216 (5%)	5,759 (6%)	6,255 (6%)	6,708 (7%)	7,126 (7%)
Vans	Petrol	441 (4%)	446 (4%)	451 (4%)	457 (4%)	462 (4%)	251 (2%)	253 (2%)	255 (2%)	258 (2%)	260 (2%)	321 (2%)	318 (2%)	315 (2%)	312 (2%)	309 (2%)	306 (2%)
Vans	Diesel	10,842 (94%)	10,954 (93%)	11,066 (92%)	11,178 (91%)	11,290 (90%)	6,124 (48%)	6,167 (48%)	6,210 (48%)	6,252 (48%)	6,295 (48%)	7,750 (59%)	7,765 (59%)	7,779 (58%)	7,794 (58%)	7,809 (58%)	7,824 (58%)
Vans	PHEV_Petrol	6 (0%)	9 (0%)	12 (0%)	15 (0%)	17 (0%)	142 (1%)	143 (1%)	144 (1%)	145 (1%)	146 (1%)	24 (0%)	24 (0%)	25 (0%)	25 (0%)	26 (0%)	26 (0%)
Vans	PHEV_Diesel	181 (2%)	262 (2%)	342 (3%)	422 (3%)	502 (4%)	4,087 (32%)	4,117 (32%)	4,147 (32%)	4,177 (32%)	4,207 (32%)	691 (5%)	716 (5%)	740 (6%)	765 (6%)	789 (6%)	813 (6%)
Vans	LPG	7 (0%)	9 (0%)	11 (0%)	13 (0%)	15 (0%)	9 (0%)	9 (0%)	10 (0%)	11 (0%)	11 (0%)	15 (0%)	15 (0%)	15 (0%)	15 (0%)	15 (0%)	15 (0%)
Vans	CNG	8 (0%)	11 (0%)	13 (0%)	16 (0%)	19 (0%)	11 (0%)	12 (0%)	13 (0%)	14 (0%)	15 (0%)	20 (0%)	20 (0%)	20 (0%)	20 (0%)	21 (0%)	21 (0%)

Vehicle type	Powertrain/ fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Vans	Electric	61 (1%)	92 (1%)	123 (1%)	154 (1%)	185 (1%)	1,991 (16%)	1,997 (16%)	2,004 (16%)	2,013 (15%)	2,022 (15%)	4,065 (31%)	4,036 (30%)	4,007 (30%)	3,977 (30%)	3,948 (29%)	3,918 (29%)
Vans	Fuel Cell	3 (0%)	5 (0%)	7 (0%)	9 (0%)	11 (0%)	123 (1%)	133 (1%)	141 (1%)	148 (1%)	154 (1%)	318 (2%)	366 (3%)	413 (3%)	461 (3%)	509 (4%)	557 (4%)
Rigid trucks	Diesel	10,800 (85%)	10,760 (83%)	10,719 (81%)	10,678 (79%)	10,638 (77%)	10,597 (76%)	10,606 (74%)	10,615 (73%)	10,625 (72%)	10,634 (70%)	10,643 (69%)	10,598 (68%)	10,553 (67%)	10,508 (67%)	10,464 (66%)	10,419 (65%)
Rigid trucks	Diesel Hybrid	1,675 (13%)	1,913 (15%)	2,152 (16%)	2,391 (18%)	2,630 (19%)	2,869 (21%)	3,076 (22%)	3,283 (23%)	3,491 (24%)	3,698 (24%)	3,906 (25%)	4,014 (26%)	4,123 (26%)	4,231 (27%)	4,340 (27%)	4,449 (28%)
Rigid trucks	LPG	1 (0%)	2 (0%)	2 (0%)	2 (0%)	3 (0%)	3 (0%)	4 (0%)	5 (0%)	6 (0%)	6 (0%)	7 (0%)	8 (0%)	9 (0%)	10 (0%)	11 (0%)	12 (0%)
Rigid trucks	CNG	195 (2%)	261 (2%)	327 (2%)	392 (3%)	458 (3%)	524 (4%)	594 (4%)	664 (5%)	734 (5%)	803 (5%)	873 (6%)	920 (6%)	968 (6%)	1,015 (6%)	1,063 (7%)	1,110 (7%)
Rigid trucks	Electric	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Rigid trucks	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Buses	Diesel	11,360 (89%)	11,341 (87%)	11,323 (85%)	11,304 (84%)	11,286 (82%)	11,267 (80%)	11,230 (79%)	11,193 (78%)	11,156 (77%)	11,119 (77%)	11,082 (76%)	11,018 (75%)	10,953 (75%)	10,889 (74%)	10,825 (74%)	10,761 (73%)
Buses	Diesel Hybrid	833 (7%)	1,033 (8%)	1,233 (9%)	1,432 (11%)	1,632 (12%)	1,832 (13%)	1,967 (14%)	2,103 (15%)	2,238 (16%)	2,374 (16%)	2,509 (17%)	2,574 (18%)	2,638 (18%)	2,703 (18%)	2,767 (19%)	2,832 (19%)
Buses	LPG	265 (2%)	296 (2%)	327 (2%)	358 (3%)	389 (3%)	420 (3%)	432 (3%)	445 (3%)	457 (3%)	469 (3%)	481 (3%)	482 (3%)	483 (3%)	484 (3%)	485 (3%)	486 (3%)
Buses	LNG	304 (2%)	316 (2%)	328 (2%)	339 (3%)	351 (3%)	363 (3%)	361 (3%)	360 (3%)	359 (2%)	357 (2%)	356 (2%)	361 (2%)	366 (2%)	372 (3%)	377 (3%)	382 (3%)
Buses	Electric	21 (0%)	44 (0%)	66 (0%)	88 (1%)	111 (1%)	133 (1%)	153 (1%)	172 (1%)	192 (1%)	211 (1%)	231 (2%)	235 (2%)	239 (2%)	242 (2%)	246 (2%)	250 (2%)
Buses	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (0%)	1 (0%)	1 (0%)	1 (0%)
Passenger cars	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Vehicle type	Powertrain/ fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Passenger cars	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Table 7-9: Policy option PO3b: Number and share of vehicles (building on the Alternative Baseline Scenario)

Vehicle type	Powertrain/ fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Passenger cars	Petrol	37,474 (44%)	37,660 (43%)	37,847 (43%)	38,034 (42%)	38,221 (42%)	20,808 (22%)	20,982 (22%)	21,156 (22%)	21,330 (22%)	21,503 (22%)	26,883 (27%)	26,995 (27%)	27,107 (27%)	27,218 (27%)	27,330 (27%)	27,442 (27%)
Passenger cars	Diesel	40,133 (47%)	40,771 (47%)	41,408 (47%)	42,045 (47%)	42,683 (46%)	23,469 (25%)	23,648 (25%)	23,826 (25%)	24,004 (25%)	24,180 (25%)	30,207 (31%)	30,255 (31%)	30,302 (31%)	30,349 (30%)	30,395 (30%)	30,440 (30%)
Passenger cars	PHEV_Petrol	1,017 (1%)	1,245 (1%)	1,472 (2%)	1,700 (2%)	1,927 (2%)	15,008 (16%)	14,876 (16%)	14,784 (15%)	14,722 (15%)	14,685 (15%)	2,069 (2%)	2,090 (2%)	2,111 (2%)	2,132 (2%)	2,153 (2%)	2,174 (2%)
Passenger cars	PHEV_Diesel	994 (1%)	1,264 (1%)	1,535 (2%)	1,805 (2%)	2,076 (2%)	16,339 (17%)	16,780 (18%)	17,182 (18%)	17,553 (18%)	17,899 (18%)	2,571 (3%)	2,683 (3%)	2,797 (3%)	2,910 (3%)	3,024 (3%)	3,139 (3%)
Passenger cars	LPG	2,884 (3%)	2,935 (3%)	2,986 (3%)	3,036 (3%)	3,087 (3%)	1,700 (2%)	1,776 (2%)	1,854 (2%)	1,933 (2%)	2,013 (2%)	2,596 (3%)	2,587 (3%)	2,578 (3%)	2,568 (3%)	2,558 (3%)	2,549 (3%)
Passenger cars	CNG	1,445 (2%)	1,472 (2%)	1,499 (2%)	1,527 (2%)	1,554 (2%)	857 (1%)	888 (1%)	920 (1%)	952 (1%)	985 (1%)	1,263 (1%)	1,263 (1%)	1,264 (1%)	1,265 (1%)	1,265 (1%)	1,266 (1%)
Passenger cars	E85	173 (0%)	193 (0%)	212 (0%)	231 (0%)	251 (0%)	1,458 (2%)	1,333 (1%)	1,235 (1%)	1,157 (1%)	1,092 (1%)	2,078 (2%)	2,008 (2%)	1,945 (2%)	1,890 (2%)	1,840 (2%)	1,795 (2%)
Passenger cars	Electric	770 (1%)	1,074 (1%)	1,378 (2%)	1,682 (2%)	1,985 (2%)	12,344 (13%)	12,508 (13%)	12,663 (13%)	12,813 (13%)	12,958 (13%)	26,201 (27%)	25,812 (26%)	25,473 (26%)	25,176 (25%)	24,915 (25%)	24,685 (25%)
Passenger cars	Fuel Cell	46 (0%)	106 (0%)	166 (0%)	227 (0%)	287 (0%)	1,871 (2%)	1,987 (2%)	2,084 (2%)	2,168 (2%)	2,241 (2%)	4,614 (5%)	5,216 (5%)	5,759 (6%)	6,255 (6%)	6,708 (7%)	7,126 (7%)
Vans	Petrol	441 (4%)	446 (4%)	451 (4%)	457 (4%)	462 (4%)	251 (2%)	253 (2%)	255 (2%)	258 (2%)	260 (2%)	321 (2%)	318 (2%)	315 (2%)	312 (2%)	309 (2%)	306 (2%)
Vans	Diesel	10,842 (94%)	10,954 (93%)	11,066 (92%)	11,178 (91%)	11,290 (90%)	6,124 (48%)	6,167 (48%)	6,210 (48%)	6,252 (48%)	6,295 (48%)	7,750 (59%)	7,765 (59%)	7,779 (58%)	7,794 (58%)	7,809 (58%)	7,824 (58%)
Vans	PHEV_Petrol	6 (0%)	9 (0%)	12 (0%)	15 (0%)	17 (0%)	142 (1%)	143 (1%)	144 (1%)	145 (1%)	146 (1%)	24 (0%)	24 (0%)	25 (0%)	25 (0%)	26 (0%)	26 (0%)
Vans	PHEV_Diesel	181 (2%)	262 (2%)	342 (3%)	422 (3%)	502 (4%)	4,087 (32%)	4,117 (32%)	4,147 (32%)	4,177 (32%)	4,207 (32%)	691 (5%)	716 (5%)	740 (6%)	765 (6%)	789 (6%)	813 (6%)
Vans	LPG	7 (0%)	9 (0%)	11 (0%)	13 (0%)	15 (0%)	9 (0%)	9 (0%)	10 (0%)	11 (0%)	11 (0%)	15 (0%)	15 (0%)	15 (0%)	15 (0%)	15 (0%)	15 (0%)
Vans	CNG	8 (0%)	11 (0%)	13 (0%)	16 (0%)	19 (0%)	11 (0%)	12 (0%)	13 (0%)	14 (0%)	15 (0%)	20 (0%)	20 (0%)	20 (0%)	20 (0%)	21 (0%)	21 (0%)

Vehicle type	Powertrain/ fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Vans	Electric	61 (1%)	92 (1%)	123 (1%)	154 (1%)	185 (1%)	1,991 (16%)	1,997 (16%)	2,004 (16%)	2,013 (15%)	2,022 (15%)	4,065 (31%)	4,036 (30%)	4,007 (30%)	3,977 (30%)	3,948 (29%)	3,918 (29%)
Vans	Fuel Cell	3 (0%)	5 (0%)	7 (0%)	9 (0%)	11 (0%)	123 (1%)	133 (1%)	141 (1%)	148 (1%)	154 (1%)	318 (2%)	366 (3%)	413 (3%)	461 (3%)	509 (4%)	557 (4%)
Rigid trucks	Diesel	10,800 (85%)	10,760 (83%)	10,719 (81%)	10,678 (79%)	10,638 (77%)	10,597 (76%)	10,606 (74%)	10,615 (73%)	10,625 (72%)	10,634 (70%)	10,643 (69%)	10,598 (68%)	10,553 (67%)	10,508 (67%)	10,464 (66%)	10,419 (65%)
Rigid trucks	Diesel Hybrid	1,675 (13%)	1,913 (15%)	2,152 (16%)	2,391 (18%)	2,630 (19%)	2,869 (21%)	3,076 (22%)	3,283 (23%)	3,491 (24%)	3,698 (24%)	3,906 (25%)	4,014 (26%)	4,123 (26%)	4,231 (27%)	4,340 (27%)	4,449 (28%)
Rigid trucks	LPG	1 (0%)	2 (0%)	2 (0%)	2 (0%)	3 (0%)	3 (0%)	4 (0%)	5 (0%)	6 (0%)	6 (0%)	7 (0%)	8 (0%)	9 (0%)	10 (0%)	11 (0%)	12 (0%)
Rigid trucks	CNG	195 (2%)	261 (2%)	327 (2%)	392 (3%)	458 (3%)	524 (4%)	594 (4%)	664 (5%)	734 (5%)	803 (5%)	873 (6%)	920 (6%)	968 (6%)	1,015 (6%)	1,063 (7%)	1,110 (7%)
Rigid trucks	Electric	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Rigid trucks	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Buses	Diesel	9,142 (72%)	8,877 (68%)	8,612 (65%)	8,348 (62%)	8,083 (59%)	7,818 (56%)	7,500 (53%)	7,182 (50%)	6,864 (48%)	6,546 (45%)	6,228 (42%)	6,196 (42%)	6,165 (42%)	6,133 (42%)	6,101 (42%)	6,070 (41%)
Buses	Diesel Hybrid	1,016 (8%)	1,162 (9%)	1,307 (10%)	1,453 (11%)	1,599 (12%)	1,745 (12%)	1,845 (13%)	1,946 (14%)	2,046 (14%)	2,146 (15%)	2,247 (15%)	2,280 (16%)	2,313 (16%)	2,346 (16%)	2,379 (16%)	2,412 (16%)
Buses	LPG	132 (1%)	148 (1%)	163 (1%)	179 (1%)	194 (1%)	210 (1%)	216 (2%)	222 (2%)	228 (2%)	235 (2%)	241 (2%)	241 (2%)	242 (2%)	242 (2%)	242 (2%)	243 (2%)
Buses	LNG	1,151 (9%)	1,198 (9%)	1,245 (9%)	1,292 (10%)	1,340 (10%)	1,387 (10%)	1,374 (10%)	1,361 (10%)	1,349 (9%)	1,336 (9%)	1,323 (9%)	1,326 (9%)	1,330 (9%)	1,333 (9%)	1,337 (9%)	1,340 (9%)
Buses	Electric	1,209 (9%)	1,463 (11%)	1,716 (13%)	1,970 (15%)	2,224 (16%)	2,478 (18%)	2,769 (20%)	3,060 (21%)	3,351 (23%)	3,642 (25%)	3,933 (27%)	3,937 (27%)	3,942 (27%)	3,947 (27%)	3,951 (27%)	3,956 (27%)
Buses	Fuel Cell	133 (1%)	182 (1%)	231 (2%)	279 (2%)	328 (2%)	377 (3%)	439 (3%)	501 (4%)	563 (4%)	625 (4%)	687 (5%)	688 (5%)	688 (5%)	689 (5%)	689 (5%)	690 (5%)
Passenger cars	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Vehicle type	Powertrain/ fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Passenger cars	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

7.5 Policy Option 4 – Clean vehicle definition based on powertrain type

In the case of the Policy Option 4, the alternative definition of clean vehicles on the basis of the type of powertrain and the fuel consumed has been used to identify the powertrains that meet the criteria set under the low ambition (4a) and high ambition scenario (4b) under consideration. Unlike the CO_2 based clean vehicle definition under Policy Option 3, the alternative vehicle definition ensures compliance of all vehicles, including rigid trucks and buses, can readily be identified. The requirements under PO4 therefore apply to all vehicles types. As in the case of PO3 (for cars and vans), a stepwise approach with different targets for 2025 and 2030 and different minimum share of vehicles procured has been applied. We have also assumed that the remaining vehicles procured will be conventionally fuelled. Furthermore, no impact is expected for the initial period until 2025 since no specific action will be required by procurement authorities under the CVD. In reality, it is possible that certain authorities may introduce more demanding criteria before the set deadlines.

Table 7-10 and Table 7-11 present the results of the analysis for PO4a for the period 2020-2035 for both scenarios considered and Table 7-12 and Table 7-13 for PO4b. As in the case of PO3 there is a significant increase in the scope in comparison to PO2.

Among other types of vehicles, the impacts of the PO4 are higher in terms of the share of clean vehicles procured, particularly under PO4b, where up to 75% of the vehicles procured are expected to be clean vehicles by 2030. This includes mainly electric and LPG cars, electric vans and LNG trucks. For buses, the number of clean vehicles produced is greater than both the baseline and alternative baseline, however zero emission (ZE) vehicles are shown to be lower in the policy scenario than the alternative baseline. This is due the assumption that half of the mandate for clean vehicles is met by ZE vehicles, whilst there is a very high market share for ZE buses within the alternative baseline.

Table 7-10: Policy option 4a: Number and share of vehicles procured (building on the Baseline scenario)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Passenger cars	Petrol	37,474 (44%)	37,660 (43%)	37,847 (43%)	38,034 (42%)	38,221 (42%)	31,271 (33%)	31,592 (33%)	31,914 (33%)	32,235 (33%)	32,557 (33%)	23,001 (23%)	23,132 (23%)	23,264 (23%)	23,396 (23%)	23,528 (23%)	23,660 (24%)
Passenger cars	Diesel	40,133 (47%)	40,771 (47%)	41,408 (47%)	42,045 (47%)	42,683 (46%)	35,271 (38%)	35,606 (38%)	35,941 (38%)	36,276 (38%)	36,611 (38%)	25,846 (26%)	25,926 (26%)	26,006 (26%)	26,086 (26%)	26,166 (26%)	26,245 (26%)
Passenger cars	PHEV_Petrol	1,017 (1%)	1,245 (1%)	1,472 (2%)	1,700 (2%)	1,927 (2%)	4,256 (5%)	4,342 (5%)	4,424 (5%)	4,502 (5%)	4,578 (5%)	8,055 (8%)	8,053 (8%)	8,052 (8%)	8,051 (8%)	8,051 (8%)	8,051 (8%)
Passenger cars	PHEV_Diesel	994 (1%)	1,264 (1%)	1,535 (2%)	1,805 (2%)	2,076 (2%)	4,633 (5%)	4,898 (5%)	5,141 (5%)	5,368 (6%)	5,580 (6%)	10,010 (10%)	10,341 (10%)	10,669 (11%)	10,992 (11%)	11,312 (11%)	11,628 (12%)
Passenger cars	LPG	2,884 (3%)	2,935 (3%)	2,986 (3%)	3,036 (3%)	3,087 (3%)	6,196 (7%)	6,099 (6%)	6,016 (6%)	5,946 (6%)	5,887 (6%)	10,109 (10%)	9,970 (10%)	9,833 (10%)	9,700 (10%)	9,568 (10%)	9,439 (9%)
Passenger cars	CNG	1,445 (2%)	1,472 (2%)	1,499 (2%)	1,527 (2%)	1,554 (2%)	3,122 (3%)	3,049 (3%)	2,985 (3%)	2,930 (3%)	2,881 (3%)	4,917 (5%)	4,869 (5%)	4,822 (5%)	4,777 (5%)	4,732 (5%)	4,688 (5%)
Passenger cars	E85	173 (0%)	193 (0%)	212 (0%)	231 (0%)	251 (0%)	847 (1%)	774 (1%)	718 (1%)	672 (1%)	635 (1%)	1,045 (1%)	1,010 (1%)	978 (1%)	950 (1%)	925 (1%)	903 (1%)
Passenger cars	Electric	770 (1%)	1,074 (1%)	1,378 (2%)	1,682 (2%)	1,985 (2%)	7,170 (8%)	7,265 (8%)	7,355 (8%)	7,442 (8%)	7,527 (8%)	13,179 (13%)	12,983 (13%)	12,813 (13%)	12,663 (13%)	12,532 (13%)	12,416 (12%)
Passenger cars	Fuel Cell	46 (0%)	106 (0%)	166 (0%)	227 (0%)	287 (0%)	1,087 (1%)	1,154 (1%)	1,211 (1%)	1,259 (1%)	1,302 (1%)	2,321 (2%)	2,623 (3%)	2,897 (3%)	3,146 (3%)	3,374 (3%)	3,585 (4%)
Vans	Petrol	441 (4%)	446 (4%)	451 (4%)	457 (4%)	462 (4%)	356 (3%)	359 (3%)	363 (3%)	366 (3%)	370 (3%)	261 (2%)	259 (2%)	258 (2%)	256 (2%)	254 (2%)	252 (2%)
Vans	Diesel	10,842 (94%)	10,954 (93%)	11,066 (92%)	11,178 (91%)	11,290 (90%)	8,695 (68%)	8,758 (68%)	8,820 (68%)	8,883 (68%)	8,945 (68%)	6,307 (48%)	6,337 (48%)	6,366 (48%)	6,395 (48%)	6,425 (48%)	6,454 (48%)
Vans	PHEV_Petrol	6 (0%)	9 (0%)	12 (0%)	15 (0%)	17 (0%)	78 (1%)	78 (1%)	79 (1%)	80 (1%)	81 (1%)	141 (1%)	140 (1%)	138 (1%)	137 (1%)	136 (1%)	135 (1%)
Vans	PHEV_Diesel	181 (2%)	262 (2%)	342 (3%)	422 (3%)	502 (4%)	2,235 (18%)	2,262 (18%)	2,286 (18%)	2,309 (18%)	2,330 (18%)	4,081 (31%)	4,105 (31%)	4,128 (31%)	4,151 (31%)	4,174 (31%)	4,197 (31%)
Vans	LPG	7 (0%)	9 (0%)	11 (0%)	13 (0%)	15 (0%)	64 (0%)	59 (0%)	56 (0%)	53 (0%)	51 (0%)	86 (1%)	84 (1%)	82 (1%)	80 (1%)	78 (1%)	76 (1%)
Vans	CNG	8 (0%)	11 (0%)	13 (0%)	16 (0%)	19 (0%)	82 (1%)	77 (1%)	73 (1%)	71 (1%)	68 (1%)	115 (1%)	114 (1%)	112 (1%)	111 (1%)	109 (1%)	108 (1%)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Vans	Electric	61 (1%)	92 (1%)	123 (1%)	154 (1%)	185 (1%)	1,158 (9%)	1,161 (9%)	1,165 (9%)	1,170 (9%)	1,176 (9%)	2,051 (16%)	2,036 (15%)	2,022 (15%)	2,007 (15%)	1,992 (15%)	1,977 (15%)
Vans	Fuel Cell	3 (0%)	5 (0%)	7 (0%)	9 (0%)	11 (0%)	72 (1%)	77 (1%)	82 (1%)	86 (1%)	90 (1%)	161 (1%)	185 (1%)	209 (2%)	233 (2%)	257 (2%)	281 (2%)
Rigid trucks	Diesel	10,800 (85%)	10,760 (83%)	10,719 (81%)	10,678 (79%)	10,638 (77%)	10,219 (73%)	10,273 (72%)	10,325 (71%)	10,376 (70%)	10,426 (69%)	9,645 (63%)	9,632 (62%)	9,618 (61%)	9,604 (61%)	9,590 (60%)	9,575 (60%)
Rigid trucks	Diesel Hybrid	1,675 (13%)	1,913 (15%)	2,152 (16%)	2,391 (18%)	2,630 (19%)	2,766 (20%)	2,979 (21%)	3,194 (22%)	3,409 (23%)	3,626 (24%)	3,539 (23%)	3,648 (23%)	3,758 (24%)	3,867 (25%)	3,978 (25%)	4,088 (26%)
Rigid trucks	LPG	1 (0%)	2 (0%)	2 (0%)	2 (0%)	3 (0%)	4 (0%)	4 (0%)	5 (0%)	5 (0%)	6 (0%)	12 (0%)	13 (0%)	14 (0%)	15 (0%)	16 (0%)	17 (0%)
Rigid trucks	CNG	195 (2%)	261 (2%)	327 (2%)	392 (3%)	458 (3%)	668 (5%)	681 (5%)	694 (5%)	708 (5%)	721 (5%)	1,484 (10%)	1,494 (10%)	1,504 (10%)	1,514 (10%)	1,524 (10%)	1,534 (10%)
Rigid trucks	Electric	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	186 (1%)	188 (1%)	191 (1%)	194 (1%)	197 (1%)	404 (3%)	405 (3%)	407 (3%)	409 (3%)	411 (3%)	413 (3%)
Rigid trucks	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	150 (1%)	154 (1%)	158 (1%)	163 (1%)	167 (1%)	344 (2%)	348 (2%)	352 (2%)	356 (2%)	359 (2%)	363 (2%)
Buses	Diesel	11,360 (89%)	11,341 (87%)	11,323 (85%)	11,304 (84%)	11,286 (82%)	6,920 (49%)	6,908 (49%)	6,897 (48%)	6,885 (48%)	6,873 (47%)	3,454 (24%)	3,437 (23%)	3,419 (23%)	3,401 (23%)	3,384 (23%)	3,366 (23%)
Buses	Diesel Hybrid	833 (7%)	1,033 (8%)	1,233 (9%)	1,432 (11%)	1,632 (12%)	1,125 (8%)	1,210 (9%)	1,296 (9%)	1,381 (10%)	1,467 (10%)	782 (5%)	803 (5%)	824 (6%)	844 (6%)	865 (6%)	886 (6%)
Buses	LPG	265 (2%)	296 (2%)	327 (2%)	358 (3%)	389 (3%)	2,136 (15%)	2,188 (15%)	2,240 (16%)	2,292 (16%)	2,343 (16%)	3,996 (27%)	3,977 (27%)	3,958 (27%)	3,939 (27%)	3,921 (27%)	3,903 (27%)
Buses	LNG	304 (2%)	316 (2%)	328 (2%)	339 (3%)	351 (3%)	1,845 (13%)	1,829 (13%)	1,813 (13%)	1,798 (12%)	1,783 (12%)	2,952 (20%)	2,976 (20%)	3,000 (20%)	3,024 (21%)	3,047 (21%)	3,070 (21%)
Buses	Electric	21 (0%)	44 (0%)	66 (0%)	88 (1%)	111 (1%)	1,986 (14%)	2,005 (14%)	2,023 (14%)	2,041 (14%)	2,060 (14%)	3,468 (24%)	3,470 (24%)	3,472 (24%)	3,474 (24%)	3,475 (24%)	3,477 (24%)
Buses	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	4 (0%)	4 (0%)	4 (0%)	4 (0%)	4 (0%)	6 (0%)	7 (0%)	7 (0%)	8 (0%)	9 (0%)	9 (0%)
Passenger cars	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Passenger cars	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Table 7-11: Policy option 4a: Number and share of vehicles procured (building on the Alternative baseline scenario)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Passenger cars	Petrol	37,474 (44%)	37,660 (43%)	37,847 (43%)	38,034 (42%)	38,221 (42%)	31,271 (33%)	31,592 (33%)	31,914 (33%)	32,235 (33%)	32,557 (33%)	23,001 (23%)	23,132 (23%)	23,264 (23%)	23,396 (23%)	23,528 (23%)	23,660 (24%)
Passenger cars	Diesel	40,133 (47%)	40,771 (47%)	41,408 (47%)	42,045 (47%)	42,683 (46%)	35,271 (38%)	35,606 (38%)	35,941 (38%)	36,276 (38%)	36,611 (38%)	25,846 (26%)	25,926 (26%)	26,006 (26%)	26,086 (26%)	26,166 (26%)	26,245 (26%)
Passenger cars	PHEV_Petrol	1,017 (1%)	1,245 (1%)	1,472 (2%)	1,700 (2%)	1,927 (2%)	4,256 (5%)	4,342 (5%)	4,424 (5%)	4,502 (5%)	4,578 (5%)	8,055 (8%)	8,053 (8%)	8,052 (8%)	8,051 (8%)	8,051 (8%)	8,051 (8%)
Passenger cars	PHEV_Diesel	994 (1%)	1,264 (1%)	1,535 (2%)	1,805 (2%)	2,076 (2%)	4,633 (5%)	4,898 (5%)	5,141 (5%)	5,368 (6%)	5,580 (6%)	10,010 (10%)	10,341 (10%)	10,669 (11%)	10,992 (11%)	11,312 (11%)	11,628 (12%)
Passenger cars	LPG	2,884 (3%)	2,935 (3%)	2,986 (3%)	3,036 (3%)	3,087 (3%)	6,196 (7%)	6,099 (6%)	6,016 (6%)	5,946 (6%)	5,887 (6%)	10,109 (10%)	9,970 (10%)	9,833 (10%)	9,700 (10%)	9,568 (10%)	9,439 (9%)
Passenger cars	CNG	1,445 (2%)	1,472 (2%)	1,499 (2%)	1,527 (2%)	1,554 (2%)	3,122 (3%)	3,049 (3%)	2,985 (3%)	2,930 (3%)	2,881 (3%)	4,917 (5%)	4,869 (5%)	4,822 (5%)	4,777 (5%)	4,732 (5%)	4,688 (5%)
Passenger cars	E85	173 (0%)	193 (0%)	212 (0%)	231 (0%)	251 (0%)	847 (1%)	774 (1%)	718 (1%)	672 (1%)	635 (1%)	1,045 (1%)	1,010 (1%)	978 (1%)	950 (1%)	925 (1%)	903 (1%)
Passenger cars	Electric	770 (1%)	1,074 (1%)	1,378 (2%)	1,682 (2%)	1,985 (2%)	7,170 (8%)	7,265 (8%)	7,355 (8%)	7,442 (8%)	7,527 (8%)	13,179 (13%)	12,983 (13%)	12,813 (13%)	12,663 (13%)	12,532 (13%)	12,416 (12%)
Passenger cars	Fuel Cell	46 (0%)	106 (0%)	166 (0%)	227 (0%)	287 (0%)	1,087 (1%)	1,154 (1%)	1,211 (1%)	1,259 (1%)	1,302 (1%)	2,321 (2%)	2,623 (3%)	2,897 (3%)	3,146 (3%)	3,374 (3%)	3,585 (4%)
Vans	Petrol	441 (4%)	446 (4%)	451 (4%)	457 (4%)	462 (4%)	356 (3%)	359 (3%)	363 (3%)	366 (3%)	370 (3%)	261 (2%)	259 (2%)	258 (2%)	256 (2%)	254 (2%)	252 (2%)
Vans	Diesel	10,842 (94%)	10,954 (93%)	11,066 (92%)	11,178 (91%)	11,290 (90%)	8,695 (68%)	8,758 (68%)	8,820 (68%)	8,883 (68%)	8,945 (68%)	6,307 (48%)	6,337 (48%)	6,366 (48%)	6,395 (48%)	6,425 (48%)	6,454 (48%)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Vans	PHEV_Petrol	6 (0%)	9 (0%)	12 (0%)	15 (0%)	17 (0%)	78 (1%)	78 (1%)	79 (1%)	80 (1%)	81 (1%)	141 (1%)	140 (1%)	138 (1%)	137 (1%)	136 (1%)	135 (1%)
Vans	PHEV_Diesel	181 (2%)	262 (2%)	342 (3%)	422 (3%)	502 (4%)	2,235 (18%)	2,262 (18%)	2,286 (18%)	2,309 (18%)	2,330 (18%)	4,081 (31%)	4,105 (31%)	4,128 (31%)	4,151 (31%)	4,174 (31%)	4,197 (31%)
Vans	LPG	7 (0%)	9 (0%)	11 (0%)	13 (0%)	15 (0%)	64 (0%)	59 (0%)	56 (0%)	53 (0%)	51 (0%)	86 (1%)	84 (1%)	82 (1%)	80 (1%)	78 (1%)	76 (1%)
Vans	CNG	8 (0%)	11 (0%)	13 (0%)	16 (0%)	19 (0%)	82 (1%)	77 (1%)	73 (1%)	71 (1%)	68 (1%)	115 (1%)	114 (1%)	112 (1%)	111 (1%)	109 (1%)	108 (1%)
Vans	Electric	61 (1%)	92 (1%)	123 (1%)	154 (1%)	185 (1%)	1,158 (9%)	1,161 (9%)	1,165 (9%)	1,170 (9%)	1,176 (9%)	2,051 (16%)	2,036 (15%)	2,022 (15%)	2,007 (15%)	1,992 (15%)	1,977 (15%)
Vans	Fuel Cell	3 (0%)	5 (0%)	7 (0%)	9 (0%)	11 (0%)	72 (1%)	77 (1%)	82 (1%)	86 (1%)	90 (1%)	161 (1%)	185 (1%)	209 (2%)	233 (2%)	257 (2%)	281 (2%)
Rigid trucks	Diesel	10,800 (85%)	10,760 (83%)	10,719 (81%)	10,678 (79%)	10,638 (77%)	10,219 (73%)	10,273 (72%)	10,325 (71%)	10,376 (70%)	10,426 (69%)	9,645 (63%)	9,632 (62%)	9,618 (61%)	9,604 (61%)	9,590 (60%)	9,575 (60%)
Rigid trucks	Diesel Hybrid	1,675 (13%)	1,913 (15%)	2,152 (16%)	2,391 (18%)	2,630 (19%)	2,766 (20%)	2,979 (21%)	3,194 (22%)	3,409 (23%)	3,626 (24%)	3,539 (23%)	3,648 (23%)	3,758 (24%)	3,867 (25%)	3,978 (25%)	4,088 (26%)
Rigid trucks	LPG	1 (0%)	2 (0%)	2 (0%)	2 (0%)	3 (0%)	4 (0%)	4 (0%)	5 (0%)	5 (0%)	6 (0%)	12 (0%)	13 (0%)	14 (0%)	15 (0%)	16 (0%)	17 (0%)
Rigid trucks	CNG	195 (2%)	261 (2%)	327 (2%)	392 (3%)	458 (3%)	668 (5%)	681 (5%)	694 (5%)	708 (5%)	721 (5%)	1,484 (10%)	1,494 (10%)	1,504 (10%)	1,514 (10%)	1,524 (10%)	1,534 (10%)
Rigid trucks	Electric	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	186 (1%)	188 (1%)	191 (1%)	194 (1%)	197 (1%)	404 (3%)	405 (3%)	407 (3%)	409 (3%)	411 (3%)	413 (3%)
Rigid trucks	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	150 (1%)	154 (1%)	158 (1%)	163 (1%)	167 (1%)	344 (2%)	348 (2%)	352 (2%)	356 (2%)	359 (2%)	363 (2%)
Buses	Diesel	9,142 (72%)	8,877 (68%)	8,612 (65%)	8,348 (62%)	8,083 (59%)	6,577 (47%)	6,515 (46%)	6,446 (45%)	6,368 (44%)	6,281 (43%)	3,113 (21%)	3,099 (21%)	3,085 (21%)	3,071 (21%)	3,057 (21%)	3,042 (21%)
Buses	Diesel Hybrid	1,016 (8%)	1,162 (9%)	1,307 (10%)	1,453 (11%)	1,599 (12%)	1,468 (10%)	1,603 (11%)	1,746 (12%)	1,898 (13%)	2,059 (14%)	1,123 (8%)	1,140 (8%)	1,157 (8%)	1,175 (8%)	1,192 (8%)	1,209 (8%)
Buses	LPG	132 (1%)	148 (1%)	163 (1%)	179 (1%)	194 (1%)	523 (4%)	546 (4%)	569 (4%)	593 (4%)	617 (4%)	1,071 (7%)	1,070 (7%)	1,070 (7%)	1,070 (7%)	1,069 (7%)	1,069 (7%)
Buses	LNG	1,151 (9%)	1,198 (9%)	1,245 (9%)	1,292 (10%)	1,340 (10%)	3,457 (25%)	3,471 (25%)	3,484 (24%)	3,497 (24%)	3,510 (24%)	5,878 (40%)	5,883 (40%)	5,888 (40%)	5,893 (40%)	5,899 (40%)	5,904 (40%)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Buses	Electric	1,209 (9%)	1,463 (11%)	1,716 (13%)	1,970 (15%)	2,224 (16%)	1,727 (12%)	1,734 (12%)	1,741 (12%)	1,751 (12%)	1,761 (12%)	2,957 (20%)	2,960 (20%)	2,962 (20%)	2,964 (20%)	2,966 (20%)	2,969 (20%)
Buses	Fuel Cell	133 (1%)	182 (1%)	231 (2%)	279 (2%)	328 (2%)	263 (2%)	275 (2%)	285 (2%)	294 (2%)	302 (2%)	517 (4%)	517 (4%)	517 (4%)	517 (4%)	518 (4%)	518 (4%)
Passenger cars	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Passenger cars	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Table 7-12: Policy option 4b: Number and share vehicles procured (building on the Baseline scenario)

Vehicle type	Powertrain/ fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Passenger cars	Petrol	37,474 (44%)	37,660 (43%)	37,847 (43%)	38,034 (42%)	38,221 (42%)	21,877 (23%)	22,101 (23%)	22,326 (23%)	22,551 (23%)	22,776 (23%)	12,985 (13%)	13,059 (13%)	13,133 (13%)	13,207 (13%)	13,282 (13%)	13,356 (13%)
Passenger cars	Diesel	40,133 (47%)	40,771 (47%)	41,408 (47%)	42,045 (47%)	42,683 (46%)	24,675 (26%)	24,909 (26%)	25,144 (26%)	25,378 (26%)	25,612 (26%)	14,590 (15%)	14,636 (15%)	14,681 (15%)	14,726 (15%)	14,771 (15%)	14,816 (15%)
Passenger cars	PHEV_Petrol	1,017 (1%)	1,245 (1%)	1,472 (2%)	1,700 (2%)	1,927 (2%)	7,371 (8%)	7,520 (8%)	7,662 (8%)	7,798 (8%)	7,929 (8%)	11,507 (12%)	11,505 (12%)	11,503 (12%)	11,502 (12%)	11,502 (11%)	11,502 (11%)
Passenger cars	PHEV_Diesel	994 (1%)	1,264 (1%)	1,535 (2%)	1,805 (2%)	2,076 (2%)	8,025 (9%)	8,482 (9%)	8,905 (9%)	9,297 (10%)	9,664 (10%)	14,299 (15%)	14,773 (15%)	15,241 (15%)	15,703 (16%)	16,160 (16%)	16,611 (17%)
Passenger cars	LPG	2,884 (3%)	2,935 (3%)	2,986 (3%)	3,036 (3%)	3,087 (3%)	10,731 (11%)	10,563 (11%)	10,420 (11%)	10,299 (11%)	10,196 (10%)	14,441 (15%)	14,242 (14%)	14,048 (14%)	13,857 (14%)	13,669 (14%)	13,485 (13%)
Passenger cars	CNG	1,445 (2%)	1,472 (2%)	1,499 (2%)	1,527 (2%)	1,554 (2%)	5,408 (6%)	5,281 (6%)	5,170 (5%)	5,074 (5%)	4,990 (5%)	7,024 (7%)	6,956 (7%)	6,889 (7%)	6,824 (7%)	6,760 (7%)	6,697 (7%)
Passenger cars	E85	173 (0%)	193 (0%)	212 (0%)	231 (0%)	251 (0%)	1,467 (2%)	1,341 (1%)	1,243 (1%)	1,164 (1%)	1,099 (1%)	1,493 (2%)	1,443 (1%)	1,398 (1%)	1,358 (1%)	1,322 (1%)	1,290 (1%)
Passenger cars	Electric	770 (1%)	1,074 (1%)	1,378 (2%)	1,682 (2%)	1,985 (2%)	12,418 (13%)	12,583 (13%)	12,739 (13%)	12,890 (13%)	13,036 (13%)	18,827 (19%)	18,548 (19%)	18,304 (18%)	18,091 (18%)	17,903 (18%)	17,737 (18%)
Passenger cars	Fuel Cell	46 (0%)	106 (0%)	166 (0%)	227 (0%)	287 (0%)	1,882 (2%)	1,999 (2%)	2,097 (2%)	2,181 (2%)	2,255 (2%)	3,316 (3%)	3,748 (4%)	4,139 (4%)	4,494 (5%)	4,820 (5%)	5,121 (5%)
Vans	Petrol	441 (4%)	446 (4%)	451 (4%)	457 (4%)	462 (4%)	249 (2%)	252 (2%)	254 (2%)	256 (2%)	259 (2%)	147 (1%)	146 (1%)	145 (1%)	144 (1%)	143 (1%)	142 (1%)
Vans	Diesel	10,842 (94%)	10,954 (93%)	11,066 (92%)	11,178 (91%)	11,290 (90%)	6,088 (48%)	6,132 (48%)	6,176 (48%)	6,220 (48%)	6,264 (48%)	3,550 (27%)	3,566 (27%)	3,583 (27%)	3,599 (27%)	3,616 (27%)	3,633 (27%)
Vans	PHEV_Petrol	6 (0%)	9 (0%)	12 (0%)	15 (0%)	17 (0%)	135 (1%)	136 (1%)	137 (1%)	139 (1%)	140 (1%)	202 (2%)	200 (2%)	198 (1%)	196 (1%)	195 (1%)	193 (1%)
Vans	PHEV_Diesel	181 (2%)	262 (2%)	342 (3%)	422 (3%)	502 (4%)	3,880 (30%)	3,926 (31%)	3,968 (31%)	4,007 (31%)	4,045 (31%)	5,847 (44%)	5,881 (44%)	5,915 (44%)	5,948 (44%)	5,981 (45%)	6,013 (45%)
Vans	LPG	7 (0%)	9 (0%)	11 (0%)	13 (0%)	15 (0%)	111 (1%)	103 (1%)	97 (1%)	93 (1%)	89 (1%)	123 (1%)	120 (1%)	117 (1%)	114 (1%)	112 (1%)	109 (1%)
Vans	CNG	8 (0%)	11 (0%)	13 (0%)	16 (0%)	19 (0%)	142 (1%)	134 (1%)	128 (1%)	123 (1%)	119 (1%)	165 (1%)	163 (1%)	161 (1%)	159 (1%)	157 (1%)	155 (1%)

Vehicle type	Powertrain/ fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Vans	Electric	61 (1%)	92 (1%)	123 (1%)	154 (1%)	185 (1%)	2,009 (16%)	2,015 (16%)	2,022 (16%)	2,031 (16%)	2,041 (16%)	2,939 (22%)	2,918 (22%)	2,897 (22%)	2,875 (22%)	2,854 (21%)	2,832 (21%)
Vans	Fuel Cell	3 (0%)	5 (0%)	7 (0%)	9 (0%)	11 (0%)	124 (1%)	135 (1%)	143 (1%)	150 (1%)	155 (1%)	230 (2%)	264 (2%)	299 (2%)	333 (2%)	368 (3%)	403 (3%)
Rigid trucks	Diesel	10,800 (85%)	10,760 (83%)	10,719 (81%)	10,678 (79%)	10,638 (77%)	9,410 (67%)	9,459 (66%)	9,507 (65%)	9,554 (64%)	9,600 (63%)	8,832 (57%)	8,820 (57%)	8,808 (56%)	8,795 (56%)	8,782 (55%)	8,768 (55%)
Rigid trucks	Diesel Hybrid	1,675 (13%)	1,913 (15%)	2,152 (16%)	2,391 (18%)	2,630 (19%)	2,547 (18%)	2,743 (19%)	2,941 (20%)	3,139 (21%)	3,339 (22%)	3,241 (21%)	3,341 (21%)	3,441 (22%)	3,541 (22%)	3,642 (23%)	3,744 (23%)
Rigid trucks	LPG	1 (0%)	2 (0%)	2 (0%)	2 (0%)	3 (0%)	8 (0%)	9 (0%)	10 (0%)	11 (0%)	11 (0%)	18 (0%)	20 (0%)	21 (0%)	23 (0%)	24 (0%)	25 (0%)
Rigid trucks	CNG	195 (2%)	261 (2%)	327 (2%)	392 (3%)	458 (3%)	1,349 (10%)	1,376 (10%)	1,403 (10%)	1,430 (10%)	1,457 (10%)	2,219 (14%)	2,234 (14%)	2,248 (14%)	2,263 (14%)	2,278 (14%)	2,293 (14%)
Rigid trucks	Electric	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	376 (3%)	381 (3%)	386 (3%)	392 (3%)	398 (3%)	604 (4%)	606 (4%)	608 (4%)	611 (4%)	614 (4%)	617 (4%)
Rigid trucks	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	303 (2%)	312 (2%)	320 (2%)	329 (2%)	337 (2%)	515 (3%)	521 (3%)	527 (3%)	532 (3%)	537 (3%)	542 (3%)
Buses	Diesel	11,360 (89%)	11,341 (87%)	11,323 (85%)	11,304 (84%)	11,286 (82%)	3,484 (25%)	3,478 (25%)	3,472 (24%)	3,467 (24%)	3,461 (24%)	3,466 (24%)	3,449 (24%)	3,431 (23%)	3,413 (23%)	3,395 (23%)	3,377 (23%)
Buses	Diesel Hybrid	833 (7%)	1,033 (8%)	1,233 (9%)	1,432 (11%)	1,632 (12%)	566 (4%)	609 (4%)	652 (5%)	695 (5%)	739 (5%)	785 (5%)	806 (5%)	826 (6%)	847 (6%)	868 (6%)	889 (6%)
Buses	LPG	265 (2%)	296 (2%)	327 (2%)	358 (3%)	389 (3%)	3,564 (25%)	3,652 (26%)	3,739 (26%)	3,825 (27%)	3,911 (27%)	2,993 (20%)	2,979 (20%)	2,964 (20%)	2,950 (20%)	2,937 (20%)	2,923 (20%)
Buses	LNG	304 (2%)	316 (2%)	328 (2%)	339 (3%)	351 (3%)	3,079 (22%)	3,052 (22%)	3,027 (21%)	3,001 (21%)	2,977 (20%)	2,211 (15%)	2,229 (15%)	2,247 (15%)	2,265 (15%)	2,282 (16%)	2,299 (16%)
Buses	Electric	21 (0%)	44 (0%)	66 (0%)	88 (1%)	111 (1%)	3,315 (24%)	3,346 (24%)	3,377 (24%)	3,407 (24%)	3,438 (24%)	5,195 (35%)	5,198 (35%)	5,200 (35%)	5,203 (35%)	5,206 (35%)	5,209 (35%)
Buses	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (0%)	6 (0%)	6 (0%)	6 (0%)	6 (0%)	9 (0%)	10 (0%)	11 (0%)	12 (0%)	13 (0%)	14 (0%)
Passenger cars	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Vehicle type	Powertrain/ fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Passenger cars	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Table 7-13: Policy option 4b: Number and share vehicles procured (building on the Alternative baseline scenario)

Vehicle type	Powertrain/ fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Passenger cars	Petrol	37,474 (44%)	37,660 (43%)	37,847 (43%)	38,034 (42%)	38,221 (42%)	21,877 (23%)	22,101 (23%)	22,326 (23%)	22,551 (23%)	22,776 (23%)	12,985 (13%)	13,059 (13%)	13,133 (13%)	13,207 (13%)	13,282 (13%)	13,356 (13%)
Passenger cars	Diesel	40,133 (47%)	40,771 (47%)	41,408 (47%)	42,045 (47%)	42,683 (46%)	24,675 (26%)	24,909 (26%)	25,144 (26%)	25,378 (26%)	25,612 (26%)	14,590 (15%)	14,636 (15%)	14,681 (15%)	14,726 (15%)	14,771 (15%)	14,816 (15%)
Passenger cars	PHEV_Petrol	1,017 (1%)	1,245 (1%)	1,472 (2%)	1,700 (2%)	1,927 (2%)	7,371 (8%)	7,520 (8%)	7,662 (8%)	7,798 (8%)	7,929 (8%)	11,507 (12%)	11,505 (12%)	11,503 (12%)	11,502 (12%)	11,502 (11%)	11,502 (11%)
Passenger cars	PHEV_Diesel	994 (1%)	1,264 (1%)	1,535 (2%)	1,805 (2%)	2,076 (2%)	8,025 (9%)	8,482 (9%)	8,905 (9%)	9,297 (10%)	9,664 (10%)	14,299 (15%)	14,773 (15%)	15,241 (15%)	15,703 (16%)	16,160 (16%)	16,611 (17%)
Passenger cars	LPG	2,884 (3%)	2,935 (3%)	2,986 (3%)	3,036 (3%)	3,087 (3%)	10,731 (11%)	10,563 (11%)	10,420 (11%)	10,299 (11%)	10,196 (10%)	14,441 (15%)	14,242 (14%)	14,048 (14%)	13,857 (14%)	13,669 (14%)	13,485 (13%)
Passenger cars	CNG	1,445 (2%)	1,472 (2%)	1,499 (2%)	1,527 (2%)	1,554 (2%)	5,408 (6%)	5,281 (6%)	5,170 (5%)	5,074 (5%)	4,990 (5%)	7,024 (7%)	6,956 (7%)	6,889 (7%)	6,824 (7%)	6,760 (7%)	6,697 (7%)
Passenger cars	E85	173 (0%)	193 (0%)	212 (0%)	231 (0%)	251 (0%)	1,467 (2%)	1,341 (1%)	1,243 (1%)	1,164 (1%)	1,099 (1%)	1,493 (2%)	1,443 (1%)	1,398 (1%)	1,358 (1%)	1,322 (1%)	1,290 (1%)
Passenger cars	Electric	770 (1%)	1,074 (1%)	1,378 (2%)	1,682 (2%)	1,985 (2%)	12,418 (13%)	12,583 (13%)	12,739 (13%)	12,890 (13%)	13,036 (13%)	18,827 (19%)	18,548 (19%)	18,304 (18%)	18,091 (18%)	17,903 (18%)	17,737 (18%)
Passenger cars	Fuel Cell	46 (0%)	106 (0%)	166 (0%)	227 (0%)	287 (0%)	1,882 (2%)	1,999 (2%)	2,097 (2%)	2,181 (2%)	2,255 (2%)	3,316 (3%)	3,748 (4%)	4,139 (4%)	4,494 (5%)	4,820 (5%)	5,121 (5%)
Vans	Petrol	441 (4%)	446 (4%)	451 (4%)	457 (4%)	462 (4%)	249 (2%)	252 (2%)	254 (2%)	256 (2%)	259 (2%)	147 (1%)	146 (1%)	145 (1%)	144 (1%)	143 (1%)	142 (1%)
Vans	Diesel	10,842 (94%)	10,954 (93%)	11,066 (92%)	11,178 (91%)	11,290 (90%)	6,088 (48%)	6,132 (48%)	6,176 (48%)	6,220 (48%)	6,264 (48%)	3,550 (27%)	3,566 (27%)	3,583 (27%)	3,599 (27%)	3,616 (27%)	3,633 (27%)

Vehicle type	Powertrain/ fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Vans	PHEV_Petrol	6 (0%)	9 (0%)	12 (0%)	15 (0%)	17 (0%)	135 (1%)	136 (1%)	137 (1%)	139 (1%)	140 (1%)	202 (2%)	200 (2%)	198 (1%)	196 (1%)	195 (1%)	193 (1%)
Vans	PHEV_Diesel	181 (2%)	262 (2%)	342 (3%)	422 (3%)	502 (4%)	3,880 (30%)	3,926 (31%)	3,968 (31%)	4,007 (31%)	4,045 (31%)	5,847 (44%)	5,881 (44%)	5,915 (44%)	5,948 (44%)	5,981 (45%)	6,013 (45%)
Vans	LPG	7 (0%)	9 (0%)	11 (0%)	13 (0%)	15 (0%)	111 (1%)	103 (1%)	97 (1%)	93 (1%)	89 (1%)	123 (1%)	120 (1%)	117 (1%)	114 (1%)	112 (1%)	109 (1%)
Vans	CNG	8 (0%)	11 (0%)	13 (0%)	16 (0%)	19 (0%)	142 (1%)	134 (1%)	128 (1%)	123 (1%)	119 (1%)	165 (1%)	163 (1%)	161 (1%)	159 (1%)	157 (1%)	155 (1%)
Vans	Electric	61 (1%)	92 (1%)	123 (1%)	154 (1%)	185 (1%)	2,009 (16%)	2,015 (16%)	2,022 (16%)	2,031 (16%)	2,041 (16%)	2,939 (22%)	2,918 (22%)	2,897 (22%)	2,875 (22%)	2,854 (21%)	2,832 (21%)
Vans	Fuel Cell	3 (0%)	5 (0%)	7 (0%)	9 (0%)	11 (0%)	124 (1%)	135 (1%)	143 (1%)	150 (1%)	155 (1%)	230 (2%)	264 (2%)	299 (2%)	333 (2%)	368 (3%)	403 (3%)
Rigid trucks	Diesel	10,800 (85%)	10,760 (83%)	10,719 (81%)	10,678 (79%)	10,638 (77%)	9,410 (67%)	9,459 (66%)	9,507 (65%)	9,554 (64%)	9,600 (63%)	8,832 (57%)	8,820 (57%)	8,808 (56%)	8,795 (56%)	8,782 (55%)	8,768 (55%)
Rigid trucks	Diesel Hybrid	1,675 (13%)	1,913 (15%)	2,152 (16%)	2,391 (18%)	2,630 (19%)	2,547 (18%)	2,743 (19%)	2,941 (20%)	3,139 (21%)	3,339 (22%)	3,241 (21%)	3,341 (21%)	3,441 (22%)	3,541 (22%)	3,642 (23%)	3,744 (23%)
Rigid trucks	LPG	1 (0%)	2 (0%)	2 (0%)	2 (0%)	3 (0%)	8 (0%)	9 (0%)	10 (0%)	11 (0%)	11 (0%)	18 (0%)	20 (0%)	21 (0%)	23 (0%)	24 (0%)	25 (0%)
Rigid trucks	CNG	195 (2%)	261 (2%)	327 (2%)	392 (3%)	458 (3%)	1,349 (10%)	1,376 (10%)	1,403 (10%)	1,430 (10%)	1,457 (10%)	2,219 (14%)	2,234 (14%)	2,248 (14%)	2,263 (14%)	2,278 (14%)	2,293 (14%)
Rigid trucks	Electric	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	376 (3%)	381 (3%)	386 (3%)	392 (3%)	398 (3%)	604 (4%)	606 (4%)	608 (4%)	611 (4%)	614 (4%)	617 (4%)
Rigid trucks	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	303 (2%)	312 (2%)	320 (2%)	329 (2%)	337 (2%)	515 (3%)	521 (3%)	527 (3%)	532 (3%)	537 (3%)	542 (3%)
Buses	Diesel	9,142 (72%)	8,877 (68%)	8,612 (65%)	8,348 (62%)	8,083 (59%)	3,311 (24%)	3,280 (23%)	3,245 (23%)	3,206 (22%)	3,162 (22%)	3,124 (21%)	3,110 (21%)	3,096 (21%)	3,081 (21%)	3,067 (21%)	3,053 (21%)
Buses	Diesel Hybrid	1,016 (8%)	1,162 (9%)	1,307 (10%)	1,453 (11%)	1,599 (12%)	739 (5%)	807 (6%)	879 (6%)	956 (7%)	1,037 (7%)	1,127 (8%)	1,144 (8%)	1,161 (8%)	1,179 (8%)	1,196 (8%)	1,213 (8%)
Buses	LPG	132 (1%)	148 (1%)	163 (1%)	179 (1%)	194 (1%)	873 (6%)	911 (6%)	950 (7%)	989 (7%)	1,029 (7%)	802 (5%)	802 (5%)	801 (5%)	801 (5%)	801 (5%)	801 (5%)
Buses	LNG	1,151 (9%)	1,198 (9%)	1,245 (9%)	1,292 (10%)	1,340 (10%)	5,770 (41%)	5,793 (41%)	5,815 (41%)	5,837 (41%)	5,858 (40%)	4,402 (30%)	4,406 (30%)	4,410 (30%)	4,414 (30%)	4,418 (30%)	4,422 (30%)

Vehicle type	Powertrain/ fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Buses	Electric	1,209 (9%)	1,463 (11%)	1,716 (13%)	1,970 (15%)	2,224 (16%)	2,883 (21%)	2,893 (20%)	2,907 (20%)	2,922 (20%)	2,939 (20%)	4,430 (30%)	4,433 (30%)	4,437 (30%)	4,440 (30%)	4,443 (30%)	4,447 (30%)
Buses	Fuel Cell	133 (1%)	182 (1%)	231 (2%)	279 (2%)	328 (2%)	438 (3%)	459 (3%)	476 (3%)	491 (3%)	505 (3%)	774 (5%)	775 (5%)	775 (5%)	775 (5%)	775 (5%)	776 (5%)
Passenger cars	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Passenger cars	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

7.6 Policy option 5 - Mandatory monetisation

In the case of PO5, all authorities will be required to use the monetisation methodology. This policy option, by definition, tests an extreme change to the Directive in order to understand the impact of mandatory use of the monetisation methodology.

In this case, we have followed the same approach described in PO2 for all vehicles procured and assumed that all authorities will only procure vehicles that minimise the total (internal and external) costs. The costs estimated include purchase, operation, maintenance and repair (fixed) costs and the external costs as estimated using the methodology.

As indicated earlier, this is unrealistic but it the only option available in the absence of rather detailed input from stakeholders that would be needed in order to assess how changes in the total costs (internal and external) would affect the purchase decision taking into account supply constraints.

Another difference from other policy options is that the Directive will be replaced by a Regulation. This is expected to expedite its adoption as there will not be any need for a transposition into national legislation.

Table 7-14 and Table 7-15 present the expected impact on type and number of vehicles purchased by type and in comparison to the baseline for the period 2020-2035. As can be seen, in the case of passenger cars, the use of the methodology suggest that a petrol passenger car will still be the preferred option with the least internal and external costs. Thus, the share of clean passenger cars is expected to be zero. For vans, the methodology points to LPG vans, electric trucks and electric buses as the least costly which would imply that they authorities will only purchase such vehicles. As already indicated this is an unrealistic scenario. There are both market supply and infrastructure constraints in the case of LPG and electric vehicles that will only be possible to address over a certain period of time.

Table 7-14: Policy option 5: Number and share of vehicles procured (building on the Baseline scenario)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Passenger cars	Petrol	84,937 (100%)	86,720 (100%)	88,503 (100%)	90,287 (100%)	92,070 (100%)	93,854 (100%)	94,779 (100%)	95,705 (100%)	96,631 (100%)	97,556 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Passenger cars	Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Passenger cars	PHEV_Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Passenger cars	PHEV_Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Passenger cars	LPG	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Passenger cars	CNG	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Passenger cars	E85	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Passenger cars	Electric	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	98,482 (100%)	98,909 (100%)	99,335 (100%)	99,762 (100%)	100,189 (100%)	100,615 (100%)
Passenger cars	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Petrol	11,549 (100%)	11,787 (100%)	12,025 (100%)	12,263 (100%)	12,501 (100%)	12,739 (100%)	12,832 (100%)	12,925 (100%)	13,018 (100%)	13,111 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	PHEV_Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	PHEV_Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	LPG	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	CNG	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Vans	Electric	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	13,204 (100%)	13,259 (100%)	13,314 (100%)	13,370 (100%)	13,425 (100%)	13,480 (100%)
Vans	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Rigid trucks	Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	15,429 (100%)	15,541 (100%)	15,653 (100%)	15,765 (100%)	15,878 (100%)	15,990 (100%)
Rigid trucks	Diesel Hybrid	12,671 (100%)	12,935 (100%)	13,200 (100%)	13,464 (100%)	13,729 (100%)	13,993 (100%)	14,280 (100%)	14,567 (100%)	14,855 (100%)	15,142 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Rigid trucks	LPG	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Rigid trucks	CNG	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Rigid trucks	Electric	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Rigid trucks	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Buses	Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Buses	Diesel Hybrid	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Buses	LPG	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Buses	LNG	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Buses	Electric	12,784 (100%)	13,030 (100%)	13,276 (100%)	13,522 (100%)	13,768 (100%)	14,015 (100%)	14,144 (100%)	14,272 (100%)	14,401 (100%)	14,530 (100%)	14,659 (100%)	14,670 (100%)	14,680 (100%)	14,691 (100%)	14,701 (100%)	14,712 (100%)
Buses	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Passenger cars	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Passenger cars	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Table 7-15: Policy option 5: Number and share of vehicles procured (building on the Alternative baseline scenario)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Passenger cars	Petrol	84,937 (100%)	86,720 (100%)	88,503 (100%)	90,287 (100%)	92,070 (100%)	93,854 (100%)	94,779 (100%)	95,705 (100%)	96,631 (100%)	97,556 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Passenger cars	Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Passenger cars	PHEV_Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Passenger cars	PHEV_Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Passenger cars	LPG	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Passenger cars	CNG	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Passenger cars	E85	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Passenger cars	Electric	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	98,482 (100%)	98,909 (100%)	99,335 (100%)	99,762 (100%)	100,189 (100%)	100,615 (100%)
Passenger cars	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Petrol	11,549 (100%)	11,787 (100%)	12,025 (100%)	12,263 (100%)	12,501 (100%)	12,739 (100%)	12,832 (100%)	12,925 (100%)	13,018 (100%)	13,111 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	PHEV_Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Vans	PHEV_Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	LPG	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	CNG	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Electric	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	13,204 (100%)	13,259 (100%)	13,314 (100%)	13,370 (100%)	13,425 (100%)	13,480 (100%)
Vans	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Rigid trucks	Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	15,429 (100%)	15,541 (100%)	15,653 (100%)	15,765 (100%)	15,878 (100%)	15,990 (100%)
Rigid trucks	Diesel Hybrid	12,671 (100%)	12,935 (100%)	13,200 (100%)	13,464 (100%)	13,729 (100%)	13,993 (100%)	14,280 (100%)	14,567 (100%)	14,855 (100%)	15,142 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Rigid trucks	LPG	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Rigid trucks	CNG	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Rigid trucks	Electric	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Rigid trucks	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Buses	Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Buses	Diesel Hybrid	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Buses	LPG	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Buses	LNG	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Buses	Electric	12,783 (100%)	13,029 (100%)	13,275 (100%)	13,522 (100%)	13,768 (100%)	14,014 (100%)	14,143 (100%)	14,272 (100%)	14,401 (100%)	14,530 (100%)	14,659 (100%)	14,670 (100%)	14,680 (100%)	14,690 (100%)	14,701 (100%)	14,711 (100%)

Vehicle type	Powertrain/fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Buses	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Passenger cars	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Passenger cars	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

7.7 Policy option 6 – Combined option for clean vehicle definition

In the case of the Policy Option 6, light duty vehicles (LDVs) (e.g. passenger cars and vans) are treated separately to heavy duty vehicles (HDVs) (e.g. rigid trucks and buses).

For LDVs a clean vehicle definition based on tailpipe emissions is used following the approach and thresholds set under Policy Option 3b - the more demanding set of thresholds under Policy Option 3. In the case of HDVs, we have used the approach adopted under Policy option 4 defining clean vehicles on the basis of the type of powertrain and setting national and EU targets for 2025 and 2030 as set under Policy option PO4b that sets more demanding targets in terms of the share of clean vehicles and zero emissions vehicles. Thus, conventional buses and trucks (petrol and diesel) are not considered as clean vehicles. Table 7-16 and Table 7-17**Error! Reference source not found.** below present the results of the analysis for the two alternative scenarios.

Table 7-16: Policy option 6: Number and share of vehicles procured (building on the Baseline scenario)

Vehicle type	Powertrain/ fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Passenger cars	Petrol	37,474 (44%)	37,660 (43%)	37,847 (43%)	38,034 (42%)	38,221 (42%)	20,808 (22%)	20,982 (22%)	21,156 (22%)	21,330 (22%)	21,503 (22%)	26,883 (27%)	26,995 (27%)	27,107 (27%)	27,218 (27%)	27,330 (27%)	27,442 (27%)
Passenger cars	Diesel	40,133 (47%)	40,771 (47%)	41,408 (47%)	42,045 (47%)	42,683 (46%)	23,469 (25%)	23,648 (25%)	23,826 (25%)	24,004 (25%)	24,180 (25%)	30,207 (31%)	30,255 (31%)	30,302 (31%)	30,349 (30%)	30,395 (30%)	30,440 (30%)
Passenger cars	PHEV_Petrol	1,017 (1%)	1,245 (1%)	1,472 (2%)	1,700 (2%)	1,927 (2%)	15,008 (16%)	14,876 (16%)	14,784 (15%)	14,722 (15%)	14,685 (15%)	2,069 (2%)	2,090 (2%)	2,111 (2%)	2,132 (2%)	2,153 (2%)	2,174 (2%)
Passenger cars	PHEV_Diesel	994 (1%)	1,264 (1%)	1,535 (2%)	1,805 (2%)	2,076 (2%)	16,339 (17%)	16,780 (18%)	17,182 (18%)	17,553 (18%)	17,899 (18%)	2,571 (3%)	2,683 (3%)	2,797 (3%)	2,910 (3%)	3,024 (3%)	3,139 (3%)
Passenger cars	LPG	2,884 (3%)	2,935 (3%)	2,986 (3%)	3,036 (3%)	3,087 (3%)	1,700 (2%)	1,776 (2%)	1,854 (2%)	1,933 (2%)	2,013 (2%)	2,596 (3%)	2,587 (3%)	2,578 (3%)	2,568 (3%)	2,558 (3%)	2,549 (3%)
Passenger cars	CNG	1,445 (2%)	1,472 (2%)	1,499 (2%)	1,527 (2%)	1,554 (2%)	857 (1%)	888 (1%)	920 (1%)	952 (1%)	985 (1%)	1,263 (1%)	1,263 (1%)	1,264 (1%)	1,265 (1%)	1,265 (1%)	1,266 (1%)
Passenger cars	E85	173 (0%)	193 (0%)	212 (0%)	231 (0%)	251 (0%)	1,458 (2%)	1,333 (1%)	1,235 (1%)	1,157 (1%)	1,092 (1%)	2,078 (2%)	2,008 (2%)	1,945 (2%)	1,890 (2%)	1,840 (2%)	1,795 (2%)
Passenger cars	Electric	770 (1%)	1,074 (1%)	1,378 (2%)	1,682 (2%)	1,985 (2%)	12,344 (13%)	12,508 (13%)	12,663 (13%)	12,813 (13%)	12,958 (13%)	26,201 (27%)	25,812 (26%)	25,473 (26%)	25,176 (25%)	24,915 (25%)	24,685 (25%)
Passenger cars	Fuel Cell	46 (0%)	106 (0%)	166 (0%)	227 (0%)	287 (0%)	1,871 (2%)	1,987 (2%)	2,084 (2%)	2,168 (2%)	2,241 (2%)	4,614 (5%)	5,216 (5%)	5,759 (6%)	6,255 (6%)	6,708 (7%)	7,126 (7%)
Vans	Petrol	441 (4%)	446 (4%)	451 (4%)	457 (4%)	462 (4%)	251 (2%)	253 (2%)	255 (2%)	258 (2%)	260 (2%)	321 (2%)	318 (2%)	315 (2%)	312 (2%)	309 (2%)	306 (2%)
Vans	Diesel	10,842 (94%)	10,954 (93%)	11,066 (92%)	11,178 (91%)	11,290 (90%)	6,124 (48%)	6,167 (48%)	6,210 (48%)	6,252 (48%)	6,295 (48%)	7,750 (59%)	7,765 (59%)	7,779 (58%)	7,794 (58%)	7,809 (58%)	7,824 (58%)
Vans	PHEV_Petrol	6 (0%)	9 (0%)	12 (0%)	15 (0%)	17 (0%)	142 (1%)	143 (1%)	144 (1%)	145 (1%)	146 (1%)	24 (0%)	24 (0%)	25 (0%)	25 (0%)	26 (0%)	26 (0%)
Vans	PHEV_Diesel	181 (2%)	262 (2%)	342 (3%)	422 (3%)	502 (4%)	4,087 (32%)	4,117 (32%)	4,147 (32%)	4,177 (32%)	4,207 (32%)	691 (5%)	716 (5%)	740 (6%)	765 (6%)	789 (6%)	813 (6%)
Vans	LPG	7 (0%)	9 (0%)	11 (0%)	13 (0%)	15 (0%)	9 (0%)	9 (0%)	10 (0%)	11 (0%)	11 (0%)	15 (0%)	15 (0%)	15 (0%)	15 (0%)	15 (0%)	15 (0%)
Vans	CNG	8 (0%)	11 (0%)	13 (0%)	16 (0%)	19 (0%)	11 (0%)	12 (0%)	13 (0%)	14 (0%)	15 (0%)	20 (0%)	20 (0%)	20 (0%)	20 (0%)	21 (0%)	21 (0%)

Vehicle type	Powertrain/ fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Vans	Electric	61 (1%)	92 (1%)	123 (1%)	154 (1%)	185 (1%)	1,991 (16%)	1,997 (16%)	2,004 (16%)	2,013 (15%)	2,022 (15%)	4,065 (31%)	4,036 (30%)	4,007 (30%)	3,977 (30%)	3,948 (29%)	3,918 (29%)
Vans	Fuel Cell	3 (0%)	5 (0%)	7 (0%)	9 (0%)	11 (0%)	123 (1%)	133 (1%)	141 (1%)	148 (1%)	154 (1%)	318 (2%)	366 (3%)	413 (3%)	461 (3%)	509 (4%)	557 (4%)
Rigid trucks	Diesel	10,800 (85%)	10,760 (83%)	10,719 (81%)	10,678 (79%)	10,638 (77%)	9,410 (67%)	9,459 (66%)	9,507 (65%)	9,554 (64%)	9,600 (63%)	8,832 (57%)	8,820 (57%)	8,808 (56%)	8,795 (56%)	8,782 (55%)	8,768 (55%)
Rigid trucks	Diesel Hybrid	1,675 (13%)	1,913 (15%)	2,152 (16%)	2,391 (18%)	2,630 (19%)	2,547 (18%)	2,743 (19%)	2,941 (20%)	3,139 (21%)	3,339 (22%)	3,241 (21%)	3,341 (21%)	3,441 (22%)	3,541 (22%)	3,642 (23%)	3,744 (23%)
Rigid trucks	LPG	1 (0%)	2 (0%)	2 (0%)	2 (0%)	3 (0%)	8 (0%)	9 (0%)	10 (0%)	11 (0%)	11 (0%)	18 (0%)	20 (0%)	21 (0%)	23 (0%)	24 (0%)	25 (0%)
Rigid trucks	CNG	195 (2%)	261 (2%)	327 (2%)	392 (3%)	458 (3%)	1,349 (10%)	1,376 (10%)	1,403 (10%)	1,430 (10%)	1,457 (10%)	2,219 (14%)	2,234 (14%)	2,248 (14%)	2,263 (14%)	2,278 (14%)	2,293 (14%)
Rigid trucks	Electric	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	376 (3%)	381 (3%)	386 (3%)	392 (3%)	398 (3%)	604 (4%)	606 (4%)	608 (4%)	611 (4%)	614 (4%)	617 (4%)
Rigid trucks	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	303 (2%)	312 (2%)	320 (2%)	329 (2%)	337 (2%)	515 (3%)	521 (3%)	527 (3%)	532 (3%)	537 (3%)	542 (3%)
Buses	Diesel	11,360 (89%)	11,341 (87%)	11,323 (85%)	11,304 (84%)	11,286 (82%)	3,484 (25%)	3,478 (25%)	3,472 (24%)	3,467 (24%)	3,461 (24%)	3,466 (24%)	3,449 (24%)	3,431 (23%)	3,413 (23%)	3,395 (23%)	3,377 (23%)
Buses	Diesel Hybrid	833 (7%)	1,033 (8%)	1,233 (9%)	1,432 (11%)	1,632 (12%)	566 (4%)	609 (4%)	652 (5%)	695 (5%)	739 (5%)	785 (5%)	806 (5%)	826 (6%)	847 (6%)	868 (6%)	889 (6%)
Buses	LPG	265 (2%)	296 (2%)	327 (2%)	358 (3%)	389 (3%)	3,564 (25%)	3,652 (26%)	3,739 (26%)	3,825 (27%)	3,911 (27%)	2,993 (20%)	2,979 (20%)	2,964 (20%)	2,950 (20%)	2,937 (20%)	2,923 (20%)
Buses	LNG	304 (2%)	316 (2%)	328 (2%)	339 (3%)	351 (3%)	3,079 (22%)	3,052 (22%)	3,027 (21%)	3,001 (21%)	2,977 (20%)	2,211 (15%)	2,229 (15%)	2,247 (15%)	2,265 (15%)	2,282 (16%)	2,299 (16%)
Buses	Electric	21 (0%)	44 (0%)	66 (0%)	88 (1%)	111 (1%)	3,315 (24%)	3,346 (24%)	3,377 (24%)	3,407 (24%)	3,438 (24%)	5,195 (35%)	5,198 (35%)	5,200 (35%)	5,203 (35%)	5,206 (35%)	5,209 (35%)
Buses	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (0%)	6 (0%)	6 (0%)	6 (0%)	6 (0%)	9 (0%)	10 (0%)	11 (0%)	12 (0%)	13 (0%)	14 (0%)
Passenger cars	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Vehicle type	Powertrain/ fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Passenger cars	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Table 7-17: Policy option 6: Number and share of vehicles procured (building on the Alternative baseline scenario)

Vehicle type	Powertrain/ fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Passenger cars	Petrol	37,474 (44%)	37,660 (43%)	37,847 (43%)	38,034 (42%)	38,221 (42%)	20,808 (22%)	20,982 (22%)	21,156 (22%)	21,330 (22%)	21,503 (22%)	26,883 (27%)	26,995 (27%)	27,107 (27%)	27,218 (27%)	27,330 (27%)	27,442 (27%)
Passenger cars	Diesel	40,133 (47%)	40,771 (47%)	41,408 (47%)	42,045 (47%)	42,683 (46%)	23,469 (25%)	23,648 (25%)	23,826 (25%)	24,004 (25%)	24,180 (25%)	30,207 (31%)	30,255 (31%)	30,302 (31%)	30,349 (30%)	30,395 (30%)	30,440 (30%)
Passenger cars	PHEV_Petrol	1,017 (1%)	1,245 (1%)	1,472 (2%)	1,700 (2%)	1,927 (2%)	15,008 (16%)	14,876 (16%)	14,784 (15%)	14,722 (15%)	14,685 (15%)	2,069 (2%)	2,090 (2%)	2,111 (2%)	2,132 (2%)	2,153 (2%)	2,174 (2%)
Passenger cars	PHEV_Diesel	994 (1%)	1,264 (1%)	1,535 (2%)	1,805 (2%)	2,076 (2%)	16,339 (17%)	16,780 (18%)	17,182 (18%)	17,553 (18%)	17,899 (18%)	2,571 (3%)	2,683 (3%)	2,797 (3%)	2,910 (3%)	3,024 (3%)	3,139 (3%)
Passenger cars	LPG	2,884 (3%)	2,935 (3%)	2,986 (3%)	3,036 (3%)	3,087 (3%)	1,700 (2%)	1,776 (2%)	1,854 (2%)	1,933 (2%)	2,013 (2%)	2,596 (3%)	2,587 (3%)	2,578 (3%)	2,568 (3%)	2,558 (3%)	2,549 (3%)
Passenger cars	CNG	1,445 (2%)	1,472 (2%)	1,499 (2%)	1,527 (2%)	1,554 (2%)	857 (1%)	888 (1%)	920 (1%)	952 (1%)	985 (1%)	1,263 (1%)	1,263 (1%)	1,264 (1%)	1,265 (1%)	1,265 (1%)	1,266 (1%)
Passenger cars	E85	173 (0%)	193 (0%)	212 (0%)	231 (0%)	251 (0%)	1,458 (2%)	1,333 (1%)	1,235 (1%)	1,157 (1%)	1,092 (1%)	2,078 (2%)	2,008 (2%)	1,945 (2%)	1,890 (2%)	1,840 (2%)	1,795 (2%)
Passenger cars	Electric	770 (1%)	1,074 (1%)	1,378 (2%)	1,682 (2%)	1,985 (2%)	12,344 (13%)	12,508 (13%)	12,663 (13%)	12,813 (13%)	12,958 (13%)	26,201 (27%)	25,812 (26%)	25,473 (26%)	25,176 (25%)	24,915 (25%)	24,685 (25%)
Passenger cars	Fuel Cell	46 (0%)	106 (0%)	166 (0%)	227 (0%)	287 (0%)	1,871 (2%)	1,987 (2%)	2,084 (2%)	2,168 (2%)	2,241 (2%)	4,614 (5%)	5,216 (5%)	5,759 (6%)	6,255 (6%)	6,708 (7%)	7,126 (7%)
Vans	Petrol	441 (4%)	446 (4%)	451 (4%)	457 (4%)	462 (4%)	251 (2%)	253 (2%)	255 (2%)	258 (2%)	260 (2%)	321 (2%)	318 (2%)	315 (2%)	312 (2%)	309 (2%)	306 (2%)
Vans	Diesel	10,842 (94%)	10,954 (93%)	11,066 (92%)	11,178 (91%)	11,290 (90%)	6,124 (48%)	6,167 (48%)	6,210 (48%)	6,252 (48%)	6,295 (48%)	7,750 (59%)	7,765 (59%)	7,779 (58%)	7,794 (58%)	7,809 (58%)	7,824 (58%)

Vehicle type	Powertrain/ fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Vans	PHEV_Petrol	6 (0%)	9 (0%)	12 (0%)	15 (0%)	17 (0%)	142 (1%)	143 (1%)	144 (1%)	145 (1%)	146 (1%)	24 (0%)	24 (0%)	25 (0%)	25 (0%)	26 (0%)	26 (0%)
Vans	PHEV_Diesel	181 (2%)	262 (2%)	342 (3%)	422 (3%)	502 (4%)	4,087 (32%)	4,117 (32%)	4,147 (32%)	4,177 (32%)	4,207 (32%)	691 (5%)	716 (5%)	740 (6%)	765 (6%)	789 (6%)	813 (6%)
Vans	LPG	7 (0%)	9 (0%)	11 (0%)	13 (0%)	15 (0%)	9 (0%)	9 (0%)	10 (0%)	11 (0%)	11 (0%)	15 (0%)	15 (0%)	15 (0%)	15 (0%)	15 (0%)	15 (0%)
Vans	CNG	8 (0%)	11 (0%)	13 (0%)	16 (0%)	19 (0%)	11 (0%)	12 (0%)	13 (0%)	14 (0%)	15 (0%)	20 (0%)	20 (0%)	20 (0%)	20 (0%)	21 (0%)	21 (0%)
Vans	Electric	61 (1%)	92 (1%)	123 (1%)	154 (1%)	185 (1%)	1,991 (16%)	1,997 (16%)	2,004 (16%)	2,013 (15%)	2,022 (15%)	4,065 (31%)	4,036 (30%)	4,007 (30%)	3,977 (30%)	3,948 (29%)	3,918 (29%)
Vans	Fuel Cell	3 (0%)	5 (0%)	7 (0%)	9 (0%)	11 (0%)	123 (1%)	133 (1%)	141 (1%)	148 (1%)	154 (1%)	318 (2%)	366 (3%)	413 (3%)	461 (3%)	509 (4%)	557 (4%)
Rigid trucks	Diesel	10,800 (85%)	10,760 (83%)	10,719 (81%)	10,678 (79%)	10,638 (77%)	9,410 (67%)	9,459 (66%)	9,507 (65%)	9,554 (64%)	9,600 (63%)	8,832 (57%)	8,820 (57%)	8,808 (56%)	8,795 (56%)	8,782 (55%)	8,768 (55%)
Rigid trucks	Diesel Hybrid	1,675 (13%)	1,913 (15%)	2,152 (16%)	2,391 (18%)	2,630 (19%)	2,547 (18%)	2,743 (19%)	2,941 (20%)	3,139 (21%)	3,339 (22%)	3,241 (21%)	3,341 (21%)	3,441 (22%)	3,541 (22%)	3,642 (23%)	3,744 (23%)
Rigid trucks	LPG	1 (0%)	2 (0%)	2 (0%)	2 (0%)	3 (0%)	8 (0%)	9 (0%)	10 (0%)	11 (0%)	11 (0%)	18 (0%)	20 (0%)	21 (0%)	23 (0%)	24 (0%)	25 (0%)
Rigid trucks	CNG	195 (2%)	261 (2%)	327 (2%)	392 (3%)	458 (3%)	1,349 (10%)	1,376 (10%)	1,403 (10%)	1,430 (10%)	1,457 (10%)	2,219 (14%)	2,234 (14%)	2,248 (14%)	2,263 (14%)	2,278 (14%)	2,293 (14%)
Rigid trucks	Electric	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	376 (3%)	381 (3%)	386 (3%)	392 (3%)	398 (3%)	604 (4%)	606 (4%)	608 (4%)	611 (4%)	614 (4%)	617 (4%)
Rigid trucks	Fuel Cell	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	303 (2%)	312 (2%)	320 (2%)	329 (2%)	337 (2%)	515 (3%)	521 (3%)	527 (3%)	532 (3%)	537 (3%)	542 (3%)
Buses	Diesel	9,142 (72%)	8,877 (68%)	8,612 (65%)	8,348 (62%)	8,083 (59%)	3,311 (24%)	3,280 (23%)	3,245 (23%)	3,206 (22%)	3,162 (22%)	3,124 (21%)	3,110 (21%)	3,096 (21%)	3,081 (21%)	3,067 (21%)	3,053 (21%)
Buses	Diesel Hybrid	1,016 (8%)	1,162 (9%)	1,307 (10%)	1,453 (11%)	1,599 (12%)	739 (5%)	807 (6%)	879 (6%)	956 (7%)	1,037 (7%)	1,127 (8%)	1,144 (8%)	1,161 (8%)	1,179 (8%)	1,196 (8%)	1,213 (8%)
Buses	LPG	132 (1%)	148 (1%)	163 (1%)	179 (1%)	194 (1%)	873 (6%)	911 (6%)	950 (7%)	989 (7%)	1,029 (7%)	802 (5%)	802 (5%)	801 (5%)	801 (5%)	801 (5%)	801 (5%)
Buses	LNG	1,151 (9%)	1,198 (9%)	1,245 (9%)	1,292 (10%)	1,340 (10%)	5,770 (41%)	5,793 (41%)	5,815 (41%)	5,837 (41%)	5,858 (40%)	4,402 (30%)	4,406 (30%)	4,410 (30%)	4,414 (30%)	4,418 (30%)	4,422 (30%)

Vehicle type	Powertrain/ fuel	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Buses	Electric	1,209 (9%)	1,463 (11%)	1,716 (13%)	1,970 (15%)	2,224 (16%)	2,883 (21%)	2,893 (20%)	2,907 (20%)	2,922 (20%)	2,939 (20%)	4,430 (30%)	4,433 (30%)	4,437 (30%)	4,440 (30%)	4,443 (30%)	4,447 (30%)
Buses	Fuel Cell	133 (1%)	182 (1%)	231 (2%)	279 (2%)	328 (2%)	438 (3%)	459 (3%)	476 (3%)	491 (3%)	505 (3%)	774 (5%)	775 (5%)	775 (5%)	775 (5%)	775 (5%)	776 (5%)
Passenger cars	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Petrol	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Passenger cars	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vans	Efficient Diesel	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Annex 8 MONETISATION METHODOLOGY – DETAILED PRESENTATION OF CALCULATIONS

8.1 Introduction

According to the description of the policy options, the monetisation methodology should be used by all procurement authorities in the case of the proposed Policy Option 5 and may also be selected in the case of Policy Option 2. Using the monetisation methodology, authorities will be able calculate operational lifetime costs of energy consumption, CO_2 emissions, and air pollutant emissions associated with operating a vehicle. Once calculated, these external costs can then be *internalised* in the purchasing decision.

According to the description of Policy Option 5, the total costs of the vehicle including purchase price, maintenance and repair and the external costs estimated with the use of the monetisation methodology should be used to identify the powertrain that should be selected. In Annex 7 (Section 7.3) we present the overall approach followed. In this Annex, we present the approach followed to determine the total costs and rank the vehicles accordingly and explain all assumptions made.

The following sections cover:

- The presentation of the calculations of the external costs, include a brief description of the monetisation methodology, the data used and the calculations for each vehicle type and powertrain;
- The presentation of data and relevant assumption on the internal costs for each vehicle type and powertrain; and
- The presentation on the total costs and the resulting ranking of each vehicle type.

8.2 Calculation of external costs

In estimating the external costs, we used the monetisation methodology as described in the Directive and applied the updated external cost figures in light of scientific progress and express costs in constant prices of the year 2016, by using the 2014 DG MOVE external cost handbook.

The monetisation methodology requires the contracting authority to acquire, for each vehicle under consideration, data on:

- The vehicle's **fuel consumption** (or, in the case of electricity, energy consumption) per kilometre
- **CO_2 emissions** per kilometre, and
- **Air pollutant emissions** per kilometre (including NO_X, particulate matter, and non-methane hydrocarbons).

Specifically, the following calculations are to be used followed:

- *Energy costs: Energy consumption (MJ/km) × Price of energy (€/MJ) × Lifetime mileage of vehicle (km)*
- *CO_2 and pollutant emissions costs: CO_2 emissions (kg/km) × CO_2 emissions cost factor (€/kg) × Lifetime mileage of vehicle (km)*
- *Pollutant emissions costs: Pollutant emissions (kg/km) × Pollutant emissions cost factor (€/kg) × Lifetime mileage of vehicle (km)*

The sources of data used for each of the variables is presented the Table 8-1 below.

Table 8-1: Data inputs and sources used

Variable	Description	Sources used
Vehicle lifetime mileage	Average operational lifetime for vehicles	CVD
Price of energy	Data on cost of energy for different fuel types – single value used for all fuels	DG ENER Oil Bulletin Data
CO_2 and pollutant emissions costs	Damage costs of main pollutants from transport, in € per ton	2014 Handbook on external costs of transport
Average energy consumption of new vehicles	New vehicles' average energy consumption over time. This is one element used to calculate the fuel costs.	REF2016+ scenario
CO_2 emissions Passenger cars and vans	New vehicles' average CO_2 emissions over time, by fuel type. Real-world emissions are used in the model.	REF2016+ scenario
CO_2 emissions – Buses and trucks	Real-world average CO_2 emissions for trucks and buses. These have been calculated based on the energy consumption of HDVs and by applying emissions factors from combustion for each fuel type.	REF2016+ scenario, IEA for emissions factors
Air pollutant emissions - Passenger cars and vans	Real-world NOx, PM and NMHC emissions performance by fuel type, from empirical studies up to 2019. From 2019 onwards following Commission legislation on real-driving emissions (RDE). Post-2019; no subsequent change in emission factors assumed.	Studies from the International Council on Clean Transportation (ICCT), in addition to RDE legislation
Air pollutant emissions – Buses and trucks	Real-world NOx, PM and NMHC emissions by fuel type from empirical studies, in line with Euro VI standard.	Studies from the ICCT, own estimates based on Euro VI limit values

Concerning the vehicle lifetime, we used the values provided in the Directive as presented in **Table 8-2**.

Table 8-2: Lifetime Vehicle Mileage

Vehicle type	Value
Passenger cars (km)	200,000
Light Commercial Vehicles (km)	250,000

Vehicle type	Value
Heavy goods vehicles (km)	1,000,000
Buses (km)	800,000

Concerning the cost of energy, we also followed the approach outlined in the Directive which indicates that the calculation should be independent of the fuel type of the vehicles being assessed as it is intended to allow comparison in the energy efficiency performance, not the real-world energy costs. A two-step process was followed:

1) First determining which is the lower of the cost of a single unit of petrol or diesel before tax when used as a transport fuel, then

2) Divide this cost by the energy content fuel conversion factor defined in the monetisation methodology.

On the basis of the calculation, the value of 0.0161 €/MJ was used for all fuel types, including alternatives.

Table 8-3: Unit cost used by fuel type for fuel calculations

	EU Average Price 2015 (without taxes)[1] (€/L)	Energy content (MJ/litre)	Cost of fuel (€/MJ) (Excluding taxes)
Petrol	0.515	32	0.0161
Diesel	0.530	36	0.0147

Source; (1) DG ENER Oil Bulletin Data (http://ec.europa.eu/energy/en/statistics/weekly-oil-bulletin)

Prices for different external costs, which have been updated to align with the EU Handbook (expressed in 2016 prices). In the case of carbon prices the upper-bound values have been used. A summary of the current values used in the CVD and the updated cost values used is presented in Table 8-4 below.

Table 8-4: Reference values for pollutant costs: CVD versus EU handbook (prices adjusted to inflation)

Source	NO_x (€/g)	Particulate matter (€/g)	NMHC (€/g)	CO_2 (€/kg)	
				Low	*High*
CVD	0.004	0.087	0.001	0.030	0.040
EU handbook, all areas (2015 prices)	0.011	0.042	0.002	0.051	0.178
Ratio EU handbook-CVD	*2.6*	*0.5*	*1.7*	*1.7*	*4.4*

Data on performance of each vehicle (by vehicle type and powertrain) in terms of fuel consumption and emissions used is presented in Table 8-5.

Table 8-5: Vehicle performance data inputs used

		2020					2025					2030					2035				
Vehicle Type	Fuel type	Fuel consumption (MJ/km)	NMHC (g/km)	PM (g/km)	NOx (g/km)	CO2 (g/km)	Fuel consumption (MJ/km)	NMHC (g/km)	PM (g/km)	NOx (g/km)	CO2 (g/km)	Fuel consumption (MJ/km)	NMHC (g/km)	PM (g/km)	NOx (g/km)	CO2 (g/km)	Fuel consumption (MJ/km)	NMHC (g/km)	PM (g/km)	NOx (g/km)	CO2 (g/km)
Passenger cars	Petrol	2.0	0.07	0.005	0.06	96.4	1.9	0.07	0.005	0.06	91.3	1.8	0.07	0.005	0.06	88.3	1.8	0.07	0.005	0.06	84.5
Passenger cars	Diesel	1.7	0.00	0.005	0.17	93.3	1.7	0.00	0.005	0.12	89.5	1.6	0.00	0.005	0.12	87.3	1.6	0.00	0.005	0.12	84.1
Passenger cars	PHEV Petrol	1.0	0.07	0.005	0.06	22.3	1.0	0.07	0.005	0.06	21.7	1.0	0.07	0.005	0.06	21.5	1.0	0.07	0.005	0.06	21.3
Passenger cars	PHEV Diesel	0.9	0.00	0.005	0.17	19.2	0.9	0.00	0.005	0.17	18.6	0.9	0.00	0.005	0.17	18.2	0.9	0.00	0.005	0.17	18.2
Passenger cars	LPG	2.1	0.07	0.005	0.06	83.8	2.1	0.07	0.005	0.06	80.7	2.1	0.07	0.005	0.06	78.0	2.0	0.07	0.005	0.06	76.5
Passenger cars	CNG	2.5	0.07	0.005	0.06	107.0	2.4	0.07	0.005	0.06	104.2	2.4	0.07	0.005	0.06	101.7	2.4	0.07	0.005	0.06	99.9
Passenger cars	E85	2.8	0.00	0.000	0.00	0.0	2.8	0.00	0.000	0.00	0.0	2.8	0.00	0.000	0.00	0.0	2.8	0.00	0.000	0.00	0.0
Passenger cars	Electric	0.5	0.00	0.000	0.00	0.0	0.5	0.00	0.000	0.00	0.0	0.4	0.00	0.000	0.00	0.0	0.4	0.00	0.000	0.00	0.0
Passenger cars	Fuel Cell	1.1	0.00	0.000	0.00	0.0	1.1	0.00	0.000	0.00	0.0	1.0	0.00	0.000	0.00	0.0	1.0	0.00	0.000	0.00	0.0
Vans	Petrol	2.9	0.09	0.005	0.07	148.3	2.8	0.09	0.005	0.07	144.6	2.7	0.09	0.005	0.07	142.7	2.7	0.09	0.005	0.07	141.7
Vans	Diesel	2.5	0.00	0.005	0.32	151.3	2.5	0.00	0.005	0.16	147.8	2.4	0.00	0.005	0.16	146.1	2.4	0.00	0.005	0.16	145.3
Vans	PHEV Petrol	1.1	0.09	0.005	0.07	35.0	1.1	0.09	0.005	0.07	34.4	1.1	0.09	0.005	0.07	34.1	1.1	0.09	0.005	0.07	34.0
Vans	PHEV Diesel	1.1	0.00	0.005	0.32	30.3	1.1	0.00	0.005	0.23	29.9	1.1	0.00	0.005	0.23	29.7	1.1	0.00	0.005	0.23	29.6
Vans	LPG	2.1	0.09	0.005	0.07	107.4	2.1	0.09	0.005	0.07	103.5	2.1	0.09	0.005	0.07	100.7	2.0	0.09	0.005	0.07	100.0
Vans	CNG	2.5	0.09	0.005	0.07	151.4	2.4	0.09	0.005	0.07	147.6	2.4	0.09	0.005	0.07	144.3	2.4	0.09	0.005	0.07	143.7
Vans	Electric	0.7	0.00	0.000	0.00	0.0	0.7	0.00	0.000	0.00	0.0	0.7	0.00	0.000	0.00	0.0	0.7	0.00	0.000	0.00	0.0
Vans	Fuel Cell	1.5	0.00	0.000	0.00	0.0	1.4	0.00	0.000	0.00	0.0	1.5	0.00	0.000	0.00	0.0	1.5	0.00	0.000	0.00	0.0

		2020					2025					2030					2035				
Vehicle Type	Fuel type	Fuel consumption (MJ/km)	NMHC (g/km)	PM (g/km)	NOx (g/km)	CO2 (g/km)	Fuel consumption (MJ/km)	NMHC (g/km)	PM (g/km)	NOx (g/km)	CO2 (g/km)	Fuel consumption (MJ/km)	NMHC (g/km)	PM (g/km)	NOx (g/km)	CO2 (g/km)	Fuel consumption (MJ/km)	NMHC (g/km)	PM (g/km)	NOx (g/km)	CO2 (g/km)
Rigid trucks	Diesel	8.2	0.00	0.008	0.24	607.3	8.0	0.00	0.008	0.23	588.9	7.8	0.00	0.008	0.23	574.3	7.6	0.00	0.007	0.22	563.0
Rigid trucks	Diesel Hybrid	7.2	0.00	0.007	0.21	531.2	6.9	0.00	0.007	0.20	513.1	6.8	0.00	0.007	0.20	503.8	6.7	0.00	0.007	0.20	497.7
Rigid trucks	LPG	8.2	0.13	0.008	0.24	514.2	8.0	0.12	0.008	0.23	503.8	7.9	0.12	0.008	0.23	496.4	7.8	0.12	0.008	0.23	489.4
Rigid trucks	LNG	8.3	0.13	0.008	0.24	466.4	8.1	0.13	0.008	0.24	454.0	7.9	0.12	0.008	0.23	444.4	7.8	0.12	0.008	0.23	436.4
Rigid trucks	Electric	2.4	0.00	0.000	0.00	0.0	2.3	0.00	0.000	0.00	0.0	2.3	0.00	0.000	0.00	0.0	2.3	0.00	0.000	0.00	0.0
Rigid trucks	Fuel Cell	4.2	0.00	0.000	0.00	0.0	3.9	0.00	0.000	0.00	0.0	3.8	0.00	0.000	0.00	0.0	3.8	0.00	0.000	0.00	0.0
Buses	Diesel	16.7	0.00	0.016	0.48	1235.6	16.5	0.00	0.016	0.48	1220.5	16.3	0.00	0.016	0.48	1210.9	16.3	0.00	0.016	0.47	1206.3
Buses	Diesel Hybrid	15.4	0.00	0.015	0.45	1140.4	14.7	0.00	0.014	0.43	1089.6	14.4	0.00	0.014	0.42	1065.8	14.3	0.00	0.014	0.42	1058.5
Buses	LPG	17.9	0.28	0.017	0.52	1125.8	18.0	0.28	0.017	0.52	1134.6	18.0	0.28	0.017	0.52	1133.5	18.0	0.28	0.017	0.52	1133.2
Buses	CNG	18.6	0.29	0.018	0.54	1175.6	18.5	0.29	0.018	0.54	1167.2	18.4	0.29	0.018	0.54	1162.6	18.4	0.29	0.018	0.53	1159.9
Buses	Electric	3.5	0.00	0.000	0.00	0.0	3.5	0.00	0.000	0.00	0.0	3.5	0.00	0.000	0.00	0.0	3.5	0.00	0.000	0.00	0.0
Buses	Fuel Cell	7.9	0.00	0.000	0.00	0.0	7.4	0.00	0.000	0.00	0.0	7.3	0.00	0.000	0.00	0.0	7.2	0.00	0.000	0.00	0.0

8.3 Internal costs

Internal costs considered in the calculations included:

- the purchase cost of vehicles
- fixed lifetime costs – including operation (e.g. road tax), maintenance, repair and insurance.

In order to determine the fixed costs for vehicles over their lifetime, the following assumptions were made on their operational lifetime (years):

- 10 years was assumed for cars and vans
- 11 years for trucks
- 15 years for buses.

These figures are in line with the analysis in the CVD ex-post evaluation (Ricardo & TEPR, 2015, p. 96) and reflects the expected lifetime required for public vehicles to realise the lifetime mileage outlined within the CVD.

Vehicle and fixed costs used by vehicle type and powertrain draw on data from the REF2016+ scenario[25].

Table 8-6: Vehicle purchase and fixed costs

		2020		2025		2030		2035	
Vehicle Type	Fuel type	Capital cost at retail (€)	Annual fixed cost	Capital cost at retail (€)	Annual fixed cost	Capital cost at retail (€)	Annual fixed cost	Capital cost at retail (€)	Annual fixed cost
Passenger cars	Petrol	19,682	1,310	20,481	1,310	20,485	1,310	20,716	1,310
Passenger cars	Diesel	22,958	1,461	23,141	1,461	23,218	1,461	23,346	1,461
Passenger cars	PHEV Petrol	29,471	1,383	26,472	1,383	25,819	1,342	25,318	1,342
Passenger cars	PHEV Diesel	32,050	1,425	29,228	1,425	28,615	1,383	28,150	1,383
Passenger cars	LPG	21,056	1,391	21,675	1,391	21,385	1,391	21,385	1,391
Passenger cars	CNG	21,628	1,391	22,247	1,391	21,957	1,391	21,957	1,391
Passenger cars	E85	20,204	1,391	20,823	1,391	20,534	1,391	20,534	1,391
Passenger cars	Electric	34,703	1,198	29,928	1,198	27,617	1,261	26,992	1,261
Passenger cars	Fuel Cell	54,493	1,246	39,967	1,246	35,806	1,322	33,220	1,322
Vans	Petrol	17,589	2,268	18,598	2,268	18,867	2,268	19,114	2,268

[25] Except fixed annual costs for the following categories of passengers cars and vans: PHEV, EV and FCEVs. Data for those are based on data collected by Ricardo Energy & Environment, no battery replacement was assumed during their operational lifetime.

		2020		2025		2030		2035	
Vehicle Type	Fuel type	Capital cost at retail (€)	Annual fixed cost	Capital cost at retail (€)	Annual fixed cost	Capital cost at retail (€)	Annual fixed cost	Capital cost at retail (€)	Annual fixed cost
Vans	Diesel	21,702	2,358	22,311	2,358	22,560	2,358	22,781	2,358
Vans	PHEV Petrol	29,636	2,310	26,007	2,310	25,091	2,244	24,502	2,244
Vans	PHEV Diesel	32,779	2,352	29,466	2,352	28,775	2,285	28,224	2,285
Vans	LPG	18,894	2,308	19,552	2,308	19,349	2,308	19,349	2,308
Vans	CNG	19,469	2,308	20,127	2,308	19,924	2,308	19,924	2,308
Vans	Electric	35,207	2,098	33,797	2,098	30,393	2,090	29,414	2,090
Vans	Fuel Cell	51,042	2,209	37,905	2,209	34,265	2,161	31,777	2,161
Rigid trucks	Diesel	66,813	4,031	67,176	4,031	67,389	4,031	67,605	4,031
Rigid trucks	Diesel Hybrid	91,347	4,031	91,709	4,031	91,923	4,031	92,138	4,031
Rigid trucks	LPG	73,320	4,334	73,683	4,334	73,897	4,334	74,112	4,334
Rigid trucks	CNG	74,706	4,535	75,069	4,535	75,283	4,535	75,498	4,535
Rigid trucks	Electric	110,882	5,543	99,446	5,543	93,659	5,543	91,729	5,543
Rigid trucks	Fuel Cell	138,699	5,543	134,823	5,543	130,227	5,543	124,548	5,543
Buses	Diesel	278,737	9,071	279,263	9,071	279,263	9,071	279,263	9,071
Buses	Diesel Hybrid	297,603	9,071	298,130	9,071	298,130	9,071	298,130	9,071
Buses	LPG	296,090	9,474	296,616	9,474	296,616	9,474	296,616	9,474
Buses	LNG	303,118	9,776	303,645	9,776	303,645	9,776	303,645	9,776
Buses	Electric	352,167	12,094	340,498	12,094	330,497	12,094	327,163	12,094
Buses	Fuel Cell	365,896	12,094	359,201	12,094	351,261	12,094	341,453	12,094

8.4 Total cost of vehicles

On the basis of the above figures, the total costs of vehicles of different powertrains were estimated for the 5-yearly intervals – 2020 and 2025.

Table 8-7: Calculated total cost of vehicles by vehicle type and powertrain – 2020 and 2025

		2020				2025			
Vehicle Type	**Fuel type**	**Purchase cost (€)**	**Fixed costs (€)**	**Total MM (€)**	**Total cost (€)**	**Purchase cost (€)**	**Fixed costs (€)**	**Total MM (€)**	**Total cost (€)**
Passenger cars	Petrol	19,682	13,102	9,971	**42,755**	20,481	13,102	9,429	**43,012**
Passenger cars	Diesel	22,958	14,614	9,293	**46,865**	23,141	14,614	8,815	**46,570**
Passenger cars	PHEV Petrol	29,471	13,423	4,108	**47,002**	26,472	13,423	4,072	**43,966**
Passenger cars	PHEV Diesel	32,050	13,830	4,050	**49,930**	29,228	13,830	3,892	**46,950**
Passenger cars	LPG	21,056	13,908	10,014	**44,978**	21,675	13,908	9,790	**45,373**
Passenger cars	CNG	21,628	13,908	10,562	**46,097**	22,247	13,908	10,372	**46,527**
Passenger cars	E85	20,204	13,908	9,073	**43,186**	20,823	13,908	8,974	**43,706**
Passenger cars	Electric	34,703	12,607	1,764	**49,074**	29,928	12,607	1,506	**44,040**
Passenger cars	Fuel Cell	54,493	13,221	3,695	**71,409**	39,967	13,221	3,396	**56,585**
Vans	Petrol	17,589	22,676	16,105	**56,371**	18,598	22,676	15,629	**56,904**
Vans	Diesel	21,702	23,583	15,475	**60,760**	22,311	23,583	14,623	**60,517**
Vans	PHEV Petrol	29,636	22,442	5,698	**57,775**	26,007	22,442	5,848	**54,297**
Vans	PHEV Diesel	32,779	22,850	6,120	**61,749**	29,466	22,850	5,830	**58,145**
Vans	LPG	18,894	23,080	11,912	**53,886**	19,552	23,080	11,661	**54,292**
Vans	CNG	19,469	23,080	14,519	**57,068**	20,127	23,080	14,252	**57,459**
Vans	Electric	35,207	20,903	2,862	**58,972**	33,797	20,903	2,818	**57,517**
Vans	Fuel Cell	51,042	21,610	6,174	**78,827**	37,905	21,610	5,735	**65,251**
Rigid trucks	Diesel	66,813	44,345	204,405	**315,563**	67,176	44,345	198,203	**309,723**
Rigid trucks	Diesel Hybrid	91,347	44,345	178,804	**314,495**	91,709	44,345	172,704	**308,758**
Rigid trucks	LPG	73,320	47,671	193,218	**314,209**	73,683	47,671	189,309	**310,663**
Rigid trucks	LNG	74,706	49,888	190,405	**314,999**	75,069	49,888	185,370	**310,327**
Rigid trucks	Electric	110,882	60,974	38,088	**209,944**	99,446	60,974	37,707	**198,128**

Rigid trucks	Fuel Cell	138,699	60,974	67,345	**267,018**	134,823	60,974	62,796	**258,593**
Buses	Diesel	278,737	136,059	332,718	**747,513**	279,263	136,059	328,633	**743,955**
Buses	Diesel Hybrid	297,603	136,059	307,069	**740,730**	298,130	136,059	293,396	**727,585**
Buses	LPG	296,090	142,106	338,446	**776,641**	296,616	142,106	341,110	**779,832**
Buses	CNG	303,118	146,641	353,411	**803,170**	303,645	146,641	350,910	**801,196**
Buses	Electric	352,167	181,411	45,705	**579,283**	340,498	181,411	45,248	**567,158**
Buses	Fuel Cell	365,896	181,411	102,364	**649,671**	359,201	181,411	95,449	**636,062**

On this basis, we have ranked different powertrains for each vehicle type.

Table 8-8: Ranking of compliant[26] vehicles by powertrain on the basis of total costs (internal and external) calculated using the monetisation methodology (Rank 1: cheapest)

Vehicle Type	2020	2025	2030	2035
Passenger cars	1-Petrol 2-E85 3-LPG 4-CNG 5-Diesel 6-PHEV Petrol 7-Electric 8-PHEV Diesel 9-Fuel Cell	1-Petrol 2-Electric 3-E85 4-PHEV Petrol 5-LPG 6-CNG 7-Diesel 8-PHEV Diesel 9-Fuel Cell	1-Electric 2-Petrol 3-PHEV Petrol 4-E85 5-LPG 6-CNG 7-PHEV Diesel 8-Diesel 9-Fuel Cell	1-Electric 2-Petrol 3-PHEV Petrol 4-E85 5-LPG 6-PHEV Diesel 7-CNG 8-Diesel 9-Fuel Cell
Vans	1-LPG 2-Petrol 3-CNG 4-PHEV Petrol 5-Electric 6-Diesel 7-PHEV Diesel 8-Fuel Cell	1-LPG 2-PHEV Petrol 3-Petrol 4-CNG 5-Electric 6-PHEV Diesel 7-Diesel 8-Fuel Cell	1-PHEV Petrol 2-LPG 3-Electric 4-Petrol 5-CNG 6-PHEV Diesel 7-Diesel 8-Fuel Cell	1-PHEV Petrol 2-Electric 3-LPG 4-CNG 5-PHEV Diesel 6-Petrol 7-Fuel Cell 8-Diesel
Rigid trucks	1-Electric 2-Fuel Cell 3-LPG 4-Diesel Hybrid 5-CNG 6-Diesel	1-Electric 2-Fuel Cell 3-Diesel Hybrid 4-Diesel 5-CNG 6-LPG	1-Electric 2-Fuel Cell 3-Diesel 4-Diesel Hybrid 5-CNG 6-LPG	1-Electric 2-Fuel Cell 3-Diesel 4-CNG 5-Diesel Hybrid 6-LPG
Buses	1-Electric 2-Fuel Cell 3-Diesel Hybrid 4-Diesel 5-LPG 6-LNG	1-Electric 2-Fuel Cell 3-Diesel Hybrid 4-Diesel 5-LPG 6-LNG	1-Electric 2-Fuel Cell 3-Diesel Hybrid 4-Diesel 5-LPG 6-LNG	1-Electric 2-Fuel Cell 3-Diesel Hybrid 4-Diesel 5-LPG 6-LNG

The ranking has been used to inform our analysis of PO2 and PO5 in terms of the vehicles to be selected by procurement authorities. The approach adopted was described in Annex 7 (Section 7.3).

[26] Vehicles that have greater than 1% share by 2030 in the updated EU reference scenario 2016.

Annex 9 DEVELOPMENT OF THE COST-BENEFIT MODEL

9.1 Model overview

The cost-benefit model used to assess the policy options in this project has been developed by modifying, updating and substantially expanding the model developed by Ricardo as part of the ex-post evaluation of the Clean Vehicles Directive (Ricardo & TEPR, 2015).

The objective of the model is to quantify the potential impacts of proposed changes to the Directive on capital and operational costs for procurement authorities, as well as the impact on CO_2 and air pollutant emissions from publicly procured vehicles. Vehicle procurements over the period 2020-2035 are considered within the model. These impacts are monetised (over the lifetime of the vehicles procured during the assessment period – until 2050) and compared to the baseline scenario, allowing for assessment of the policy options.

The model has been developed in Microsoft Excel and consists of three main sections:

- Inputs – includes the baseline data and the relevant parameters for the policy package definitions
- Calculations – all the calculations required to develop the baseline scenario and assess the impacts of the selected policy option are held in this section
- Outputs – the results from the modelling are displayed in this section covering each option and all relevant variables used. The outputs section also contains several controls that allow the user to change the baseline scenario (main baseline scenario or Alternative baseline for buses), the policy option being analysed, discount rate and the year to start discounting from.

9.2 Inputs and data sources

The inputs to the model can be divided into two sections:

- Baseline data inputs
- Policy package definitions.

The baseline data in the model primarily draws on an update of the EU Reference Scenario 2016 to ensure consistency with other initiatives that are part of the Mobility Packages (as described in Annex 3).

The policy package definitions are also included in the model. For each policy option, the following inputs are provided:

- **Scope of the policy package** (i.e. whether only purchases are included within the scope of the Directive, or whether leased vehicles and transport services are also included) – as presented in Section 3 of the main report.
- **Policy implementation period** (2020-2035 for all policy options considered)
- **Definition of clean vehicles and minimum threshold of clean vehicles for each policy option** broken down by: vehicle type (passenger car, van, truck or bus) and whether a zero-emission vehicle, or a compliant non-zero emission clean vehicle – as presented in Section 3 of the main report.
- **Expected distribution of vehicles procured** by vehicle type and powertrain for each scenario – as explained in Section 5 of the main report (detailed tables provided in Annex 7).
- **Administration costs** (in € per contract, for both procurers and suppliers) – based on information from the ex-post evaluation as presented in Section 5.2.1.3 of the main report.

9.3 Model calculations and functionality

Within the model a series of calculations are performed for both the baseline scenario and the policy options being assessed. The results of these are then used estimate the impact of the policy option in comparison to the baseline. The calculation steps are as follows:

- Step 1: Calculation of the publicly procured vehicle fleet
- Step 2: Calculation of vehicle mileage
- Step 3: Calculation of energy and emissions
- Step 4: Calculation of costs
- Step 5: Calculation of impacts

Step 1: Calculation of the publicly procured vehicle fleet

Four main types of vehicles are considered in the analysis:

- Passenger cars
- Vans (light commercial vehicles)
- Rigid trucks (with a gross vehicle weight <16 tonnes)
- Buses.

The model includes a breakdown of each vehicle type by powertrain so that the impacts of procuring different powertrain options can be assessed. Overall, the powertrain/fuel types match those in the PRIMES-TREMOVE model developed by ICCS-E3MLab and used for the EU Reference scenario 2016 and its updates. However, the powertrains have been grouped in a slightly different way relative to PRIMES-TREMOVE model:

- For both passenger cars and vans ‘Petrol’ and ‘Petrol Hybrid’ vehicles have been combined into one category in the CVD Impact Assessment cost-benefit model.
- Similarly, ‘Diesel’ and ‘Diesel Hybrid’ have also been combined into one category for each vehicle type.

The full list of vehicle types and powertrain/fuel categories included in the analysis is shown in Figure 2. The figure also shows whether the vehicle has been defined as an alternatively fuelled vehicle (AFV), alternatively fuelled non-zero emission vehicle (AFV non-zero), or a zero-emission vehicle (ZEV). The AFV definitions are based on the Alternative Fuels Infrastructure Directive (Directive 2014/94/EU).

Figure 2: Vehicle types and powertrains included in the model

Vehicle list: AFV=alternatively fuelled vehicle; ZEV=zero emissions vehicle

t_VehicleList

Index	Vehicle type	Powertrain/fue	Fuel	AFV	AFV non-zer	ZEV
1	Passenger cars	Petrol	Petrol	FALSE	FALSE	FALSE
2	Passenger cars	Diesel	Diesel	FALSE	FALSE	FALSE
3	Passenger cars	PHEV_Petrol	PHEV Petrol - Car	TRUE	TRUE	FALSE
4	Passenger cars	PHEV_Diesel	PHEV Diesel - Car	TRUE	TRUE	FALSE
5	Passenger cars	LPG	LPG	TRUE	TRUE	FALSE
6	Passenger cars	CNG	CNG	TRUE	TRUE	FALSE
7	Passenger cars	E85	Ethanol	TRUE	FALSE	TRUE
8	Passenger cars	Electric	Electricity	TRUE	FALSE	TRUE
9	Passenger cars	Fuel Cell	Hydrogen	TRUE	FALSE	TRUE
10	Vans	Petrol	Petrol	FALSE	FALSE	FALSE
11	Vans	Diesel	Diesel	FALSE	FALSE	FALSE
12	Vans	PHEV_Petrol	PHEV Petrol - Van	TRUE	TRUE	FALSE
13	Vans	PHEV_Diesel	PHEV Diesel - Van	TRUE	TRUE	FALSE
14	Vans	LPG	LPG	TRUE	TRUE	FALSE
15	Vans	CNG	CNG	TRUE	TRUE	FALSE
16	Vans	Electric	Electricity	TRUE	FALSE	TRUE
17	Vans	Fuel Cell	Hydrogen	TRUE	FALSE	TRUE
18	Rigid trucks	Diesel	Diesel	FALSE	FALSE	FALSE
19	Rigid trucks	Diesel Hybrid	Diesel	FALSE	FALSE	FALSE
20	Rigid trucks	LPG	LPG	TRUE	TRUE	FALSE
21	Rigid trucks	CNG	CNG	TRUE	TRUE	FALSE
22	Rigid trucks	Electric	Electricity	TRUE	FALSE	TRUE
23	Rigid trucks	Fuel Cell	Hydrogen	TRUE	FALSE	TRUE
24	Buses	Diesel	Diesel	FALSE	FALSE	FALSE
25	Buses	Diesel Hybrid	Diesel	FALSE	FALSE	FALSE
26	Buses	LPG	LPG	TRUE	TRUE	FALSE
27	Buses	LNG	LNG	TRUE	TRUE	FALSE
28	Buses	Electric	Electricity	TRUE	FALSE	TRUE
29	Buses	Fuel Cell	Hydrogen	TRUE	FALSE	TRUE

The size and age profile of the publicly procured fleet is first calculated so that vehicle mileage, energy consumption, emissions and costs can be calculated later in the model.

The total number of vehicles procured in each modelling year was derived from analysis of the TED database (see Section 3.1.1) and the projected growth in new vehicle registrations in REF2016+. The number of vehicle procurements is assumed to be the same in the baseline and in all policy options. For each policy option separate distributions were produced based on the relevant definition of that policy option.

The calculation also takes into account vehicle survival rates[27] and can be summarised as:

*Number of vehicles in the fleet in that year = number of vehicles procured * survival % in that year.*

Based on the year of procurement and modelling year, the vehicle fleet can therefore be tracked over the course of the policy assessment period. For example, in 2022 the total number of petrol passenger cars in the publicly procured fleet would be: (vehicle procurements in 2020 * survival rate for vehicle age 2) + (vehicle procurements in 2021 * survival rate for vehicle age 1) + (vehicle procurements in 2022 * survival rate for vehicle age 0). An illustration of this is provided in Figure 3 to aid understanding.

[27] Survival rates were obtained from Ricardo Energy & Environment's SULTAN model, which has been calibrated to the EU Reference Scenario

Figure 3: Snapshot of the publicly procured vehicle fleet calculations

Calculation of the public sector fleet in the baseline scenario

This sheet calculates the size/age profile of the public sector fleet so that vehicle mileage, energy consumption, emissions and costs can be calculated
It takes into account vehicle survival rates and the overall calculation is
*No. purchases in that year * survival % in that year no = number of vehicles in the fleet in that year*

No. veh type	No. of years	Check table rows	Manual check (Index=120):						
33	17	TRUE		TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE

Year (in number format) >> 2019 2020 2021 2022 2023 2024

t_B_FleetProfile

Index	Veh. Index	Vehicle type	Powertrain/fuel	Year of purcha	Lookup - year of purchase	2019	2020	2021	2022	2023	2024
1	1	Passenger cars	Petrol	2019	4	0	0	0	0	0	0
2	1	Passenger cars	Petrol	2020	5	0	37,474	37,337	37,170	36,966	36,716
3	1	Passenger cars	Petrol	2021	6	0	0	37,660	37,523	37,356	37,150
4	1	Passenger cars	Petrol	2022	7	0	0	0	37,847	37,709	37,541
5	1	Passenger cars	Petrol	2023	8	0	0	0	0	38,034	37,896
6	1	Passenger cars	Petrol	2024	9	0	0	0	0	0	38,221
7	1	Passenger cars	Petrol	2025	10	0	0	0	0	0	0
8	1	Passenger cars	Petrol	2026	11	0	0	0	0	0	0
9	1	Passenger cars	Petrol	2027	12	0	0	0	0	0	0
10	1	Passenger cars	Petrol	2028	13	0	0	0	0	0	0
11	1	Passenger cars	Petrol	2029	14	0	0	0	0	0	0
12	1	Passenger cars	Petrol	2030	15	0	0	0	0	0	0
13	1	Passenger cars	Petrol	2031	16	0	0	0	0	0	0
14	1	Passenger cars	Petrol	2032	17	0	0	0	0	0	0
15	1	Passenger cars	Petrol	2033	18	0	0	0	0	0	0
16	1	Passenger cars	Petrol	2034	19	0	0	0	0	0	0
17	1	Passenger cars	Petrol	2035	20	0	0	0	0	0	0

Step 2: Calculation of vehicle mileage

The total vehicle mileage by vehicle type and powertrain option for each modelling year are then calculated based on the vehicle fleet profile (Step 1). The calculation can be summarised as:

*Vehicle mileage (km) = number of vehicles in the fleet * average annual mileage (in km) for that age vehicle.*

For example, in 2022, the total mileage of petrol passenger cars in the fleet would be (number of vehicles procured in 2020 * mileage for vehicles in third year of ownership) + (number of vehicles procured in 2021 * mileage for vehicles in second year of ownership) + (number of vehicles procured in 2022 * mileage for vehicles in first year of ownership).

Figure 4: Snapshot of the vehicle mileage calculations

Vehicle mileage in the baseline

This sheet calculates the vehicle mileage of the public sector fleet for each year of the assessment period
The overall calculation is as follows:
*Vehicle mileage (km) = no of veh in the fleet * average annual mileage for that age vehicle*

No. veh ty	No. of years	Check table rows	Manual check (Index=308):						
33	17	TRUE		TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE

Fleet lookup >> 7 8 9 10 11 12
Year (in number format) >> 2019 2020 2021 2022 2023 2024

t_B_Mileage

Index	Veh. Index	Vehicle type	Powertrain/fuel	Year of purchase	2019	2020	2021	2022	2023	2024
1	1	Passenger cars	Petrol	2019	0	0	0	0	0	0
2	1	Passenger cars	Petrol	2020	0	1,139,945,415	1,062,877,082	997,685,844	721,057,495	671,720,605
3	1	Passenger cars	Petrol	2021	0	0	1,145,628,123	1,068,175,599	1,002,659,378	724,652,017
4	1	Passenger cars	Petrol	2022	0	0	0	1,151,310,831	1,073,474,116	1,007,632,912
5	1	Passenger cars	Petrol	2023	0	0	0	0	1,156,993,539	1,078,772,633
6	1	Passenger cars	Petrol	2024	0	0	0	0	0	1,162,676,246
7	1	Passenger cars	Petrol	2025	0	0	0	0	0	0
8	1	Passenger cars	Petrol	2026	0	0	0	0	0	0
9	1	Passenger cars	Petrol	2027	0	0	0	0	0	0
10	1	Passenger cars	Petrol	2028	0	0	0	0	0	0
11	1	Passenger cars	Petrol	2029	0	0	0	0	0	0
12	1	Passenger cars	Petrol	2030	0	0	0	0	0	0
13	1	Passenger cars	Petrol	2031	0	0	0	0	0	0
14	1	Passenger cars	Petrol	2032	0	0	0	0	0	0
15	1	Passenger cars	Petrol	2033	0	0	0	0	0	0
16	1	Passenger cars	Petrol	2034	0	0	0	0	0	0
17	1	Passenger cars	Petrol	2035	0	0	0	0	0	0

Step 3: Calculation of energy and emissions

In the next step, all energy consumption and vehicle emissions calculations are performed. Again, these are performed for every modelling year. The following results are calculated:

- Energy consumption – based on mileage and energy consumption per vehicle-kilometre
- Tailpipe CO_2 emissions – based on mileage and real-world CO_2 emissions per km
- Tailpipe NO_x emissions – based on mileage and emissions factor per km
- Tailpipe PM emissions – based on mileage and emissions factor per km
- Tailpipe NMHC emissions – based on mileage and emissions factor per km

For all these calculations, vehicle mileage was taken from **Step 2**, while energy consumption and emissions factors were derived from the source data listed in **Error! Reference source not found.**. An example of the energy consumption calculations is shown in Figure 5.

Figure 5: Snapshot of the energy and emissions calculations in the model

Policy package: energy and emissions calculations

		Check table size	Check results
Go	*Energy consumption*	TRUE	TRUE
Go	*Tailpipe CO2*	TRUE	TRUE
Go	*NMHCs*	TRUE	TRUE
Go	*NOx*	TRUE	TRUE
Go	*PM*	TRUE	TRUE

Energy consumption MJ

*Vehicle km * Energy consumption in MJ/vkm*

No. veh types	No. of years	Check table rows	Manual check (Index=18)						
33	17	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
			Year >>	6	7	8	9	10	11

t_P_Energy

Index	Vehicle index	Year of purchase	Column	2019	2020	2021	2022	2023	2024
1	1	2019	8	0	0	0	0	0	0
2	1	2020	9	0	2,484,272,981	2,316,318,644	2,174,247,954	1,571,394,234	1,463,874,786
3	1	2021	10	0	0	2,475,051,350	2,307,720,460	2,166,177,137	1,565,561,213
4	1	2022	11	0	0	0	2,465,394,048	2,298,716,060	2,157,725,019
5	1	2023	12	0	0	0	0	2,455,301,075	2,289,305,442
6	1	2024	13	0	0	0	0	0	2,444,772,431
7	1	2025	14	0	0	0	0	0	0
8	1	2026	15	0	0	0	0	0	0
9	1	2027	16	0	0	0	0	0	0
10	1	2028	17	0	0	0	0	0	0
11	1	2029	18	0	0	0	0	0	0

Step 4: Calculation of costs

Next, all the cost calculations are performed for every modelling year. The following costs are calculated:

- Vehicle upfront costs – based on the number of vehicles publicly procured and the price of the vehicle
- Administration costs (for both procurers and suppliers) – based on the number of procurement contracts[28] and the admin cost per contract
- Annual vehicle fixed costs (covering operation, maintenance and insurance) – based on the number of vehicles in the fleet and the average annual cost per vehicle
- Fuel cost (excluding taxes) – based on the energy consumption and the price of fuel/energy

[28] The average number of vehicles procured per contract was derived from analysis of the ex-post evaluation stakeholder survey

- Fuel tax revenue – based on the energy consumption and the tax element of fuel/energy
- Emissions costs – based on the emissions and the emissions costs from the Updated Handbook on External Costs of Transport[29].

The data for these calculations has been derived from the sources listed in **Error! Reference source not found.**. An example of the administration cost calculations is provided in Figure 6.

Figure 6: Snapshot of the calculations in the costs section of the model

Number of contracts

Number of vehicles procured / vehicles per contract (for each vehicle type)

Figures in use: TED - total procuremen 2 *<< chooses input table*

No. years	*Check table columns*
17	TRUE

t_B_NoContracts

		7	8	9	10	11
Index	Vehicle type	2019	2020	2021	2022	2023
1	Passenger cars	845	876	894	912	931
2	Vans	715	722	737	752	766
3	Rigid trucks	670	667	681	695	709
4	Buses	423	426	434	443	451

Admin costs 2016€ - procurers

*Number of contracts * admin cost*

No. years	*Check table columns*
17	TRUE

t_B_AdminCosts

	No. procured vehicles >>	3	4	5	6	7
Index	Cost category	2019	2020	2021	2022	2023
1	Passenger cars	€ 0	€ 53,852	€ 54,982	€ 56,113	€ 57,244
2	Vans	€ 0	€ 44,390	€ 45,305	€ 46,220	€ 47,136
3	Rigid trucks	€ 0	€ 41,013	€ 41,869	€ 42,725	€ 43,581
4	Buses	€ 0	€ 26,205	€ 26,710	€ 27,215	€ 27,719

Step 5: Calculation of impacts

In the last step, the results from the previous steps are collated in results tables for easier analysis. Tables are generated for both the baseline scenario and the policy option being analysed. As shown in Figure 7, a total table (showing the overall results from all vehicles) is produced, as well as individual tables for each vehicle type.

[29] Damage costs for 'All areas' were used, rather than an urban/rural split as the model works on an EU level. In the Handbook, costs are presented in 2010 Euros. The values were converted to 2016 Euros and at the request of DG MOVE, the same emissions costs were used for all years in the analysis (€97 per tonne CO_2, €1,696 per tonne NMHCs, €11,520 per tonne NO_x, €42,880 per tonne PM – all values in €, 2016.

Figure 7: Snapshot of the results calculations

Baseline - summary of non-discounted costs

Scenario: Baseline

	Category	Units	2019	2020	2021	2022	2023	2024
TOTAL	Number of vehicles bough	Number	0	121,939	124,471	127,003	129,535	132,068
	No. of AFVs	Number	0	10,417	11,929	13,440	14,951	16,463
	Percent AFVs	%	0%	9%	10%	11%	12%	12%
	No. of AFV non-zero	Number	0	8,022	8,814	9,607	10,399	11,192
	No. of ZEVs	Number	0	2,395	3,114	3,833	4,552	5,271
	Admin costs to procurers	€	0	165,459	168,866	172,273	175,680	179,087
	Admin costs to suppliers	€	0	182,946	186,713	190,480	194,247	198,014
	Capital costs	€	0	6,699,409,426	6,880,190,458	7,058,196,823	7,233,428,521	7,405,885,551
	Annual fixed costs	€	0	317,040,579	637,433,450	960,650,062	1,286,099,554	1,613,121,323
	Energy consumption	GJ	0	19,068,348	37,495,516	54,827,550	70,177,962	84,566,120
	Fuel costs	€	0	384,669,294	771,146,226	1,149,125,879	1,498,659,191	1,839,248,128
	Fuel tax revenues	€	0	380,769,418	748,483,371	1,094,546,362	1,398,681,066	1,683,804,760
	CO2 emissions	tonnes	0	1,361,929	2,672,023	3,897,820	4,977,592	5,983,647
	NMHC emissions	kg	0	107,901	211,468	310,894	389,617	465,105
	NOx emissions	kg	0	794,352	1,424,541	2,015,973	2,514,310	2,997,971
	PM emissions	kg	0	27,492	53,807	78,587	99,450	119,062
	CO2 costs	€	0	132,714,154	260,377,261	379,825,918	485,045,083	583,080,875
	NMHC costs	€	0	182,952	358,556	527,138	660,617	788,611
	NOx costs	€	0	9,151,132	16,411,066	23,224,510	28,965,484	34,537,381
	PM costs	€	0	1,178,855	2,307,259	3,369,834	4,264,440	5,105,417

	Category	Units	2019	2020	2021	2022	2023	2024
Passenger cars	Number of vehicles bough	Number	0	84,937	86,720	88,503	90,287	92,070
	No. of AFVs	Number	0	7,330	8,289	9,248	10,208	11,167
	Percent AFVs	%	0%	9%	10%	10%	11%	12%
	No. of AFV non-zero	Number	0	6,341	6,916	7,492	8,068	8,644
	No. of ZEVs	Number	0	989	1,373	1,756	2,140	2,523
	Admin costs to procurers	€	0	53,852	54,982	56,113	57,244	58,374
	Admin costs to suppliers	€	0	59,543	60,793	62,044	63,294	64,544
	Capital costs	€	0	1,845,509,164	1,900,340,692	1,953,794,037	2,005,869,199	2,056,566,178
	Annual fixed costs	€	0	117,813,064	237,649,242	359,406,742	482,960,449	608,156,906
	Energy consumption	GJ	0	4,735,504	9,178,242	13,374,429	16,442,968	19,320,301
	Fuel costs	€	0	94,654,364	186,951,305	277,503,381	347,494,745	415,677,078

The costs were then discounted, to work out the net present value. By default, a 4% discount rate has been implemented and discounting starts after 2020.

The discounted costs were then used to calculate the potential impacts of the policy option. For each impact category, the results from the baseline are subtracted from the policy option to calculate the change. For example, in the case of capital costs the calculation would be:

Impact on capital costs = Policy option capital costs – baseline capital costs

9.4 *Model outputs*

The model calculates results for a range of impact categories. As shown in Table 9-1, results are calculated for different periods, depending on the type of impact. For example, vehicle capital costs are calculated for 2020-2035 (the assessment period during which vehicles are procured), while annual fixed costs are calculated for all years between 2020 and 2050 (thus covering the lifetime of the vehicles – assuming an average 15-year lifetime).

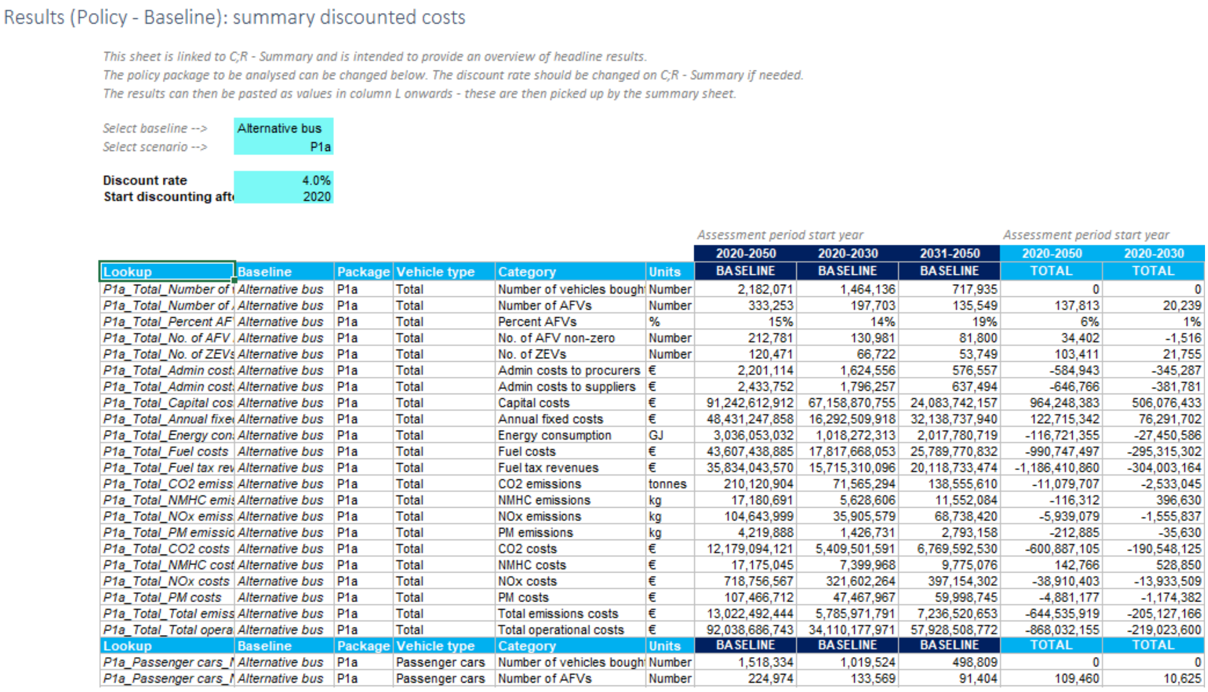
Table 9-1: List of model outputs and the range of years results are calculated for

Impact category	Period results are calculated
Number of vehicles procured	
Number and % of AFVs	2020-2035
Number and % of non-zero emissions AFVs	2020-2035
Number and % of ZEVs	2020-2035
Admin costs to procurers	2020-2035
Admin costs to suppliers	2020-2035
Capital costs	2020-2035

Annual fixed costs (covering operation, maintenance and insurance)	2020-2050
Fuel costs (excluding tax)	2020-2050
Fuel tax revenues	2020-2050
Energy and emissions	
Energy consumption	2020-2050
CO_2, NO_x, PM and NMHC emissions	2020-2050
Externalities	
CO_2, NO_x, PM and NMHC emission costs.	2020-2050

The results are then presented in terms of the impact compared to the baseline. However, as shown in Figure 8, the absolute values in the baseline (dark blue cells in the figure) are also displayed to help put the results into perspective. Results for different periods can also be displayed, corresponding to particular phases of policy packages. For example, in most policy options different thresholds are introduced in later years (e.g. 2025 and 2030) – results can then be viewed specifically for these periods to assess the effect.

Figure 8: Snapshot of the outputs produced by the model


Results (Policy - Baseline): summary discounted costs

This sheet is linked to C;R - Summary and is intended to provide an overview of headline results.
The policy package to be analysed can be changed below. The discount rate should be changed on C;R - Summary if needed.
The results can then be pasted as values in column L onwards - these are then picked up by the summary sheet.

Select baseline --> Alternative bus
Select scenario --> P1a

Discount rate 4.0%
Start discounting aft 2020

						Assessment period start year			*Assessment period start year*	
						2020-2050	2020-2030	2031-2050	2020-2050	2020-2030
Lookup	Baseline	Package	Vehicle type	Category	Units	BASELINE	BASELINE	BASELINE	TOTAL	TOTAL
P1a_Total_Number of	Alternative bus	P1a	Total	Number of vehicles bough	Number	2,182,071	1,464,136	717,935	0	0
P1a_Total_Number of	Alternative bus	P1a	Total	Number of AFVs	Number	333,253	197,703	135,549	137,813	20,239
P1a_Total_Percent AF	Alternative bus	P1a	Total	Percent AFVs	%	15%	14%	19%	6%	1%
P1a_Total_No. of AFV	Alternative bus	P1a	Total	No. of AFV non-zero	Number	212,781	130,981	81,800	34,402	-1,516
P1a_Total_No. of ZEVs	Alternative bus	P1a	Total	No. of ZEVs	Number	120,471	66,722	53,749	103,411	21,755
P1a_Total_Admin cost	Alternative bus	P1a	Total	Admin costs to procurers	€	2,201,114	1,624,556	576,557	-584,943	-345,287
P1a_Total_Admin cost	Alternative bus	P1a	Total	Admin costs to suppliers	€	2,433,752	1,796,257	637,494	-646,766	-381,781
P1a_Total_Capital cos	Alternative bus	P1a	Total	Capital costs	€	91,242,612,912	67,158,870,755	24,083,742,157	964,248,383	506,076,433
P1a_Total_Annual fixe	Alternative bus	P1a	Total	Annual fixed costs	€	48,431,247,858	16,292,509,918	32,138,737,940	122,715,342	76,291,702
P1a_Total_Energy con	Alternative bus	P1a	Total	Energy consumption	GJ	3,036,053,032	1,018,272,313	2,017,780,719	-116,721,355	-27,450,586
P1a_Total_Fuel costs	Alternative bus	P1a	Total	Fuel costs	€	43,607,438,885	17,817,668,053	25,789,770,832	-990,747,497	-295,315,302
P1a_Total_Fuel tax rev	Alternative bus	P1a	Total	Fuel tax revenues	€	35,834,043,570	15,715,310,096	20,118,733,474	-1,186,410,860	-304,003,164
P1a_Total_CO2 emiss	Alternative bus	P1a	Total	CO2 emissions	tonnes	210,120,904	71,565,294	138,555,610	-11,079,707	-2,533,045
P1a_Total_NMHC emi	Alternative bus	P1a	Total	NMHC emissions	kg	17,180,691	5,628,606	11,552,084	-116,312	396,630
P1a_Total_NOx emiss	Alternative bus	P1a	Total	NOx emissions	kg	104,643,999	35,905,579	68,738,420	-5,939,079	-1,555,837
P1a_Total_PM emissic	Alternative bus	P1a	Total	PM emissions	kg	4,219,888	1,426,731	2,793,158	-212,885	-35,630
P1a_Total_CO2 costs	Alternative bus	P1a	Total	CO2 costs	€	12,179,094,121	5,409,501,591	6,769,592,530	-600,887,105	-190,548,125
P1a_Total_NMHC cost	Alternative bus	P1a	Total	NMHC costs	€	17,175,045	7,399,968	9,775,076	142,766	528,850
P1a_Total_NOx costs	Alternative bus	P1a	Total	NOx costs	€	718,756,567	321,602,264	397,154,302	-38,910,403	-13,933,509
P1a_Total_PM costs	Alternative bus	P1a	Total	PM costs	€	107,466,712	47,467,967	59,998,745	-4,881,177	-1,174,382
P1a_Total_Total emiss	Alternative bus	P1a	Total	Total emissions costs	€	13,022,492,444	5,785,971,791	7,236,520,653	-644,535,919	-205,127,166
P1a_Total_Total opera	Alternative bus	P1a	Total	Total operational costs	€	92,038,686,743	34,110,177,971	57,928,508,772	-868,032,155	-219,023,600
Lookup	Baseline	Package	Vehicle type	Category	Units	BASELINE	BASELINE	BASELINE	TOTAL	TOTAL
P1a_Passenger cars_	Alternative bus	P1a	Passenger cars	Number of vehicles bough	Number	1,518,334	1,019,524	498,809	0	0
P1a_Passenger cars_	Alternative bus	P1a	Passenger cars	Number of AFVs	Number	224,974	133,569	91,404	109,460	10,625

Finally, the results of all policy options can be compared in the form of results tables, as shown in Figure 9. Again, these can be displayed for different periods. Prior to presentation in the report the values are rounded to an appropriate number of significant figures.

Figure 9: Model output tables

Summary of impacts - Sums for relevant period - EU Reference Scenario 2016+ baseline

Date results pasted in: 26/09/2017
Model version used: Cost benefit model v3.58

1. Results for 2020-2050

Category of impact	Unit	Type of vehicle	Baseline	P0	P1a	P1b	P2a
Number of AFVs	Number	Total	268,564	0	153,985	296,360	450,106
Number of AFVs		Passenger cars	224,974	0	109,460	191,641	392,778
Number of AFVs		Vans	17,547	0	17,280	32,647	57,328
Number of AFVs		Rigid trucks	10,994	0	594	-3,131	0
Number of AFVs		Buses	15,050	0	26,651	75,203	0
			Baseline	P0	P1a	P1b	P2a
Admin costs to procurers	million ls over 202(	Total	2.2	-2.2	-0.6	-0.2	-0.7
Admin costs to procurers		Passenger cars	0.7	-0.7	-0.2	-0.1	-0.2
Admin costs to procurers		Vans	0.6	-0.6	-0.2	0.0	-0.2
Admin costs to procurers		Rigid trucks	0.6	-0.6	-0.1	0.0	-0.2
Admin costs to procurers		Buses	0.3	-0.3	-0.1	0.0	-0.1
			Baseline	P0	P1a	P1b	P2a
Admin costs to suppliers	million ls over 202(	Total	2.4	-2.4	-0.6	-0.2	-0.8
Admin costs to suppliers		Passenger cars	0.8	-0.8	-0.2	-0.1	-0.3
Admin costs to suppliers		Vans	0.6	-0.6	-0.2	0.0	-0.2
Admin costs to suppliers		Rigid trucks	0.6	-0.6	-0.2	0.0	-0.2
Admin costs to suppliers		Buses	0.4	-0.4	-0.1	0.0	-0.1
			Baseline	P0	P1a	P1b	P2a
Capital costs	million ls over 202(	Total	88,845	0	1,300	3,950	1,960
Capital costs		Passenger cars	25,247	0	290	200	1,680
Capital costs		Vans	3,461	0	40	-10	280
Capital costs		Rigid trucks	12,551	0	150	670	0
Capital costs		Buses	47,586	0	820	3,090	0

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