CREDITING SYSTEM FOR LOW-CARBON FUELS

Critical review of the European Commission's Impact Assessment

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EXECUTIVE SUMMARY

KEY FINDINGS IN A NUTSHELL

- A crediting system for low-carbon fuels (LCF-crediting) allows vehicle manufacturers to voluntarily finance additional renewable fuels (on top of the fuel supplier obligation) and credit the corresponding emission reductions against their emission targets for new vehicles ('fleet targets').
- Introducing a crediting system should be a "no regret" measure for climate protection:
  - LCF-crediting constitutes a valuable low-carbon option as it ensures that climate targets can be met, even under suboptimal circumstances.
  - LCF-crediting would be voluntary for the manufacturers and consumers who are best-placed to choose the most cost-efficient and suitable low-carbon technology. Replies to a consultation questions clearly show that most stakeholders support the introduction of a crediting system.
  - LCF-crediting can be implemented at limited additional administrative cost since it builds on pre-existing monitoring and reporting processes for the fuel supplier obligation (from Renewable Energy Directive, RED II).
- Crediting is also a step towards a more holistic, resilient and effective climate policy that is technology-neutral, takes consumers' preferences into account and considers emissions beyond the tailpipe.
- The European Commission (EC) rejected the introduction of an LCF-crediting system. However, the methodology in the EC's Impact Assessment is inadequate to capture the value of crediting since it ignores the possibility that fleet targets are missed without a crediting system (as happened in 2020) and fails to capture basic properties of the new vehicle market (heterogeneity of vehicles types/use cases and uncertainty about future cost developments).

On 14 July 2021, the European Commission (EC) published the "Fit-for-55" package, which includes a review of the CO_2 emission standards for new passenger cars and light commercial vehicles ('fleet targets'). In this review ("Impact Assessment", IA), the European Commission rejected the idea of introducing a crediting system for low-carbon fuels (LCF).[1]

In such a crediting system[2], OEMs could voluntarily buy credits from fuel suppliers having supplied additional volumes of LCF (beyond their own obligation and

[1] The EC defines LCF as renewable and low-carbon fuels suppliers use to comply with the transport fuel targets set in the Renewable Energy Directive (see IA, p. 32).

[2] In May 2020, Frontier Economics Ltd. ("Frontier")") published a study on behalf of the German Federal Ministry for Economic Affairs and Energy (BMWi) where we developed a crediting system for renewable fuels, available online https://www.bmwi.de/Redaktion/DE/Downloads/C-D/crediting-system-for-renewable-fuels.pdf?__blob=publicationFile&v=4. The EC has referenced our proposed crediting system in the Impact Assessment SWD(2021) 613 final, Part 1, p. 32.

subject to the same sustainability criteria and caps[3]) and count the corresponding emission savings against their fleet emissions.

The eFuel Alliance, CLEPA, NGVA and VDMA have commissioned Frontier Economics Ltd. ("Frontier") to review the EC's Impact Assessment of a low-carbon fuel crediting system and summarise the findings in this report.

The methodology in the Impact Assessment is inadequate

We benchmark the methodology of the IA against the guidelines[4] which set out key requirements for impact assessments conducted by the EC ("IA guidelines").

We find that the IA does not comply with the guidelines and therefore cannot provide a robust basis for an informed policy decision:

- **The IA relies on the wrong benchmark / counterfactual** – Robust end results are contingent on the IA considering the appropriate benchmark, i.e. what could happen without the introduction of a LCF crediting system. The IA only considers "achieving (any) target through battery-electric vehicles", ignoring other technologies (such as plug-in hybrids or fuel-cell electric vehicles) or "missing the fleet targets" (as in 2020, despite temporary provisions that ease target achievement).
- **The analysis is overly simplified and fails to capture basic properties of the new vehicle market** – The new vehicle market, in practice, is characterised by the heterogeneity of vehicle types and use cases, uncertainty about future market developments and dynamic changes over time. None of these aspects are covered by the IA.

Crediting is a valuable low-carbon option for the environment, consumers and manufacturers

The new vehicle market is characterised by **high uncertainty** (e.g. prevailing battery technology and future cost reductions) and **heterogeneity** (different vehicle types and usage patterns), which precludes efforts to fully determine the optimal mix of low-carbon technologies in 2030 and beyond.

In this environment, a voluntary LCF-crediting system can provide **significant benefits** for the environment, consumers and manufacturers. Low-carbon fuels are already present in the market and there is growing global supply. A crediting system would be feasible in the short term to fill target gaps if, for example, insufficient electric vehicles were sold (e.g. because the rollout of charging infrastructure was delayed). This helps ensure that climate targets can be met, even under suboptimal circumstances, and that consumers can choose from wider-ranging low-carbon options. Public consultation responses confirm that there is **wide stakeholder support** for a crediting system. For climate impact, **cumulative GHG emissions matter ("budget principle")**, which renders

[3] The Renewable Energy Directive (RED II) specifies requirements and CO_2 savings based on feedstock and production technology. RED II also limits the use of first-generation biofuels from food and feed crops (Art. 26 (1) which would also include all volumes used for crediting.

[4] https://ec.europa.eu/info/sites/default/files/better-regulation-guidelines-impact-assessment.pdf

transformation pathways highly relevant (not just photo years as analysed in the IA).

The methodology in the IA is unsuited to capture this option value of LCF-crediting since it fails to address the key market characteristics or consider the possibility of target failure (unlike reality, when 2020 emission standards were exceeded, despite less ambitious targets than envisaged for 2030 and temporary provisions that eased the target achievement).

A crediting system can be implemented at limited administrative cost

An LCF-crediting system can be implemented with a **limited additional administrative burden**, since it builds on pre-existing monitoring and reporting processes for the RED II fuel supplier obligation.

Since all LCF credits are generated through the same existing system, compliance checks are straightforward and require minimal additional effort from national authorities. Already now, part of the fuel supplier obligation entails LCF sold by fuel suppliers to final customers (a prerequisite for credits) being reported on an intra-year basis and entered on national databases. The current timing for fuel suppliers is already compatible or can be aligned with minimal effort.

As part of the RED III draft, the EC has proposed further strengthening and expanding the role of the future Union database for renewable fuels, which would further streamline the reporting and verification process.

The IA claims (without providing evidence) that implementing an LCF-crediting system would be very complex and involve a significant administrative burden. This contradicts the EC's own assessment of a "*limited*"[5] administrative burden for expanding the future RED Union database.

A voluntary crediting system is a "no regret" measure and a step towards a holistic, resilient and effective climate policy

In a complex and dynamic market for new vehicles, **flexible policies** that entail a portfolio of low-carbon technologies and decentralised decision making (from the perspectives of manufacturers and consumers) are key to ensuring we meet climate targets effectively, at the lowest possible cost and in accordance with consumer preferences and needs. Given the limited additional administrative costs of implementing a crediting system, introducing this option constitutes a **"no regret" measure**.

To be credible and effective, a **more holistic view** of climate protection is needed, encompassing true emissions from different mobility options throughout the entire value chain (from battery and vehicle production, power and fuel mix to recycling). A crediting system would be a first step towards a more holistic policy as it bridges the gap between fuel provision and OEM regulation.

[5] RED III Impact Assessment SWD(2021) 621 final, p. 128.

The climate challenge is significant and time is short – the remaining global emission budget to limit the overall average temperature increase to 1.5°C may be exhausted in under two decades unless emissions are drastically reduced.[6] Given this urgency it seems **inappropriate to exclude technologies** (such as combustion engines with low-carbon fuels) and put "all the eggs in one basket". A lack of available technology options might otherwise become a reason to fail climate targets, which, in turn is expected to cause irreversible long-term damage. A regulation which instead focuses on resilience is better-placed to provide a level playing field for wide-ranging technologies and thereby support the delivery of climate targets in a dynamic and uncertain market environment.

[6] https://www.ipcc.ch/sr15/chapter/chapter-2/, see Figure 2.3.

1 INTRODUCTION

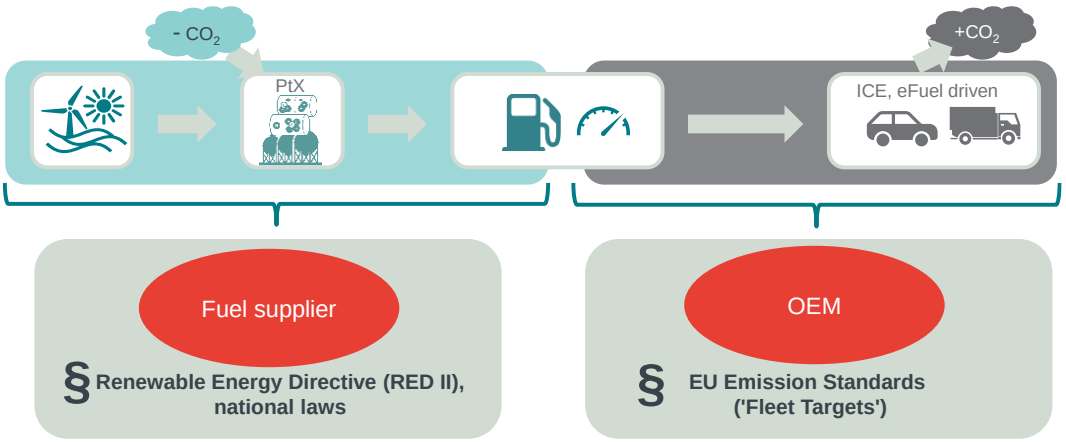
In this section, we provide the background (Section 1.1) and (Section 1.2) of this report. In Section 1.3, we set out its scope and structure.

1.1 Vehicle manufacturers are subject to fleet targets for new vehicles

The EU legal framework for reducing CO_2 emissions in the road transport sector separates responsibilities along the supply chain (Figure 1):

- **Fuel suppliers** (renewable fuel quota) – Fuel suppliers are mainly responsible for the fuel supply chain. Regulations such as the revised Renewable Energy Directive[7] ("RED II") and further regulatory requirements[8] essentially focus on the quantities and mix of fuel consumed.
- **Vehicle manufacturers** (fleet targets) – Vehicle manufacturers (often referred to as Original Equipment Manufacturers, "OEMs") are held accountable for direct vehicle emissions (regardless of the used fuel mix), i.e. en route from tank to wheels. The main instrument for regulating emission reductions is the set of emission performance standards for new vehicles[9] (also referred to as "fleet targets"), which focuses on imputed ("tailpipe") emissions based on fleet values for new vehicles.

Figure 1 Schematic overview of the regulatory separation along the fuel chain (example: eFuel)



Source: Frontier Economics

The EU legislative framework on fleet targets (see text box below) does not differentiate between fossil and renewable fuels. In the long run, car manufacturers (OEMs) can only cut their fleet emissions by selling non-hydrocarbon fuelled

[7] Directive (EU) 2018/2001.

[8] Such as Directive 2009/30/EC (Fuel Quality Directive) and the German Federal Pollution Control Act (BImSchG).

[9] Regulation (EU) 2019/631 (passenger cars and for new light commercial vehicles) and Regulation (EU) 2019/1242 (heavy-duty vehicles).

vehicles – particularly electric – on the market.[10] However, the intended objective of the regulation is to reduce GHG emissions from vehicles – and not to determine the technology mix.

EU FLEET TARGET REGULATION FOR CARS AND VANS

The EU Regulation[11] that governs the fleet targets for light duty vehicles (passenger cars/vans) has the following key features:

- **Tank-to-wheel approach ("tailpipe" emissions) –** Accordingly, only vehicle tailpipe emissions are relevant in the current context, regardless of the origin and CO_2 intensity of the fuel or electricity used.
- **A single annual EU-wide fleet target for each OEM** – For each OEM, a single EU-wide fleet target applies for each of the segments (cars and vans). Fleet targets are set annually and comprise all new vehicles registered the same year.
- **Targets tightened over time** – The basic premise is that all OEMs should lower the average Europe-wide CO_2 emissions of their new vehicles each year below an increasingly stringent fleet limit value (*denotes the EC's current proposal):

	2020	2025 onwards	2030 onwards	2035 onwards
Cars	95 g CO_2/km [NEDC[12]]	-15% vs. 2021	-37.5% vs. 2021 (-55% vs. 2021*)	-100%* vs. 2021
Vans	147 g CO_2/km [NEDC]	-15% vs. 2021	-31% vs. 2021 (-50% vs. 2021*)	-100%* vs. 2021

- **Significant penalties for underperformance** – OEMs must pay a 'penalty' of 95 EUR/g CO_2/km times the number of new vehicles.

1.2 The EC has excluded a crediting system for low-carbon fuels in its review of fleet targets

On 14 July 2021, the EC published the "Fit-for-55" package, which comprises a set of proposals to revise and update EU legislation and put new initiatives in place to make EU policies fit for reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels.[13]

Part of the Fit-for-55 package is a review of the CO_2 emission standards for new passenger cars and light commercial vehicles. This review includes scope to account for emission reductions from low-carbon fuels (LCF) via a crediting

[10] The scope for fuel efficiency improvements of internal combustion engines, which provides a second option, is relatively limited.

[11] Regulation (EU) 2019/631 (passenger cars/vans).

[12] Target will be converted into WLTP values from 2021 onwards, with a conversion rate equal to the ratio between WLTP and NEDC emissions in 2020 (yet to be determined).

[13] https://ec.europa.eu/commission/presscorner/detail/en/IP_21_3541

system.[14] In such a crediting system, OEMs could – voluntarily – buy credits from fuel suppliers that have supplied additional volumes of LCF (beyond their own RED II obligation) and count the corresponding emission saving towards their own fleet emissions.

Frontier Economics Ltd. ("Frontier") has developed a proposal for an LCF-crediting system for renewable fuels in a study[15] for the German Ministry of Economics and Energy (BMWi), to which the EC referred to in its Impact Assessment (IA).[16]

The EC has rejected the introduction of an LCF-crediting system, citing the following claims:[17]

- **Blurred responsibility** – A crediting system would blur the responsibilities of fuels suppliers and OEMs. As we show in Section 2, however, a well-designed crediting system clearly demarcates responsibility for achieving the respective targets and prohibits double counting. OEMs would merely have another option to reduce their fleet emissions.
- **Undermine effectiveness** (environmental impact) – The basis for this claim is unclear. On the contrary, the IA results confirm that a crediting system would lower fleet emissions (despite an approach that underestimates potential benefits, see Section 4), thus rendering fleet regulation more effective.
- **Undermine efficiency** – A crediting system would make compliance and ownership costlier for consumers. We show in Section 5, that the IA significantly underestimates the benefits crediting would offer OEMs and consumers by ignoring uncertainty and heterogeneity in the market as well as the real[18] potential for OEMs to miss their target.
- **Increase administrative burden/complexity** – This claim is unfounded. We demonstrate in Section 6 that aligning the crediting system with existing institutions and processes for fuel suppliers (to monitor their RED II compliance) would minimise any additional administrative burden.

1.3 Scope and structure of this report

The eFuel Alliance, CLEPA, NGVA and VDMA have commissioned Frontier to review the EC's Impact Assessment of a low-carbon fuel crediting system and summarise the findings in this report.

We address the following questions:

[14] The review also includes a proposal to tighten fleet targets (see textbox above) and to reject a move towards life cycle emissions which would broaden the scope of emissions from tailpipe emissions to those throughout the life cycle of a new vehicle (from its production to its disposal).

[15] In May 2020, Frontier Economics Ltd. ("Frontier") published a study on behalf of the German Federal Ministry for Economic Affairs and Energy (BMWi) where we developed a crediting system for renewable fuels, available online https://www.bmwi.de/Redaktion/DE/Downloads/C-D/crediting-system-for-renewable-fuels.pdf?__blob=publicationFile&v=4.

[16] SWD(2021) 613 final, Part 1, p. 32.

[17] See COM(2021) 556 final, p. 9: "However, the preferred option is not to include such an accounting mechanism, as this would blur the responsibilities of different players to reach the targets, undermine the effectiveness and efficiency of the legislation and increase the administrative burden and complexity."

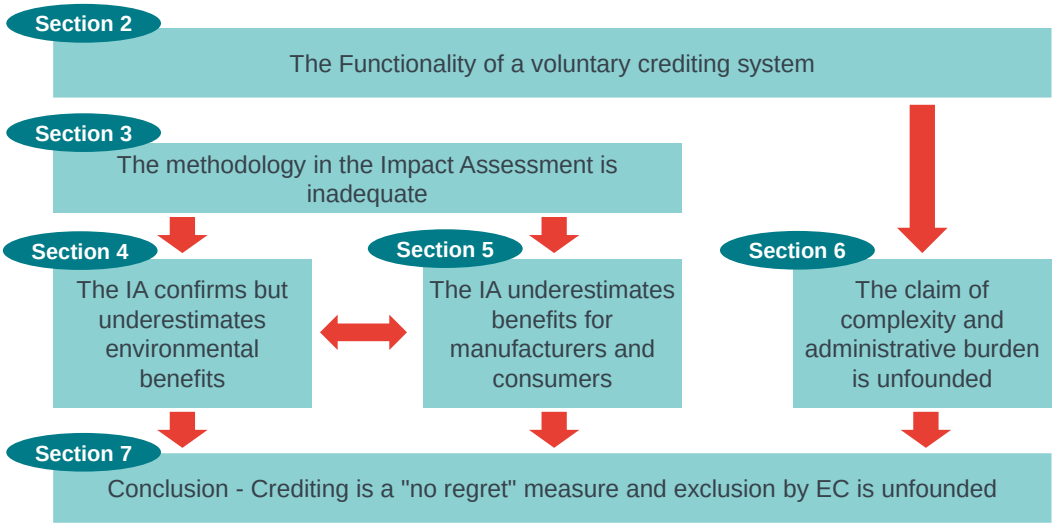
[18] On average, OEMs missed their 2020 targets, despite less ambitious targets than those proposed by the EC and significant subsidy schemes for electric vehicles which count as zero-emission vehicles, see Section 4.1.2.

- Does the IA provide the necessary information to make an informed policy decision?
- Does the IA contain appropriate methodology to assess the impact of a crediting system?
- What are the implications of the EC's proposal to exclude an LCF-crediting system?

Figure 2 sets out the structure of this report:

- In **Section 2**, we summarise the functionality of our proposed voluntary LCF-crediting system that demarcates responsibilities between fuel suppliers and OEMs and provides OEMs with an additional option to reduce emissions effectively and efficiently.
- In **Section 3**, details of the LCF-crediting system in the Impact Assessment only cover a few pages and include significant methodological deficiencies and shortfalls.
- In **Sections 4 and 5**, we set out how the Impact Assessment significantly underestimates benefits for the environment, manufacturers and consumers due to these methodological deficiencies.
- **Section 6** shows that the claim of increased complexity and administrative burden is unfounded, since an LCF-crediting system can be aligned with existing RED II reporting and monitoring processes.
- In **Section 7**, we conclude that a voluntary LCF system is a "no regret" measure and can thus significantly contribute to ensuring that tighter fleet targets can be achieved (at lower cost and considering consumer preferences and needs).

Figure 2 Structure of the report



Source: Frontier Economics

2 FUNCTIONALITY OF A VOLUNTARY CREDITING SYSTEM

Frontier has developed a crediting system for renewable fuels in a study[19] for the German Ministry of Economics and Energy (BMWi), which allows OEMs to voluntarily finance additional LCF (on top of the volumes mandated under RED II) and count the corresponding emission reductions against their fleet targets. The European Commission has referred to our proposal in their Impact Assessment.[20]

In this section we:

- Explain the basic concept of an LCF-crediting system (**Section 2.1**) that demarcates the responsibilities for achieving climate targets between fuels suppliers and OEMs; and
- Summarise the main properties of the proposed system (**Section 2.2**).

2.1 Concept of an LCF-crediting system that demarcates obligations for fuel suppliers and OEMs

Figure 3 illustrates the basic concept of an LCF-crediting system:

- **Fuel suppliers** sell low-carbon transport fuels into the market, which are then credited against their RED II renewable fuel quota.
- **Fuel suppliers** sell additional RED II-compliant low-carbon transport fuel volumes beyond their own renewable fuel quota. These volumes are financed[21] by **OEMs**, which receive credits in return. All RED II-compliant low-carbon fuels enter a single Union-wide database (in accordance with RED II, Art. 28 (2)) to prevent double counting against the renewable fuel quota (of the fuel supplier) and the fleet target (of the OEM).
- **OEMs** count these LCF credits from additional low-carbon fuel volumes – which would not otherwise have been supplied to the market – against the emissions of new vehicles in their fleet. The crediting system is designed to provide a level playing field and widen technology options. It also provides a climate-effective alternative to penalty payments if fleet targets are not met.

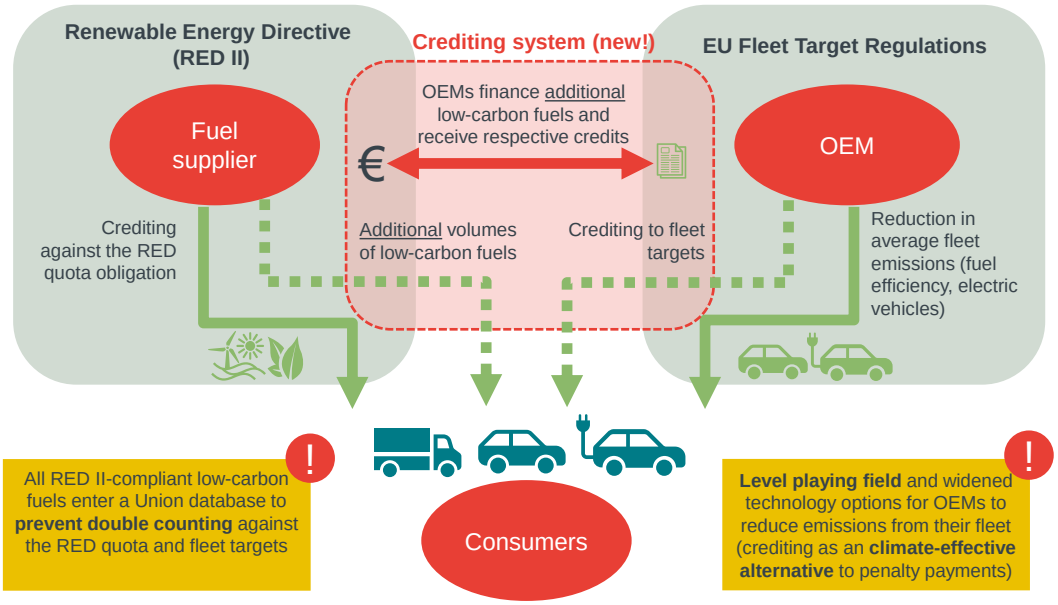
The crediting system therefore establishes a link between the fuel and vehicle sector, while still strictly demarcating the climate targets: fuel suppliers must fulfil their obligation under RED II and can only sell credits from additional LCF to OEMs. OEMs remain responsible for meeting their fleet targets but have a broader set of options to achieve them. The claim of "*blurred responsibilities*" in the IA is therefore unfounded.

[19] Available online https://www.bmwi.de/Redaktion/DE/Downloads/C-D/crediting-system-for-renewable-fuels.pdf?__blob=publicationFile&v=4.

[20] See IA, Part 1, p. 32.

[21] This is necessary if low-carbon fuels are more expensive to produce than their fossil-based counterparts.

Figure 3 Flow chart of accounting renewable fuels in fleet targets



Source: Frontier Economics

2.2 Properties of the proposed LCF-crediting system

The proposed LCF-crediting system has the following properties:[22]

- **Voluntary system as a safety belt and complement for the industry's turn towards electrification** – Participation in the crediting system is voluntary for OEMs and provides them with an additional option to offer their customers carbon-neutral combustion engine (and hybrid) cars and achieve their emission targets. Without a crediting system, OEMs might temporarily exceed their targets and pay significant penalties. OEMs have already made huge investments in e-mobility and policymakers are paving the way for charging infrastructure. An LCF-crediting system will complement the further electrification of the sector, not crowd it out.[23]
- **Freedom of choice for consumers** – Today, consumers have practically only one option for green mobility and logistics – electric vehicles. A crediting system could widen the choice. For some consumer groups, combustion engine vehicles are the most suitable – or possibly the sole – green option, particularly for long distances in sparsely populated areas.
- **Independence from bottlenecks by ramping-up electricity infrastructure –** The direct electrification of vehicles is highly contingent on the availability of electric power, hence the urgent need to extend networks, storage and generation capacities going forward. Accordingly, extending the electric system might constrain the maximal ramp-up rate of electric vehicles. LCF could

[22] For further details and background information, see our reports for BMWi (https://www.frontier-economics.com/media/3937/crediting-systems-for-renewable-fuels-in-eu-emission-standards-for-road-transport-en.pdf) and NESTE (https://www.frontier-economics.com/media/4347/crediting-system-for-renewable-fuels.pdf).

[23] In our crediting system proposal, we have also included an optional cap on emission reductions from crediting to address concerns that direct electrification could be crowded out.

therefore accelerate the defossilisation of transport by using parallel and pre-existing infrastructure.

- **Clear demarcation of responsibilities and strict additionality (no double counting) –** As illustrated in Section 2.1, the crediting system strictly demarcates the responsibility for achieving climate targets between fuel suppliers and OEMs. The proposed crediting system is based on strict additionality. Namely, to claim credits, proof that an additional litre of fossil fuels has been replaced by LCF (on top of the fuel supplier obligation) is needed. In this respect, our proposal is even more stringent than e.g. the requirements for electric vehicles, which are treated as zero-emission vehicles, even when run on fossil-generated electricity. First-generation biofuels from food and feed crops are subject to national caps under RED II.[24] These caps should also apply to all volumes used for crediting against fleet targets such that no additional first-generation biofuel volumes enter the transport sector.
- **Effective and accelerated emissions reductions** – LCFs that generate the necessary credits replace conventional fossil fuels and therefore avoid real emissions (i.e. it is not an accounting trick where emissions are seemingly reduced only to resurface elsewhere). A crediting system would also significantly accelerate climate protection due to frontloading of emission reductions. With frontloading, OEMs must surrender LCF credits covering the full lifetime emissions of new vehicles. Before year 1 of the life of a new passenger car, emissions over its entire lifetime[25] had to be taken out of the atmosphere to produce these low-carbon fuels (via biological processes in plants, the recycling of carbon-based waste materials or as input to produce synthetic fuels). This creates a negative emissions balance, which slowly declines over the vehicle lifetime (see below). Frontloading is possible since most road vehicles in Europe still run on conventional fuels, which can be replaced with renewable fuels.
- **Simple and pragmatic approach by linking to an existing monitoring process** (to ensure additionality) – Accounting LCFs against fleet targets requires some form of certification system which ensures sustainability criteria are met and double counting is prevented. We have aligned the LCF-crediting system as closely as possible with existing fuel sector regulations (RED and RED II)[26] to avoid two parallel systems with different standards and the additional administrative costs a separate LCF certification scheme would entail. See Section 6 for further details.

In the remainder of this report, we show how an LCF-crediting system is a “no regret” option which can unlock benefits for stakeholders and the environment. The low administrative cost for the crediting system seems a reasonable premium to pay to help ensure that ambitious climate targets can be achieved more reliably in road transport.

[24] The share of first-generation biofuels must not exceed 7% or the 2020-level plus 1 %-point of the final energy consumption in road and rail transport of a Member State, whatever is lower (RED II, Art. 26 (1)).

[25] In our BMWi report, p. 49, we consider a range of 160,000 – 185,000 km for the lifetime mileage.

[26] RED (Directive 2009/28/EC) establishes national databases and a certification scheme based on common principles (sustainability criteria, mass balance system). This is further developed by RED II (Directive (EU) 2018/2001) and delegated acts (sustainability criteria for synthetical fuels (RFNBOs), Union database to ensure instant data transfers and harmonisation, see Recital 84).

3 THE METHODOLOGY IN THE IMPACT ASSESSMENT IS INADEQUATE

Before discussing the results in subsequent sections, we first review the methodology of the IA. As a benchmark, we refer to the guidelines[27] which set out the key requirements for impact assessments conducted by the European Commission ("IA guidelines").

We have identified the following methodological deficiencies in the IA:

- The IA relies on the wrong benchmark/counterfactual (**Section 3.1**) – To produce robust results, the IA needs to consider the appropriate benchmark, namely what could transpire if an LCF-crediting system were not introduced. The IA only considers "achieving (any) target through battery-electric vehicles", ignoring other technologies (such as plug-in hybrids or fuel-cell electric vehicles) or "missing the fleet targets".
- The analysis is overly simplified and fails to capture basic properties of the new vehicle market (**Section 3.2**) – The new vehicle market is characterised by heterogeneity of vehicle types and use cases, uncertainty about future market developments and dynamic changes over time, none of which are captured by the IA.

We conclude that the IA does not comply with the EC's own guidelines and cannot therefore provide a robust basis for an informed policy decision (**Section 3.3**).

3.1 The IA uses the wrong benchmark

A decisive component of any Impact Assessment is the definition of a benchmark (or counterfactual), against which any new policy measure (such as a crediting system) is then measured.[28]

The IA is considering a single counterfactual: without LCF-crediting, targets are achieved and battery-electric vehicles[29] are the only benchmark technology. This is the **wrong benchmark for two reasons**:

- **Risk of missing emission targets ignored –** One obvious and plausible counterfactual is that the proposed ambitious fleet targets are unattainable with currently available low-emission technologies. This is relevant for two reasons:
  - OEMs have missed their 2020 targets, despite temporary provisions[30] that ease target achievement and significant subsidy schemes for electric

[27] https://ec.europa.eu/info/sites/default/files/better-regulation-guidelines-impact-assessment.pdf

[28] IA Guidelines, p. 21.

[29] EC IA, p. 68: "In the economic analysis of this option, a comparison is made between (i) the costs for an additional newly registered battery electric vehicle (BEV) to meet the CO_2 target as compared to an ICEV and (ii) the costs for the amount of CO_2 saved from LCF quantities that achieve the same effect for meeting the CO_2 emission standards as the additional BEV."

[30] This includes (1) the omission of the top 5% of new cars with highest CO_2 emissions which ICCT estimates would lower each manufacturer's 2020 CO_2 level by approximately 2-5 g/km and (2) super-credits for low-emission vehicles (below 50 gCO2g of CO_2/km) which can be counted twice in the fleet average.

vehicles, which count as zero-emission vehicles.[31] As of August 2021, four out of eleven[32] manufacturers also look set to miss their 2021 targets.[33]

- Targets have become increasingly stringent over time: OEMs have until 2030 to reduce average car emissions by -37.5% (compared to 2020). The EC has proposed further tightening 2030 targets to -55% for cars as part of the Fit-for-55 package. Without additional emission reduction options (such as LCF-crediting), there is a material risk that these targets may remain unmet.

This is a relevant scenario since LCF-crediting could be used to fill a target gap, effectively reduce emissions (Section 4) and avoid penalties for OEMs, which significantly outweigh the crediting cost (Section 5).

- **Battery-electric vehicles are (according to the IA) not the most expensive (incremental) technology required to meet the targets** – If LCF-crediting is introduced and does not fill a target gap (see above), it would replace the most expensive technology required to achieve the targets – unless LCF is the most expensive technology (in this case LCF simply would not be used, even when a crediting system is introduced).

  IA simulations of the future fleet composition for different target levels (Figure 4) show how a mix of drivetrain technologies is required to meet the targets, including battery-electric vehicles (BEV), plug-in hybrids (PHEV) and fuel-cell electric vehicles (FCEV). The high share of battery-electric vehicles (BEV) across the scenarios suggests that it is among the cheapest low-emission technologies in the mix.

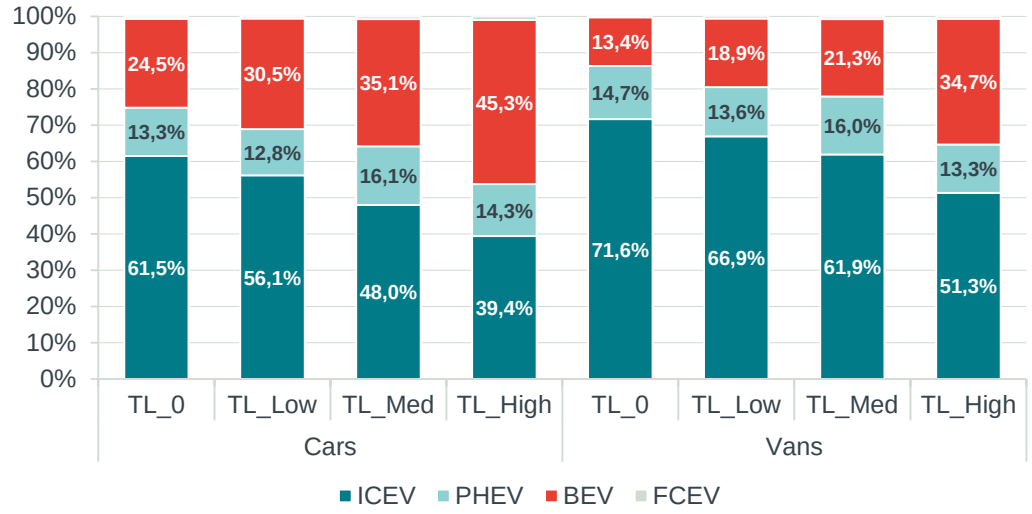
  Logically, the IA should have compared crediting with the *costliest* technology in the mix (for example fuel-cell electric vehicles or hybrids) rather than the cheapest (BEV, given the high share in simulations) to estimate the potential contribution of LCF to the technology mix.

[31] See https://theicct.org/publications/market-monitor-eu-jan2021, Table 3.

[32] Some OEMs for a 'CO_2 pool' where under-/over-achievement of individual targets are offset against each other.

[33] See https://theicct.org/publications/market-monitor-eu-aug2021

Figure 4 Impact Assessment – Simulated power train composition for new vehicles under different target levels (TL) in 2030



Source: *Frontier Economics based on Impact Assessment SWD(2021) 613 final, Part 1, Table 4.*

Note: *ICEV including hybrid electric and gas fuelled vehicles.*
ICEV = internal combustion engine vehicle (without LCF-crediting), PHEV = plug-in hybrid electric vehicle, BEV = battery-electric vehicle, FCEV = fuel-cell electric vehicle.
The final proposal of -55% for cars corresponds to a mixture of the TL_Med (-50%) and TL_High (-60%) scenarios. For vans, the proposal of -50% equals the target level of TL_High.

By using a flawed benchmark, the IA underestimates the benefits generated by introducing an LCF-crediting system (as we further show in Sections 4 and 5).

3.2 The analysis is over-simplistic and neglects basic market properties

The new vehicle market is characterised by heterogeneity of vehicle types and use cases (Section 3.2.1), uncertainty about future market developments (Section 3.2.2) and dynamic changes over time (Section 3.2.3).

As we show, the analysis in the IA is oversimplified and fails to appropriately capture any of these important properties.

3.2.1 Neglect of heterogeneity

The IA examines a **single average car** (that remains unspecified, i.e. it is even unclear whether the car concerned is small, medium or large) and concludes that battery-electric vehicles (of unspecified battery size) are cheaper for manufacturers and consumers than LCF-crediting.[34]

This approach disregards the significant heterogeneity in the new vehicle market (see text box below).

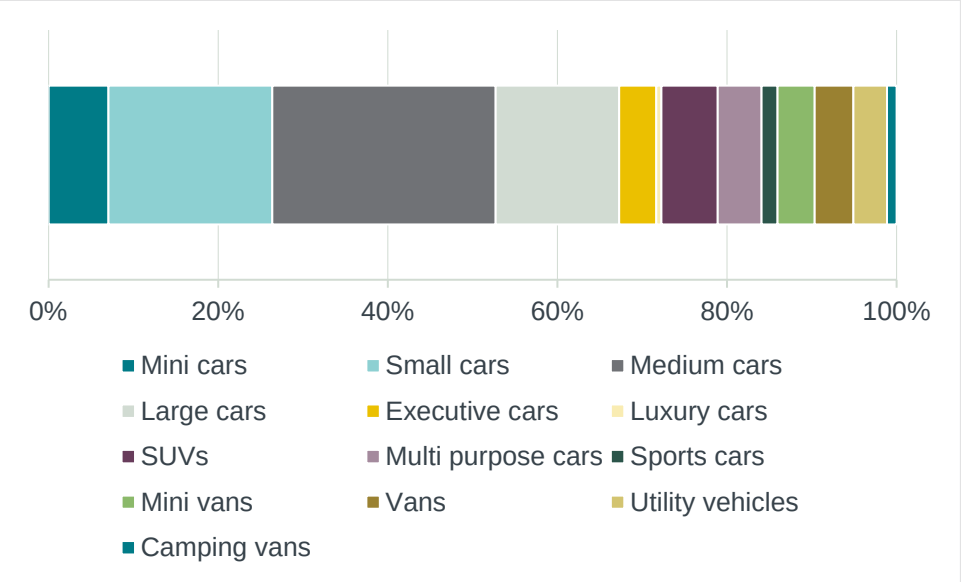
[34] IA, pp. 68-69.

HETEROGENEITY IN THE CAR MARKET (EXAMPLE: GERMANY)

The composition of the existing vehicle fleet is very diverse. Use cases for cars typically encompass daily commuting and hauling goods right up to long distance trips; each of which can be satisfied in different price categories.

Figure 5 illustrates the vast heterogeneity of the existing vehicle fleet in Germany, where vehicle segments are differentiated by size, weight, performance and application. The biggest segment – medium cars – comprises only a quarter of all vehicles. This underlines the diversity of consumer preferences and needs with regards to mobility.

Figure 5 Composition of existing vehicle fleet in Germany, 2018



Source: Frontier Economics based on KBA registration data for Germany

Ignoring heterogeneity and relying on simple averages can spawn very wrong results and policy recommendations (even if calculations for the "average" vehicle were correct).

Consider the following simple illustrative examples: Suppose the fleet comprised only three car types (small, medium and large), each with a market share of 33%. Suppose that BEV was 6,000 € cheaper for consumers than LCF in two out of the three options (due to a small battery size, the main cost driver) and 6,000 € more expensive (due to a large battery size) in the remaining option. In a simplified calculation based on an arbitrarily chosen segment (like in the IA), BEV would ostensibly provide a benefit of 6,000 € per vehicle compared to LCF. Even on an average basis, BEV would appear to offer gains of around 2,000 € per vehicle and represent the best option for consumers. However, on a more granular level, the optimal policy recommendation would be to introduce **LCF-crediting, which could reduce costs for a third of customers** and make BEV the technology of choice for two-thirds of the market.

To provide a robust basis for an informed policy decision, the IA would have to have at least differentiated between various vehicle types, as was e.g. analysed in the IA (pp. 53-55) where it examined the affordability of four different vehicle

segments (small to large) for different groups of consumers (with differing incomes).

3.2.2 Neglect of uncertainty

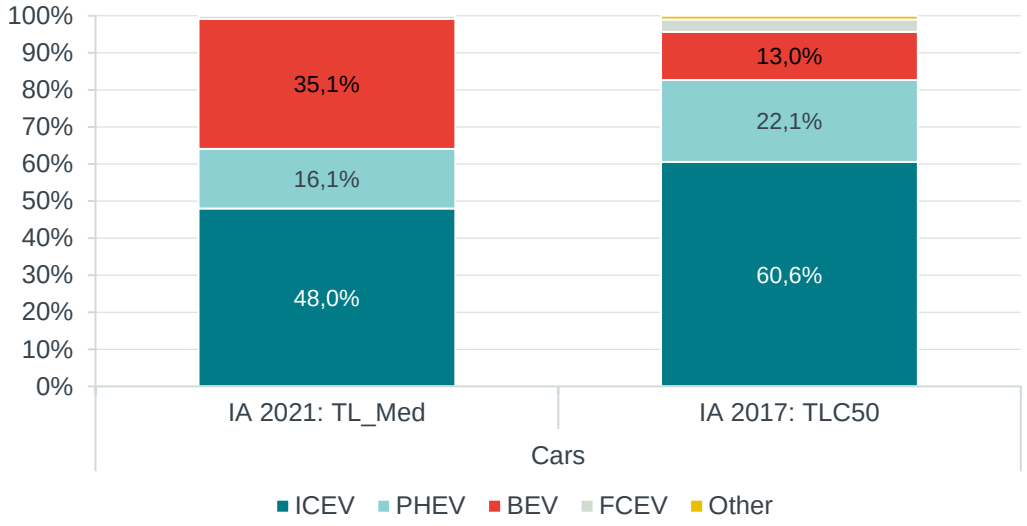
The EC calculations suggest that the key drivers (vehicle cost, electric vehicle uptake, etc.) can be predicted with high precision. However, this is not the case. For example:

- **Future vehicle costs are highly uncertain** and depend on the prevailing technology, availability, cost of raw materials and future cost reductions from learning curves (see text box below for battery development).
- **Consumer behaviour determines the future fleet composition** (i.e. shares of technologies). The uptake of new vehicle types is difficult to predict and depends on various factors, including price, availability of charging/refuelling infrastructure, short-term trends and marketing campaigns, etc.

All these uncertain factors determine whether fleet targets will be achieved in future and the relative cost incurred between different low-emission options.

This uncertainty is also reflected in the drastic changes in the Impact Assessments from 2017 and 2021 at similar 2030 target levels (Figure 6). The projected share of battery-electric vehicles has almost tripled from 2017 to 2021.

Figure 6 Uncertainty in the 2030 fleet composition – Simulations from the EC Impact Assessment 2021 vs. 2017



Source: *Frontier Economics based on Impact Assessment SWD(2021) 613 final, Part 1, Table 4 and Impact Assessment SWD(2017) 651 final, Table 6*

Note: *ICEV including hybrid electric and gas fuelled vehicles.*
The considered target level corresponds to a 50% CO_2 reduction compared to the 2021 starting point (TL_Med in the Impact Assessment 2021 and TLC_EP50 in the Impact Assessment 2017).

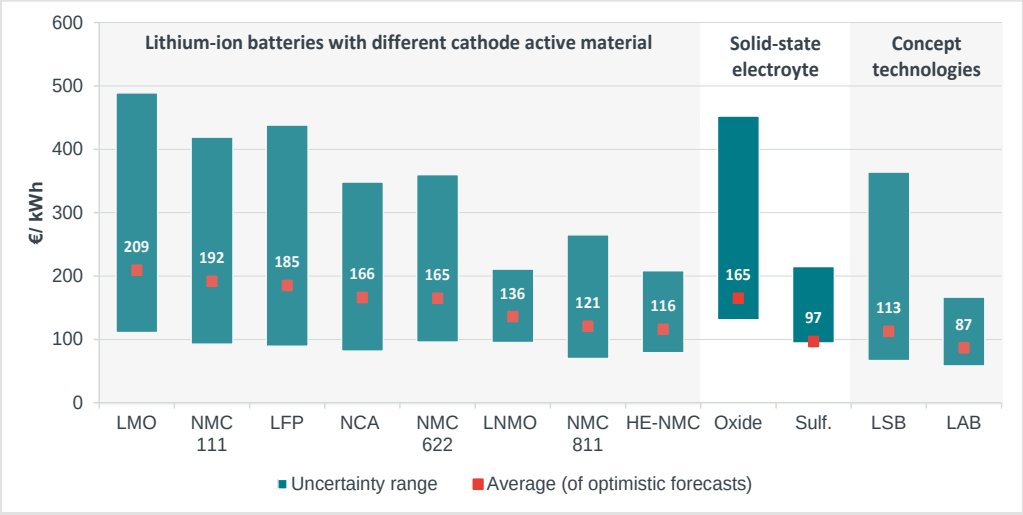
HIGH UNCERTAINTY IN FUTURE BATTERY DEVELOPMENTS

The development of battery production costs is highly uncertain:

- First, it is unclear which **battery technology** will prevail in future. The battery market is quite heterogenous and which technology prevails depends, among other factors, on technological progress and industry standards.
- Second, **material input costs** that were expected to continuously decline have recently reversed. The prices of key metals used in lithium-ion batteries have rebounded over the past 12 months, meaning no further decline in battery production costs.[35]
- Third, cost reductions from **learning curves and economies of scale** are uncertain as they depend on future production volumes.

Figure 7 illustrates the cost uncertainty for different battery technologies and input materials[36]. The long-term average cost estimates over all technologies range from 87 to 209 €/kWh, which translates into an uncertainty range of over +/-70% around the mid-point.

Figure 7 Battery technologies and associated cost estimates



Source: Frontier Economics based on Mauler et al. (2021), "Battery cost forecasting: a review of methods and results with an outlook to 2050"

To capture this uncertainty, the EC would have needed to conduct a more thorough scenario analysis (and not just a very simple high/low fuel price calculation in Figure 18 of the IA) to determine the impact from crediting under various circumstances. As we show in Section 5, considering a range of battery costs

[35] https://www.bloomberg.com/news/newsletters/2021-09-14/ev-battery-prices-risk-reversing-downward-trend-as-metals-surge [accessed on 15-09-2021]

[36] Battery technologies have been categorised into lithium-ion (LIB), solid-state(SSB), lithium-sulphur (LSB) and lithium-air batteries (LAB). LIBs are further classified by the cathode technologies lithium nickel manganese cobalt oxide(NMC), lithium nickel cobalt aluminium oxide (NCA), lithium cobalt oxide (LCO),lithium manganese oxide (LMO), lithium nickel manganese oxide (LNMO), lithium iron phosphate (LFP), lithium iron manganese phosphate (LMFP), lithium cobalt phosphate (LCP), and by the anode technologies graphite (C), silicon composite (Si/C) and lithium titanate oxide (LTO).

(rather than a point estimate) elicits very different conclusions regarding compliance cost.

Neglecting uncertainty (e.g. availability of charging infrastructure and renewable electricity) **can spawn wrong policy choices**: if the climate strategy for the transport sector rested solely on a single technology (like BEV), the market would be unable to react to disruptions (lower uptake by consumers, limited availability of raw materials, higher prices, etc.) and the risk of missing emission targets would drastically soar. IPCC[37] projections spell out how achieving even a 2° Celsius target is at risk, so further setbacks or delays in reducing emissions effectively would be unacceptable.

3.2.3 Neglect of time dimension

The IA only assesses costs and environmental benefits from an LCF-crediting system for 2030 and 2035.[38] However, **a crediting system could be set up by 2023** and become effective seven years before the first photo year (2030) the EC has analysed:

- Reliance on existing processes and institutions – The proposed LCF-crediting system is aligned with existing RED II sustainability requirements and the monitoring and reporting processes for fuel suppliers are already in place (see Section 6 for further details). A timely implementation of a crediting system is therefore feasible.
- Template for options and regulatory amendments available – We have provided a comprehensive report[39] outlining different options, recommendations on how to implement such an LCF-crediting system and draft regulatory amendments. This study was already published in May 2020 and is known to the EC.

The focus on the post-2030 period ignores significant potential benefits from a crediting system:

- The focus on the post-2030 period treats the climate challenge as if it would only occur in some distant future. However, the effective climate impact is not determined at pre-set photo years but must also consider how we reach these photo years. For climate change, **cumulative GHG emissions matter ("budget principle")**, which renders transformation pathways highly relevant. Our simulations show GHG savings from LCF-crediting can become material by 2030 (see Figure 8 in Section 4).
- **Benefits from crediting are likely to be particularly seen in early years** when the market penetration with other low-emission technologies (such as BEV and FCEV) remains ongoing and uncertain. Furthermore, the costs of these new technologies are expected to decline significantly over the next

[37] IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J. B. R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press. In Press.

[38] IA, pp. 68-72.

[39] https://www.frontier-economics.com/media/3937/crediting-systems-for-renewable-fuels-in-eu-emission-standards-for-road-transport-en.pdf

decade (see Figure 11 in Section 5 for battery costs) which increases potential cost savings from crediting, particularly in early years.

3.3 The IA does not underpin an informed policy decision

The IA guidelines set out key requirements for impact assessments conducted by the European Commission. We find that the IA on an LCF-crediting system fails to meet several requirements:

- **Oversimplified analysis** – In Section 3.2 we have shown that the IA does not capture key properties of the vehicle market, which have required further differentiations and sensitivities to show the validity and robustness of results.
- **No socioeconomic analysis –** The EC only considers compliance cost for OEMs and total cost of ownership from the consumer perspective, but does not conduct a proper cost-benefit analysis which would include further elements:
  - First, the extent to which taxes, levies and subsidies (like the financial incentives for electric vehicles, including tax reductions/exemptions, subsidies for purchase of vehicles, etc.[40]) have been considered in the total cost of ownership comparison (IA, Figure 19) remains unclear. Such government-driven cost components should not be considered in a socioeconomic cost-benefit analysis.
  - Infrastructure costs (for charging, storage, etc.) are not considered – The ramp-up of new vehicles spawns additional infrastructure investments, which are either borne directly by consumers (e.g. charging wall boxes) or partly subsidised (for public charging). Considerations of infrastructure costs reveal a significant difference between LCF-crediting and new drivetrain technologies, since low-carbon fuels can be stored, transported and distributed via existing fuel infrastructure but must be set up from scratch for new technologies.
- **Insufficient documentation –** The IA does not provide key inputs (e.g. vehicle cost, charging electricity prices) or the methodology used to calculate the results (e.g. whether taxes/subsidies are considered, future values are discounted, etc.). The annex on LCF-crediting only covers two pages (IA Part 2, pp. 97-98) and does not contain a single table. Furthermore, the annex cites several types of low-carbon fuels (HVO, FAME and bioethanol) and three price scenarios but the IA only includes results for two price scenarios (low/high, see Figure 18) and only considers advanced biofuels and synthetic fuels (RFNBOs) which are less mature technologies and thus likely to be costlier to produce in 2030.

Table 1 summarises how the IA deviates from the EC's own IA guidelines. We conclude that due to the significant methodological deficiencies and non-

[40] See ACEA for a European overview of tax benefits and purchase incentives in 2020, https://www.acea.auto/files/Electric_vehicles-Tax_benefits_purchase_incentives_European_Union_2020.pdf

compliance with the IA guidelines, the **IA does not provide a robust basis for an informed policy decision**.

Table 1 Summary of non-compliance with IA guidelines

Topic	Reference in the IA guidelines
Neglect of heterogeneity (Section 3.2.1)	*"There is, however, an obligation to make the most sensible methodological choice given the specificities of the case at hand, the availability of data and the requirement to carry out a proportionate analysis. In all cases, methodological complexity is not an excuse for not presenting the practical implications of different options for affected parties." (p. 26)*
Neglect of uncertainty (Section 3.2.2)	*"Whenever an assumption is particularly important or uncertain, sensitivity analysis should be used to check whether changing it would lead to significantly different results." (p. 26)*
Neglect of time dimension (Section 3.2.3)	"*Different impacts are likely to occur at different times (with costs often being incurred early on and benefits emerging only later). This should be reflected in the assessment, discounting monetised estimates as appropriate when these are available.*" (p. 27)
No socioeconomic analysis (Section 3.3)	"*IAs must compare the policy options on the basis of their economic, social and environmental impacts (quantified costs and benefits whenever possible) and present these in the IA report." (p. 14)*
Insufficient documentation (Section 3.3)	"*The IA report should summarise and present the results of the impact analysis in way which is accessible to the non-specialist. […] Data sources should be provided and underlying assumptions illustrated in relation to any quantification.*" (pp. 27-28)

Source: Frontier Economics

Note: Emphasis in quotes from IA guidelines added.

4 THE IA UNDERESTIMATES ENVIRONMENTAL BENEFITS

In this section we demonstrate how LCF-crediting could provide significant environmental benefits that are not captured by the IA:

- LCF-crediting is a valuable insurance option to fill emission gaps in the short term and reduce emissions more rapidly and effectively (**Section 4.1**);
- The methodology in the IA is unsuited to capture the option value of LCF-crediting due to the methodological deficiencies identified in Section 3 (**Section 4.2**); and
- LCF-crediting can be the first step on the path to a more holistic and resilient climate policy as it broadens the scope beyond tailpipe emissions (**Section 4.3**).

4.1 LCF-crediting is a valuable insurance option to achieve transport sector emission targets

There is a real and material risk of emission reduction targets being missed due to the significant uncertainty of market developments and heterogeneity in consumer preferences (**Section 4.1.1**). LCF-crediting can provide an insurance option to fill these emission gaps in the short term and reduce emissions more rapidly and effectively (**Section 4.1.2**).

4.1.1 There is a real and material risk of emission reduction targets being missed

The transport sector, which – unlike other sectors – has seen emissions increase over the last two decades,[41] faces a **significant challenge** to reduce emissions on the path to climate neutrality. The European Commission has proposed further tightening the 2030 emission targets for new vehicles as part of the Fit-for-55 package.

However, there is a **real and material risk** of the transport sector being unable to reverse the emission trend (spurred by rising mobility and logistics demand) and meet these ambitious targets if the set of available low-carbon technologies is too restricted:

- OEMs have missed their 2020 fleet targets, despite temporary provisions[42] that ease target achievement and despite significant subsidy schemes for electric vehicles.[43] For example, there is a purchase premium of up to € 9,000 per

[41] Total transport sectors emissions have risen from 828 Mt in 1990 to 1,103 Mt in 2018 (+33%), see https://www.eea.europa.eu/data-and-maps/indicators/transport-emissions-of-greenhouse-gases-7/assessment

[42] This includes (1) the omission of the top 5% of new car with highest CO_2 emissions which ICCT estimates to lower each manufacturer's 2020 CO_2 level by approximately 2-5 g/km and (2) super-credits for low-emission vehicles (below 50 g CO_2/km) which can be counted twice in the fleet average.

[43] See https://theicct.org/publications/market-monitor-eu-jan2021, Table 3.

electric vehicle in Germany, which has been extended to 2025.[44] A recent Deutsche Bank research paper has calculated total fiscal benefits (including taxes) of more than 20,000 € for an upper-medium battery-electric car over its entire lifetime (equivalent to abatement cost of more than 1,000 €/t CO_2).[45]

- Under current regulations and with a focus on tailpipe emissions, the most plausible way for OEMs to reduce emissions is by increasing the share of electric vehicles. However, the composition of the vehicle fleet also depends on how technology evolves, e.g. battery or fuel-cell cost, consumer preferences and transport needs – consumers in sparsely populated areas or with limited access to charging or hydrogen infrastructure might hesitate to buy electric vehicles, even though they are expected to become increasingly affordable.
- In particular, e-mobility requires the accelerated expansion of renewable electricity sources, but this is at risk due to public resistance against more wind turbines and power grid expansions, limitations imposed by suitable sites, grid stability issues, competing uses for renewable electricity, etc. Low-carbon fuels, conversely, might be imported from regions outside the EU (via existing shipping and distribution infrastructure) if domestic production is too costly or raw materials are scarce.

A resilient, effective long-term climate policy for the transport sectors needs to consider these (and potentially other) risks since any excess GHG emissions will remain in the atmosphere and must be counted against a shrinking "emissions budget" left if we want to limit global warming to 1.5° or even 2° Celsius. Any setbacks or delays in reducing emissions effectively would thus be unacceptable.[46]

4.1.2 LCF-crediting provides an insurance option to fill emission gaps in the short term and reduce emissions more rapidly and effectively

LCF-crediting can be used in the short term to fill a target gap, unlike new drivetrain technologies and constructing the necessary infrastructure, which might take several years. The global market for LCF is growing and the existing fleet of internal combustion engines can accommodate additional LCF for years to come.

The crediting system is set up such as to ensure that low-carbon internal combustion vehicles provide real, effective and immediate climate protection:

- **Strict established RED II sustainability framework –** The crediting system builds on the existing RED II framework, which sets out strict sustainability requirements and certification schemes that allows admissible renewable fuels to be traced throughout the fuel chain.
- **No double counting with other targets** – The proposed crediting system is based on strict additionality. In other words, to claim credits, proof that an

[44] See https://www.bmwi.de/Redaktion/DE/FAQ/Elektromobilitaet/faq-elektromobilitaet-01.html (in German). The premium is partly paid by the car manufacturer. Initially, the premium was limited to 31 December 2021 but has been extended until end of 2025.

[45] See https://www.dbresearch.de/PROD/RPS_DE-PROD/PROD0000000000519520/Vorfahrt_der_E-Mobilit%C3%A4t_vom_Staat_teuer_erkauft.PDF.

[46] See IPCC: "Climate Change 2021".

additional litre of fossil fuels has been replaced by renewable fuels (on top of the fuel supplier obligation) is needed. In this regard our proposal is even more stringent than e.g. the requirements for electric vehicles, which are treated as zero-emission, even when run on fossil-generated electricity.

- **Effective emission reductions** – Renewable fuels that generate the necessary credits replace conventional fuels and thus avoid real emissions. It is not an accounting trick where emissions are seemingly reduced only to resurface elsewhere.
- **Accelerated emissions reductions** – OEMs, *before* selling a new vehicle, must – via credits – cover *all lifetime* emissions (so-called 'frontloading'). This means that a **low-emission ICEV starts with a negative emission balance**, which is only later reduced to zero during operation. Frontloading significantly **accelerates climate protection** (see text box below).[47]

A crediting system can therefore **complement electromobility** and other non-hydrocarbon drivetrains to tackle the climate challenge for road transport.[48]

[47] Frontloading is possible since most road vehicles in Europe still run on conventional fuels, which can be replaced with renewable fuels.

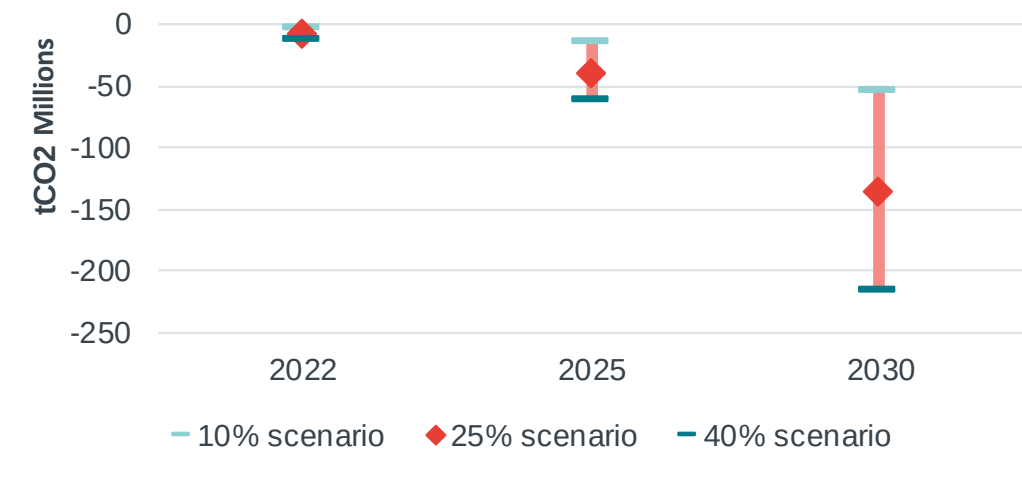
[48] OEMs have already made huge investments in e-mobility and policymakers are paving the way for charging infrastructure. In our crediting system proposal, we have also included an optional cap on emission reductions from crediting to address concerns that direct electrification could be crowded out.

SCENARIO ANALYSIS OF CUMULATIVE EMISSIONS SAVINGS FROM LCF-CREDITING WITH FRONTLOADING UNTIL 2030

In a study for NESTE, we model different scenarios (to capture uncertainty) in which fleet targets would be missed without an LCF-crediting system and any emission gap is filled by LCF-crediting to illustrate the potential benefits.

The results (Figure 8) show that small annual benefits accumulate over time and can already elicit significant emissions savings by 2030.

Figure 8 Cumulative emissions saving from introducing a crediting system in 2022



Source: *Frontier Economics (2020), Crediting system for renewable fuels – functionality and benefits, Figure 18.*

Note: *Scenarios are defined as gap (in %) of electric vehicles necessary to meet the fleet targets, e.g. the 10%-scenario assumes that 90% of the requires electric vehicles sales are realised. For reference: Total road transport emissions are, road transport reached approx. 783 Mt CO_2 (71% of all transport emissions of 1,103 Mt CO_2eq in 2019, see https://www.eea.europa.eu/data-and-maps/indicators/transport-emissions-of-greenhouse-gases-7/assessment).*

4.2 The IA methodology is unsuited to capture the option value of LCF-crediting

In Section 3 we have identified several methodology deficiencies of the IA (that clearly violate the IA guidelines), which prevents the analysis from capturing the option value of LCF-crediting:

- **Wrong benchmark** – The IA only considers scenarios in which fleet targets are met in all future years. This assumption is unjustified (given that manufacturers missed the 2020 targets and future targets are much tighter) and conveys a misplaced sense of security – in fact, we need to ensure that emission targets can be really met by providing a broad set of low-carbon options, including LCF-crediting.
- **Neglect of heterogeneity** – The IA only considers an average (unspecified) car and van. Consumer preferences and needs are diverse and there is no "one size fits all" solution. Even if electric vehicles may be the best option for the

average consumer, there will be applications where this is not the case (e.g. due to long distances requiring larger and more expensive batteries or due to the lack of charging infrastructure in certain areas).

- **Neglect of uncertainty –** The IA pretends that future vehicle cost (including for batteries) can be predicted until 2035 with certainty. Technological progress and prices and the availability of raw materials (such as platinum, lithium and cobalt) remain highly uncertain. Betting on a single technology (BEV) is very risky and entails risks of not achieving the climate targets at all (or only doing so at a higher cost, to be ultimately borne by consumers).
- **Neglect of time dimension –** The IA only considers photo years 2030 and 2035. However, with the need to limit global warming in mind, the emission trajectory towards these years makes a key difference, since CO_2 remains in the atmosphere and must be counted against the remaining CO_2 budget.

Despite these deficiencies, even the IA confirms that LCF-crediting would reduce GHG emissions.[49]

4.3 LCF-crediting is the first step towards a holistic and resilient climate policy

Emission standards for new vehicles only consider tailpipe emissions from operating a vehicle, i.e. emissions from the manufacturing of the vehicle (including battery) and the power mix used in battery-electric vehicles and the type of hydrogen (green or grey) consumed by fuel-cell electric vehicles are totally ignored.

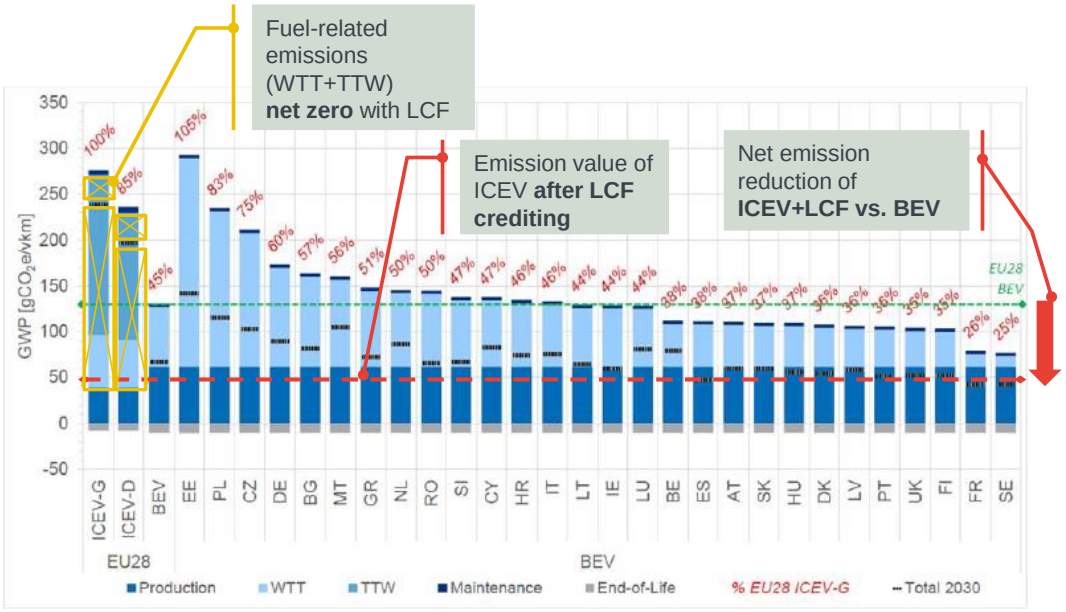
However, credible and effective climate protection requires a **more holistic view** on the climate impact of different mobility options – a full life-cycle assessment (LCA) which reveals true emissions throughout the **value chain** (from battery and vehicle production, power and fuel mix to recycling).

The IA presents limited research on LCA (Figure 9) which nevertheless clearly shows that if fuel-related emissions ("WTT" and "TTW") were offset by LCF-crediting, low-carbon ICEV would produce less emissions than battery-electric vehicles (BEV), even if the electricity mix was 100% renewable (which is not expected before 2040[50]).

[49] See IA, p. 81: "*A slight reduction of CO_2 tailpipe emissions reduction could be seen in an extreme case of a doubling of the amount of advanced biofuels used in the vehicles fleet.*" The supposedly "*extreme*" assumption is made by the IA - in reality, a broad mix of LCF could feasibly achieve an equivalent reduction of GHG emissions (in accordance with the sustainability requirements in RED II).

[50] See ENTSO-E, TYNDP 2020 Scenario Report, Figure 17: even in the most ambitious scenario, the average renewable share in the power mix does not exceed 80%.

Figure 9 Impact of LCF-crediting on life-cycle GHG emissions comparison (lower medium cars)



Source: *IA, Figure 39 (amended by Frontier Economics).*

Note: *BEV = battery-electric vehicle, ICEV = internal combustion engine vehicle, WTT = well-to-tank (emissions for fuel/electricity production), TTW = tank-to-wheel (emissions from operation of the vehicle – these are zero for BEV and correspond to tailpipe emissions for ICEV)*

This simple calculation shows how important it is to move from a pure tailpipe perspective to an LCA perspective, which would assess the real-life emissions from different drive train solutions which ultimately affect climate change (while labelling certain vehicles as zero-emissions conceals actual emissions).

A crediting system – bridging the gap between fuel provision and OEM regulation – would be the **first step towards a more holistic system** as it would link and coordinate climate protection efforts by fuel suppliers and car manufacturers. As a possible next step, CO_2 savings achieved in car production (e.g. by using green steel) might be credited in a similar manner.

5 THE IA UNDERESTIMATES BENEFITS FOR MANUFACTURERS AND CONSUMERS

In this section we show that the oversimplification (see Section 3) and selective assumptions in favour of BEV lead to a significant underestimation of the benefits for car manufacturers and consumers from LCF-crediting:

- **Benefits for car manufacturers (Section 5.1)** – The IA only compares BEV vs. LCF and ignores the possibility that without crediting, car manufacturers might miss their targets (and pay a significant penalty). Furthermore, the compliance cost for BEV seems unreasonably low and does not reflect significant uncertainty about future battery costs. Meanwhile, compliance cost for LCF ignores policy changes proposed by the EC which make LCF more competitive (reduced energy taxes for LCF and emissions trading cost for conventional fuels) and reduces the premium payable for LCF.
- **Benefits for consumers (Section 5.2)** – The IA only presents the alleged total cost of ownership (TCO) for a single (unspecified) vehicle type which does not reflect the vast differences (see Section 3.2) and therefore does not provide a reliable basis for any decision to exclude a crediting system. The results are also largely driven by differences in compliance cost, which are biased in favour of BEV (see above). The IA also does not recognise scope for consumer preferences and transportation needs to vary.

No apparent benefits from LCF-crediting – as stated in the IA – are in stark contrast to the **broad public support for LCF-crediting in the EC's consultation**[51] (**Section 5.3**). The IA does not comment on this obvious contradiction.

5.1 A voluntary crediting system can only reduce compliance cost for manufacturers

In this section, we show that an appropriate compliance cost comparison reveals the potential benefits of a voluntary crediting system, where manufacturers can choose the most cost-efficient option depending on future market developments and their fleet emission performance. As LCF-crediting would be voluntary for OEMs, they could only benefit from such a system.

The IA compares the extra cost of selling a (unspecified) battery-electric vehicle with the cost of LCF credits required to neutralise the tailpipe emissions from an internal combustion engine vehicle.[52] From this simple calculation the IA concludes that LCF-crediting is supposedly always more expensive for manufacturers than battery-electric vehicles.

[51] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12655-Revision-of-the-CO2-emission-standards-for-cars-and-vans-/public-consultation_en

[52] See IA, Figure 18.

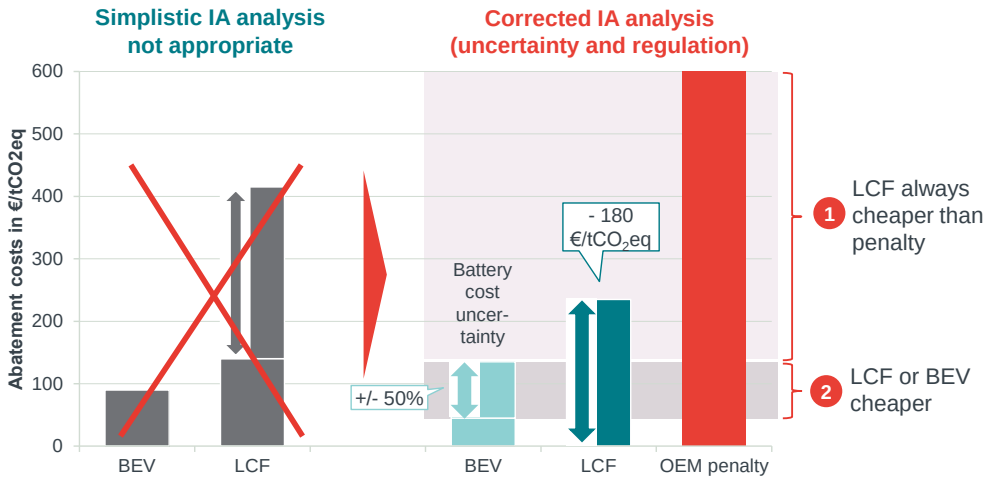
The simplified compliance cost calculation presented in the IA[53] fails to capture the option value from LCF-crediting for the following reasons:

- The IA disregards manufacturers missing their targets, which is a key motivation for introducing LCF-crediting (**Section 5.1.1**);
- The IA does not consider policy measures (proposed by the EC) that would make LCF more competitive and reduce LCF cost (**Section 5.1.2**); and
- The IA fails to address the uncertainty of battery costs, which might increase the compliance cost for BEV significantly (**5.1.3**).

If we correct some of these deficiencies in the IA calculation, LCF-crediting emerges as an economically viable option (Figure 10):

- **(1)** Crediting costs are lower than the penalty for low-carbon fuel costs considered in the IA across the board;
- **(2)** Whether BEV or LCF-crediting is cheaper depends on low-carbon fuel price vs. battery cost if uncertainty is also considered for future battery cost.

Figure 10 Corrected IA analysis of compliance cost



Source: *Frontier Economics*

Note: *See Annex A for further details. ETS = emission trading scheme for the heat and transport sectors. ETD = Energy Taxation Directive.*
In our calculation we have assumed symmetric battery cost uncertainty. However, given the carbon abatement cost of less than 100 €/t CO_2, it seems very likely that the EC has assumed (but not documented) a very low battery cost, which renders cost increases more realistic.

The IA conclusion that LCF is always costlier thus points only to an over-simplistic analysis and favourable cost assumptions and even minor adjustments to these assumptions would render it invalid.

Further context to the deficiencies in the IA's methodology is provided below.

5.1.1 The IA disregards manufacturers missing their targets, which is a key motivation for introducing LCF-crediting

The proposed LCF-crediting system was developed to equip OEMs with an *additional* option to achieve their fleet targets effectively (see Section 2). However,

[53] See IA, Figure 18.

the analysis in the IA completely disregards the possibility that manufacturers might miss their targets (as they did in 2020, see Section 4) and only compares compliance with LCF-crediting vs. BEV (the supposedly cheapest alternative drivetrain technology based on the high simulated share by the EC, see Figure 6 in Section 3.2).

OEMs must pay a per-vehicle penalty if their average emissions exceed the fleet target. For cars and vans, meanwhile, OEMs must pay a 'penalty' of 95 EUR/g CO_2/km times the number of new vehicles, which corresponds to a carbon price of ca. 514-600 EUR per tonne of CO_2, depending on the assumed lifetime mileage.[54] The penalty significantly exceeds the LCF compliance costs for cars determined in the IA (~140-420 €/t CO_2, see Figure 15 below).

In other words, the EC's own analysis shows that even for high LCF prices, **crediting would benefit** manufacturers if they otherwise missed their targets and would have to pay the penalty.

5.1.2 The IA does not consider policy measures that make LCF more competitive and reduce LCF cost

The European Commission, as part of the Fit-for-55 package, has proposed further policy measures to strengthen the role of low-carbon fuels:

- **An Emissions Trading System (ETS II) for the heat and transport sector** – imposes a price on carbon and lowers the cap on emissions from certain economic sectors every year. To address the lack of emissions reductions in road transport and buildings, a separate new emissions trading system is set up for fuel distribution for road transport and buildings.
- **Reform of the Energy Taxation Directive (ETD)** – The tax system for energy products must safeguard and improve the Single Market and support the green transition by setting the right incentives. A revision of the Energy Taxation Directive[55] proposes aligning the taxation of energy products with EU energy and climate policies, promoting clean technologies and removing outdated exemptions and reduced rates that currently encourage the use of fossil fuels.

Both measures make LCF more competitive compared to fossil fuels.

5.1.3 The IA fails to address the uncertainty of battery costs, which can increase compliance cost for BEV significantly

One of the main components of BEV manufacturing costs are the assumed costs of battery capacity and battery manufacturing.[56] Most studies expect battery production costs to decline in future, but the degree of decline varies substantially (see text box below).

[54] 95 EUR/g/km divided by an average lifetime mileage of 160,000 - 185,000 km multiplied by 10^6 (g/tonne). Assuming a longer lifetime mileage would result in a lower CO_2 price and vice versa.

[55] See EC COM(2021) 563, Annex 1, Table A. The minimum tax rate for petrol and gasoil is 10.75 €/GJ and 0.15 €/GJ for RFNBOs and advanced biofuels. The tax difference of 10.6 €/GJ equals an implicit CO_2 price of approx. 130 €/ CO_2 (@94 kg CO_2/GJ fossil fuel and 85% savings from RFNBO/advanced biofuels).

[56] See also Section 3.2.2.

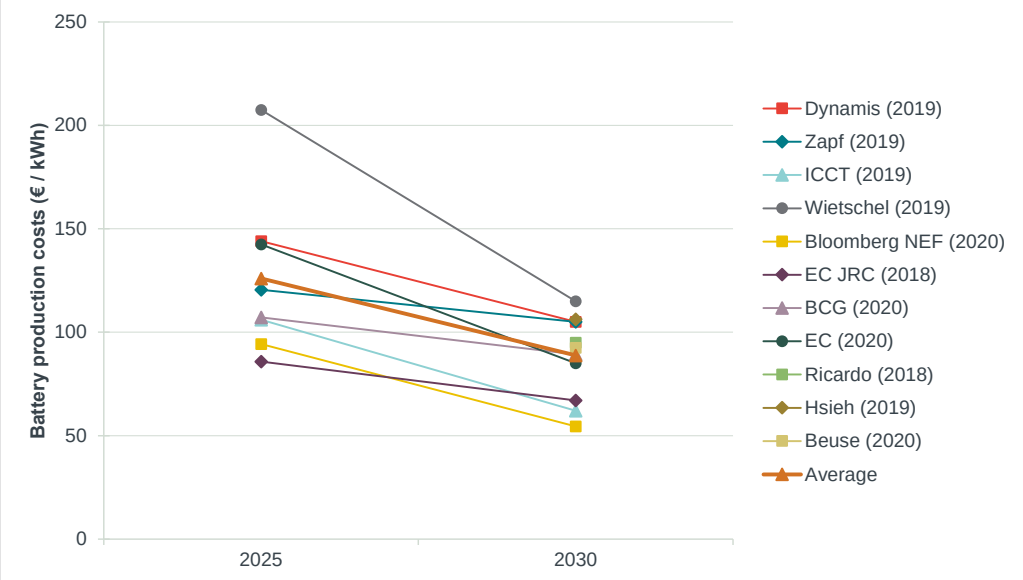
This illustration highlights why a point estimate for BEV compliance costs is unreasonable. It disregards uncertainty with respect to battery production costs and battery size (a main cost driver). A more prudent approach would be to take the range of battery production costs.

Note that the prices for metals used in lithium-ion batteries have increased over the past 12 months, halting the decline in battery production costs.[57] It is far from certain that the expected battery cost reductions can be feasibly attained by 2030.

UNCERTAINTY OF FUTURE BATTERY COST DEVELOPMENT

We reviewed relevant literature and found that cost estimates for 2030 still ranged from 54 to 115 EUR/kWh. In other words, the uncertainty between the min and max value exceeds a factor of two. This is driven by the type of estimation employed[58], the assumed number of units produced[59] and the assumed learning curves. Figure 11 shows the level and trajectory of battery manufacturing cost assumptions across the reviewed studies.

Figure 11 Meta-study on battery manufacturing cost development



Source: Frontier Economics based on literature review.

5.2 A voluntary crediting system can only benefit consumers

A crediting system is voluntary for consumers, who will compare wide-ranging car models for specific vehicle types, pick which best suits their needs and preferences

[57] https://www.bloomberg.com/news/newsletters/2021-09-14/ev-battery-prices-risk-reversing-downward-trend-as-metals-surge [accessed on 15-09-2021]

[58] Top-Down approaches extrapolate current developments in battery prices to estimate future costs, whereas Bottom-Up approaches calculate the battery production costs based on material, labour, and other costs.

[59] Battery production costs are subject to economies of scale. This means that the bigger the production facility and the more units are produced, the cheaper the individual unit.

and which offers the best price. Adding the option of LCF-crediting **can therefore only benefit consumers** as it broadens the range from which they choose.

The IA did not consider this optionality. Instead, the IA examines a simple total cost of ownership (TCO) comparison for a single (unspecified) vehicle type and concludes that using a BEV elicits a clear cost advantage compared to LCF credits.

This conclusion does not stand up to even cursory examination:

- **Wrong benchmark (no target failure considered)** – The main objective of an LCF-crediting system is to provide a compliance strategy that is immediately available with proven climate benefits and that is cheaper for OEMs than paying the penalty (and emitting more GHG) – irrespective of whether the crediting scheme is cheaper than BEV. This also benefits consumers, since OEMs that miss their targets must recuperate the penalties through costlier vehicles.[60]
- **Overestimation of LCF compliance costs** – The EC suggest that the average first user TCO for ICEV with crediting is 6,000-9,000 € per vehicle higher than for BEV.[61] This seems to be largely driven by the supposedly higher compliance cost, which were not determined inappropriately (see Section 5.1). Correcting for this methodological deficiency reveals the lack of any single dominant technology and the fact that individual consumer choice will be driven by many factors (battery size and cost, availability of chargers, personal preference for electric drivetrains, etc.).
- **Seemingly incomplete cost calculation –** As a general rule, TCO are defined as the initial purchase price for a new vehicle (incl. additional equipment, such as home chargers) plus maintenance and operating costs (incl. fuel/energy) minus the remaining resale value. The TCO calculation in the IA (IA, Figure 19) includes no initial price for the vehicle, one of the main cost drivers in TCO (the reasoning remains unclear, since none of the calculations are documented and no source is cited). The IA also ignores the additional infrastructure cost for home charging (wall boxes), which is directly borne by consumers.
- **Disregard of heterogeneity in consumer preferences** – The EC has ignored the fact that the crediting scheme is (i) voluntary and (ii) significant heterogeneity exists in the car market. Consumers will only pick up ICEV plus crediting if they provide a cheaper option for clean transport (and fit their preferences). To show that crediting is not benefiting consumers, the EC would have had to consider a wider range of vehicle types (e.g. mini, compact, sedan, SUV) and use cases (low/medium/high mileage and range). These would have impacted significantly on the results since, for example, range is directly related to the necessary battery size, which is a main cost driver for BEV.
- **Disregard of timing –** LCF-crediting can be introduced by 2023 – seven years earlier than the first photo year in the IA. The vehicle cost for BEV and other low-carbon drivetrain technologies will still be significantly higher than in 2030, considering that Germany has recently extended purchase premiums for new BEV of up to 9,000 € until 2025.

[60] Another scenario would be increased subsidies for BEV every time a larger share of OEMs seem likely to miss their target. This would socialise the compliance costs, albeit not among car buyers but all taxpayers.

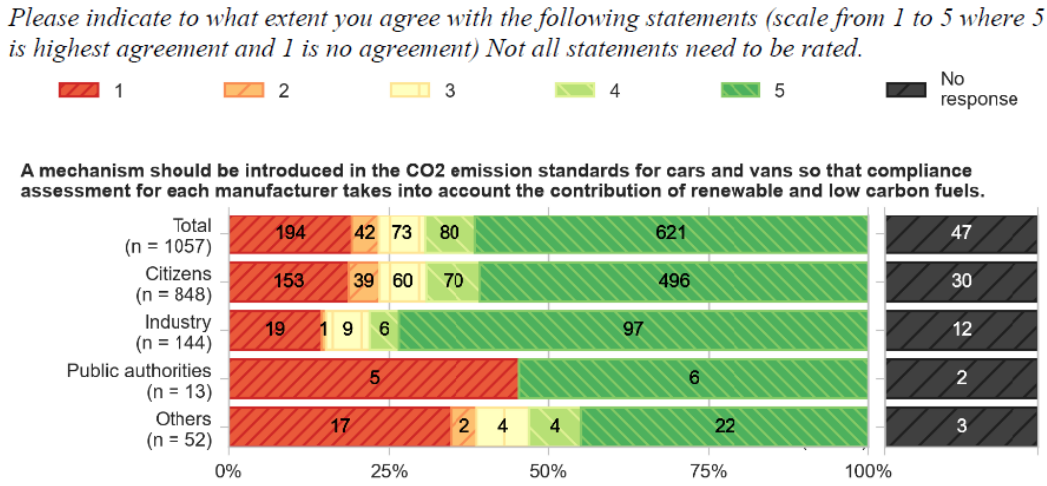
[61] IA, Figure 19.

5.3 Strong stakeholder support for crediting in EC's public consultation

Between 13 November 2020 and 5 February 2021, the EC held a public consultation on the revision of fleet targets which received 1057 contributions.[62] The stated objective of the consultation process was to gather stakeholders' views to inform the EC's IA.

Replies to the consultation questions clearly show that **most stakeholders support the introduction of a crediting system** to account for emissions savings from LCF in fleet targets (Figure 12). There is support for LCF-crediting from all stakeholder categories, ranging from 53% (26 respondents) of "other" stakeholders to 78% (103 respondents) of "industry" respondents.

Figure 12 Strong public support in favour of an LCF-crediting mechanism



Source: EC, Summary Report, Ref. Ares(2021)2795806, p. 8.

Stakeholders were also asked on potential effects from LCF-crediting.[63] 75% of respondents agreed that a crediting system would lead to additional renewable and low carbon fuels in road transport and 68% that such a system will **ensure a holistic approach to road transport decarbonisation**.

The consultation results **contradict the IA's finding** of no benefits for consumers and manufacturers. The IA does not comment on this apparent contradiction and seems to ignore the consultation outcome altogether.

[62] See EC, Summary Report, Ref. Ares(2021)2795806 - 27/04/2021.

[63] See IA, Part 2, p. 16.

6 THE CITED COMPLEXITY AND ADMINISTRATIVE BURDEN IS UNSUBSTANTIATED

Administrative costs play a crucial role when issuing policy recommendations on whether to introduce a crediting system: since such a system would be voluntary for OEMs and consumers and provide another option to achieve emission reductions. If administrative costs for the crediting option are low, introducing it would be a "no regret" measure even if the potential benefits are uncertain.

The EC claims that implementing an LCF-crediting system would be very complex and entail a significant administrative burden.[64] However, the EC fails to substantiate these claims (the whole section on the administrative burden of a crediting system covers less than half a page in the IA). The claim also contradicts the EC's own assessment of a "*limited*"[65] administrative burden for expanding the future RED Union database.

In this section, we show why the EC's claim of high complexity and administrative burden is unfounded:

- **There is no need to set up a new compliance system (Section 6.1)** – Our proposed LCF-crediting system builds on pre-existing monitoring and reporting processes for the RED II fuel supplier obligation to minimise the administrative burden and ensure strict additionality[66].
- **Additional compliance checks are straightforward and will be further facilitated by the RED II fuel database (Section 6.2)** – Since all LCF credits are generated through the existing RED II fuel supplier obligation, compliance checks are straightforward and require minimal additional efforts from national authorities. In any case, the EC has proposed further strengthening the role of the Union database (including capturing transactions), which underlines the limited administrative burden for Member States. Based on this information, a simple calculation methodology (as proposed in our BMWi report) would suffice to confirm compliance by OEMs.
- **Timing can be aligned with minimal effort (Section 6.3) –** Already today, as part of the fuel supplier obligation, LCF sold by fuel suppliers to final customers (namely, the prerequisite for credits) are reported on an intra-year basis and entered into national databases. The current timing for fuel suppliers is already compatible or can be aligned with minimal effort.

Further background information is provided in Annex B.

64 See IA, p. 72.

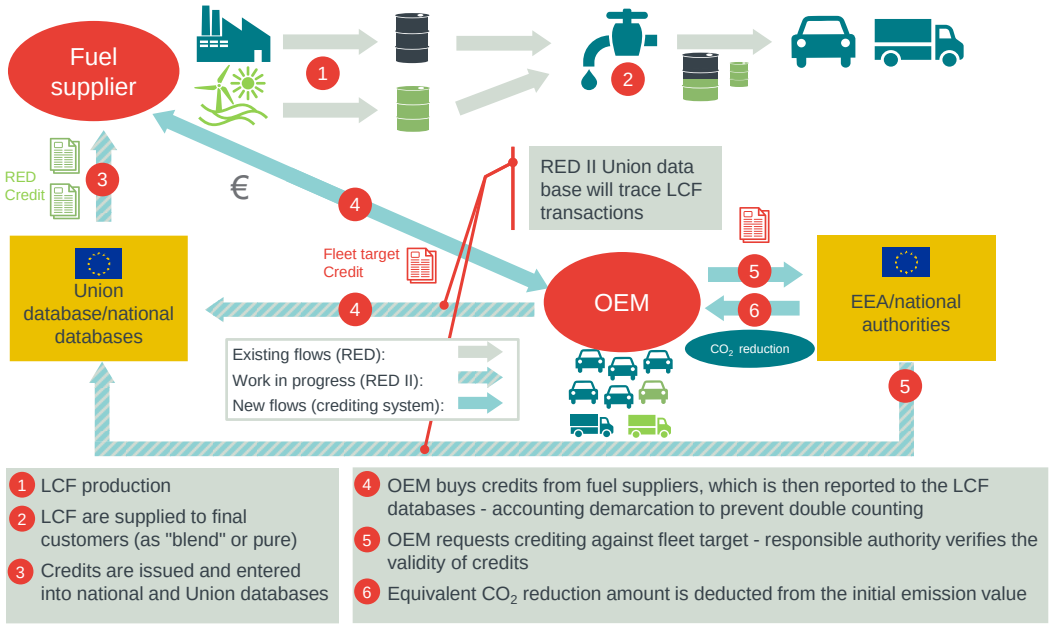
65 RED III Impact Assessment SWD(2021) 621 final, p. 128.

66 See Section 2.

6.1 The proposed crediting system relies on pre-existing monitoring processes and institutions

The EC claims that a crediting system would require a new crediting, monitoring and reporting system to be set up. As Figure 13 demonstrates, this is not the case, since national processes are already in place to verify the compliance of fuel suppliers under RED II. The only new element involves giving OEMs access to national crediting systems and aggregating the information at the EC level (steps 4-6 below). This will be further facilitated by the Union database (Section 6.3).

Figure 13 Flow chart of the LCF-crediting process



Source: Frontier Economics

Note: Union database for renewable transport fuels to be set up in accordance with RED II, Recital 84.

The basic principles are:

- Fuel suppliers are responsible for supplying LCF to final customers as a required step to generate the credits that OEMs can buy and offset against their fleet targets. The same certification and verification process as applies for RED renewable fuel targets should be used to rule out double counting and impose equivalent sustainability requirements.
- Authorities ensure that sustainability criteria are met and credits are only used once. This involves national and EU authorities which are responsible for implementing RED II (particularly the Union database for renewable transport fuels) and the authorities involved in fleet target regulations.
- Authorities must ensure that fuel suppliers continue to meet their renewable fuel obligations before supplying additional credits to OEMs.

The monitoring processes and institutions that underpin the LCF-crediting process are already in place to verify compliance by fuel suppliers, meaning any incremental administrative burden for national authorities would be minimal.

6.2 Compliance checks are straightforward and will be facilitated by the RED II/III fuel database

The EC claims that additional checks at the stage of issuing the credits and checking manufacturers' compliance (involving national authorities) would significantly increase the administrative burden.

This is not the case:

- As demonstrated above, the involvement of national authorities is straightforward as they need only trace which credits have already been used by fuel suppliers and which remain for OEMs to count against their fleet targets to avoid double counting. Already now, the national authorities are tasked with preventing a single litre of renewable fuel being double-counted against the obligations imposed on two different fuel suppliers. Some countries, like the Netherlands (HBE[67]) and Italy (CIC[68]), have even implemented trading systems for renewable fuel certificates.
- To ensure compliance, the EC would only need information from national authorities regarding the total amount of credits by OEM. This type of information would have to be reported to the Union database in any case, which must be set as part of the RED II implementation. In its RED III proposal (see text box below), the EC has proposed further extending the database scope to provide "*more transparency and traceability of the different energy carriers in all end-market segments*"[69].
- In our BMWi report, we have developed a simple calculation methodology to confirm compliance of OEMs – The calculation solely relies on parameters already defined in RED II and would only require the introduction of a single new parameter[70] (lifetime mileage).

In its own RED III Impact Assessment, the EC has emphasised that once the Union database is set up, extending its scope would only entail a limited administrative burden.[71] This clearly contradicts the assessment that a crediting system would impose a significant additional administrative burden.

67 https://www.emissionsauthority.nl/topics/general---energy-for-transport/renewable-energy-units

68 http://www.mercatoelettrico.org/En/Mercati/MCIC/MCIC.aspx

69 RED III Impact Assessment, p. 126.

70 See BMWi report, p. 49: We have proposed possible values which range from 160,000 km (based on *Regulation (EC) No 692/2008 Annex VII (1.2)* as a conservative proxy for lifetime mileage since it is used to verify the durability of pollution control devices) and average historical values in the range of 175,000 - 185,000 km based on a Report for the European Commission by Ricardo-AEA (Ref: Ares (2014)2298698).

71 "Extending the current certification scheme to cover low carbon fuels and waste heat will entail some, but limited administrative burden for MS administrations since MS will have to implement the definitions will be set out in REDII.", see RED III Impact Assessment, p. 128.

RED III PROPOSAL FOR AN EXTENDED UNION RENEWABLE FUEL DATABASE[72]

'Article 31a

Union database

1. The Commission shall ensure that a Union database is set up to enable the tracing of liquid and gaseous renewable fuels and recycled carbon fuels.

2. Member States shall require the relevant economic operators to enter in a timely manner accurate information into that database on the transactions made and the sustainability characteristics of the fuels subject to those transactions, including their life-cycle greenhouse gas emissions, starting from their point of production to the moment it is consumed in the Union. Information on whether support has been provided for the production of a specific consignment of fuel, and if so, on the type of support scheme, shall also be included in the database.

Where appropriate to improve traceability of data along the entire supply chain, the Commission is empowered to adopt delegated acts in accordance with Article 35 to further extend the scope of the information to be included in the Union database to cover relevant data from the point of production or collection of the raw material used for the fuel production.

Member States shall require fuel suppliers to enter the information necessary to verify compliance with the requirements laid down in Article 25(1), first subparagraph, into the Union database.

3. Member States shall have access to the Union database for the purposes of monitoring and data verification.

4. If guarantees of origin have been issued for the production of a consignment of renewable gases, Member States shall ensure that those guarantees of origin are cancelled before the consignment of renewable gases can be registered in the database.

5. Member States shall ensure that the accuracy and completeness of the information included by economic operators in the database is verified, for instance by using voluntary or national schemes.

For data verification, voluntary or national schemes recognised by the Commission pursuant to Article 30(4), (5) and (6) may use third party information systems as intermediaries to collect the data, provided that such use has been notified to the Commission.

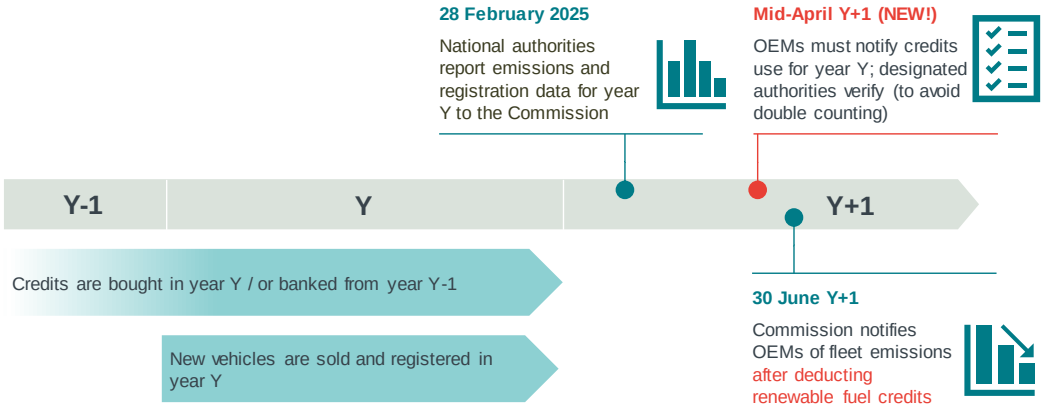
[72] EC COM(2021) 557 final, emphasis added.

6.3 The timing can be aligned with minimal effort

The EC claims that different timing in the reporting cycle for fuel suppliers (RED II obligation) and car manufacturers (fleet targets) would significantly increase the administrative burden.

Figure 14 illustrates the timing for a new vehicle sold and registered in year Y. The timeline is built around the current timing of the Fleet Regulation and annual verification procedure[73] for credits (as in the national implementation of the RED fuel supplier obligation).

Figure 14 Timeline from an OEM perspective



Source: *Frontier Economics*

Note: *New elements from the crediting system are marked red. The remaining timeline elements are taken from the current Fleet Regulation.*
The general timing of the credit generation and verification process applies irrespective of whether credits count towards average fleet emissions or are assigned towards an individual vehicle.[74]

The timing for crediting against average fleet emissions[75] in year Y would work as follows:

- **Throughout year Y**: Credits can be purchased at any time until the end of year Y. One key feature is that credits must be procured before they can be used. This ensures that credits are verified before use and prevents double counting against other legal obligations (such as the RED II-quota for suppliers). OEMs can also use valid credits from the previous year which have yet to be used (by any OEM or fuel supplier).
- **By 28 February of year Y+1 (from Fleet Regulation)**, national authorities (e.g. the KBA in Germany) must report emissions and new registration data for

[73] Alternatively, an ongoing verification procedure intra-year could be implemented where credits must be surrendered and verified year-round (and not the following year) when low/zero-carbon vehicles are sold. This approach generates additional administrative efforts but lets the OEM offer low-emission vehicles immediately after credits have been verified.

[74] The main difference is the way time credits are generated: credits must be verified before an assignment towards individual vehicles (labelled option 2 in our BMWi report). This means that credits for assignment in year Y can have to come from the previous year (Y-1). Alternatively, an intra-year verification procedure could be introduced to eliminate this time lag, see footnote 73.

[75] Here we describe the timing for crediting against the fleet against average fleet emissions (called 'option 1' in our BMWi report). For individual crediting ('option 2'), only credits from the previous year Y-1 are assignable to individual vehicles since they will have already been verified (by April of year Y).

the preceding year to the Commission.[76] Emissions are reported prior to any reductions from crediting.

- **By mid-April of year Y+1[77] (new, aligned with national RED implementation),** after reporting the registration data to the Commission, OEMs and fuel suppliers must notify the designated national authorities for renewable fuels (see Table 2 in Annex B, right column, for the currently responsible authorities in different Member States) about the number of renewable fuel credits they intend to credit against their fleet emissions for the preceding year. Only credits from year Y or banked unused credits can be used.[78] The designated national authorities then verify that OEMs have procured sufficient admissible credits and that these credits have not been surrendered by another obligated party.
- **By 30 June Y+1 (from Fleet Regulation)**, the Commission notifies OEMs of the average specific CO_2 emissions, target emissions and the credited reduction amount from renewable fuels for the preceding calendar year.

This overview shows that the **proposed timing** for the crediting scheme (Figure 14) can **work in practice** with no or only minor adjustments:

- Obligated parties (fuel suppliers) must fulfil their renewable fuel obligations with sales to final customers the very same year;
- Some countries allow unused credits to be carried over to the next obligation period ('banking');[79]
- In most Member States, the deadline for fuel suppliers (the only obligated party as things stand) is in or before April.

Note that the **timeline includes some flexibility** – companies (fuel suppliers, OEMs) wishing to participate in a crediting scheme can submit the necessary information earlier. Furthermore, these deadlines are often set through ordinances or instructions to national authorities, which could be adjusted relatively easily to accommodate a crediting scheme if Member States want to enable participation.

[76] Regulation (EU) 2019/631, Art. 7.

[77] This is the date set in German law (BImSchG), by which quota trading contracts for the previous year must be submitted to the main customs office in Cottbus to be counted against the fuel supplier quota.

[78] Throughout each year, OEMs will have to assess how many vehicles they have sold, how this impacts their average fleet emissions and how many credits they may need to meet their target. The bankability of credits (subject to validity in the national renewable fuel obligation scheme) ensures that no credits are lost, and their tradability allows OEMs to react to unexpected changes in their sales and emission data.

[79] For example, Germany and Spain. In Spain, fuel suppliers can only transfer biofuel certificates comprising up to 30% of the target.

7 CONCLUSION – LCF-CREDITING IS A "NO REGRET" MEASURE

In our report, we have shown that LCF-crediting constitutes a valuable low-carbon option for the environment, consumers and manufacturers (Section 7.1) which can be implemented at limited additional administrative cost (Section 7.2). Since crediting would be a voluntary step for the manufacturers and consumers best-placed to choose the most cost-efficient low-carbon technology, introducing a crediting system is a "no regret" measure for climate protection in road transport (7.3). It is also a step towards a more holistic, resilient and effective climate policy that is technology-open, considers consumers' preferences and considers emissions beyond the tailpipe (Section 7.4)

7.1 Crediting adds a low-carbon option for the environment, consumers and manufacturers

The new vehicle market is characterised by **high uncertainty** (e.g. prevailing battery technology and future cost reductions) and **heterogeneity** (different vehicle types and usage patterns). This makes it impossible to determine the optimal mix of low-carbon technologies in 2030 and beyond.

In this environment, a voluntary LCF-crediting system can provide **significant benefits** for the environment, consumers and manufacturers. Low-carbon fuels are already present in the market and global supply is growing. A crediting system would be a feasible short-term option to fill target gaps if, for example, insufficient electric vehicles were sold. This helps ensure that climate targets can be met, that OEMs sell more low-carbon vehicles rather than paying a penalty and that consumers can choose from a wider range of low-carbon options.

The methodology in the IA is unsuited to capture this option value of LCF-crediting, since it fails to address the key characteristics of the market and does not take the possibility of target failure into consideration (in contrast to reality, when 2020 emission standards were exceeded, despite less ambitious targets than envisaged for 2030 and temporary provisions that eased target achievement).

7.2 A crediting system can be implemented at limited administrative cost

An LCF-crediting system can be implemented with a **limited additional administrative burden** since it builds on pre-existing monitoring and reporting processes for the RED II fuel supplier obligation.

Since all LCF credits are generated through the same existing system, compliance checks are straightforward and require minimal additional efforts from national authorities. Already today, as part of the fuel supplier obligation, LCF sold by fuel suppliers to final customers (as a prerequisite for credits) is reported intra-year and enters national databases. The current timing for fuel suppliers is already compatible or can be aligned with minimal effort.

As part of the RED III draft, the EC has proposed further strengthening and expanding the role of the future Union database for renewable fuels, which would further streamline the reporting and verification process.

The IA claims (without citing any evidence) that implementing an LCF-crediting system would be very complex and entail a significant administrative burden. This contradicts the EC's own assessment of a "*limited*"[80] administrative burden for expanding the future RED Union database.

7.3 A voluntary crediting system is a "no regret" measure

LCF-crediting is voluntary for manufacturers and consumers. They will pursue the low-carbon option that is most beneficial for them:

- Consumers will compare wide-ranging car models for specific vehicle types and pick the model that best suits their needs and at the lowest possible cost of ownership.
- Manufacturers will offer vehicles which they can place profitably in the market and that minimise their compliance cost (including avoiding penalties).

In a complex and dynamic market for new vehicles, **flexible policies** that entail a portfolio of low-carbon technologies and decentralised decision making (from manufacturer and consumer perspectives) are key to ensuring we meet climate targets effectively, at the lowest possible cost and in accordance with consumer preferences and needs. Since additional administrative costs for implementing a crediting system remain limited, introducing this option is a **"no regret" measure**.

The IA, which rejected the inclusion of a crediting system, relies on an overly simplified analysis which does not comply with the respective IA guidelines. It therefore cannot provide a robust basis for an informed policy decision.

7.4 Crediting can offer a step towards a holistic, resilient and effective climate policy

Credible and effective climate protection requires a **more holistic view** on the climate impact of different mobility options – a full life-cycle perspective which reveals true emissions throughout the **value chain** (from battery and vehicle production, power and fuel mix to recycling). A crediting system – bridging the gap between fuel provision and OEM regulation – would be a first step towards a more holistic system as it links and coordinates climate protection efforts by fuel suppliers and car manufacturers.

The climate challenge is significant and time is short – the remaining global emission budget to limit the overall average temperature increase to 1.5°C may be exhausted in less than two decades unless emissions are drastically reduced.[81] Given this urgency, it seems **inappropriate to exclude technologies** (such as

[80] RED III Impact Assessment SWD(2021) 621 final, p.128.

[81] https://www.ipcc.ch/sr15/chapter/chapter-2/, see Figure 2.3.

combustion engines with low-carbon fuels) and put “all the eggs in one basket”. A lack of available technology options might otherwise mean an inability to meet climate targets, which, in turn, is expected to cause irreversible long-term damage. A regulation which focuses on resilience instead is more likely to provide a level playing field for wide-ranging technologies and consolidate efforts to meet climate targets in a dynamic and uncertain market environment.

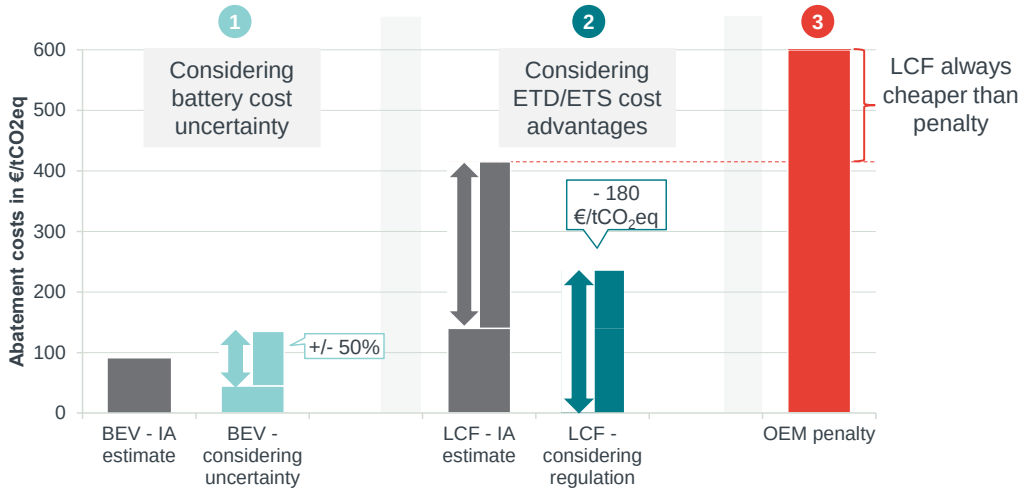
ANNEX A CORRECTION OF COMPLIANCE COST COMPARISON

Incorporating the above-mentioned points into the analysis provides a full picture of compliance costs. Figure 15 illustrates how the estimates of the IA are impacted by considering these uncertainties:

- **(1) Considering the uncertainty of battery production cost significantly increases the possible range of BEV compliance costs:** The IA considers a point estimate for the green premium of BEV based on unclear assumptions. However, considering the uncertainty around the future development of battery manufacturing costs as well as the heterogeneity of battery costs and battery size significantly increases the possible range of BEV compliance costs (Figure 15 illustrates a range of +/- 50% from the point estimate in the IA).
- **(2) Proposed policy measures decrease the compliance costs of LCF**: Policy measures introduced under the Fit-for-55 package reduce the cost premium of LCF compared to conventional fuels and thereby their "green premium".[82] The ETD/ETS comparative cost advantage of LCF is calculated by totalling the cost advantages of LCF compared to conventional fuels due to the proposed amendments to the ETD and ETS (Figure 15 illustrates a potential cost decrease of up to 180 EUR/t CO_2eq; see note below the figure for underlying assumptions). The cost advantage of LCF can be even higher if member states apply higher tax rates for fossil-based fuels than the minimum rate from ETD.
- **(3) LCF are always cheaper than the penalties OEMs must pay if they miss their target**: The IA ignores the possibility that car manufacturers might miss their targets. Considering the penalty as a realistic alternative benchmark for LCF-crediting (instead of BEV compliance costs) clearly shows the economic viability of LCF (Figure 15 illustrates a penalty between 514 and 600 EUR/t CO_2eq, based on lifetime mileages of 160,000-185,000 km to convert the penalty in EUR/gCO_2/km into EUR/tCO_2).

[82] The EC also only considers the most expensive (least mature) types of low-carbon fuel: advanced biofuels and RFNBOs. There is no reason for this, since most RED II/III consider other, more mature RE fuel technologies. Accordingly, the premium for green fuels is likely to be lower than expected in the EC calculations.

Figure 15 Comparison of BEV and LCF compliance cost, including uncertainty and heterogeneity



Source: *Frontier Economics based on Figure 18 of the IA and the Fit-for-55 proposals of the ETD and ETS.*

Note: *Note that the battery cost uncertainty is derived by taking a +/- 50% range from the IA point estimate for BEV mitigation costs. This is in line with the uncertainty range for battery production in current literature. The ETD/ETS comparative cost advantage of LCF is calculated by totalling the cost advantages of LCF compared to conventional fuels due to the proposed amendments to the ETD and ETS. In the proposed ETD, the difference in taxes between LCF and conventional fuels is 10.6 €/GJ, which translates into around 130 €/tCO_2 (at 85% CO2 saving and 94 kg CO_2/GJ fossil fuel). For the future EU ETS for the heat and transport sector, we assume a CO_2 price of 50 €/tCO_2. ETD and ETS together reduce CO_2 abatement costs from LCF by 180 €/t CO_2.This is a very conservative assumption, given that current CO_2 prices in the existing EU ETS are around 60€/tCO_2. In total, the comparative advantage of LCF reduces the "green premium" by up to 170 €/tCO_2.*

Significant uncertainty clearly exists around both BEV and LCF compliance costs and a point estimate, as cited for BEV by the IA, does not constitute a valid approach. We can envisage OEMs using a mix between BEV and LCF-crediting to achieve fleet targets provided both instruments are available. In such a scenario, vehicles with high mileage might be BEV (higher capex, lower fuel cost), while vehicles with low mileage might be ICEV with crediting. OEMs can never be worse off with a voluntary crediting scheme as they can still choose to only comply with BEV.

ANNEX B NATIONAL TIMELINES FOR THE FUEL SUPPLIER OBLIGATION

Table 2 summarises the timeline and institutions involved in the renewable obligation scheme in different Member States. This overview shows that the **proposed timing** for the LCF-crediting scheme can **work in practice** with no or only minor adjustments:

- Obligated parties (fuel suppliers) must fulfil their renewable fuel obligation with sales to final customers in the very same year;
- Some countries allow unused credits to be carried over into the next obligation period (year);[83]
- In most Member States, the deadline for fuel suppliers (the only obligated party as things stand) is in or before April.

Note that the **timeline includes some flexibility** – companies (fuel suppliers, OEMs) wishing to participate in a crediting scheme can submit the necessary information earlier than the national deadlines listed in Table 2. Furthermore, these deadlines are often set through ordinances or instructions to the national authorities which could be adjusted relatively easily to accommodate a crediting scheme should Member States wish to enable participation.

[83] For example, Germany and Spain. In Spain, fuel suppliers can only transfer biofuel certificates comprising up to 30% of the target.

Table 2 Overview – fuel supplier obligation in selected Member States

Member State	By when do obligated parties report volumes (renewable, conventional) to the authorities?	By when do national authorities confirm an obligation has been met?	Involved authorities (registry/database for renewable fuels, etc.)
Germany	15 April Y+1[84] (renewable fuels reported monthly)	Within a reasonable period of submission (not further specified)	**1.** Federal Office of Agriculture and Food operates RE fuel database Nabisy **2.** The Main Customs Office verifies obligation
Finland	31 March Y+1	No notification but complement request (even years later) if quota unmet	Energy Authority (Energiavirasto)
Sweden	1 April Y+1	-	Energy Authority (Energimyndigheten)
Lithuania	15 May Y+1	-	Estonia Energy Authority
Latvia	30 April Y+1	-	-
Netherlands	1 March Y+1	1 April Y+1[85]	**3.** National Emissions Authority (NEa) administering the HBE system **4.** Customs Authority and Statistics Office (CBS) are also involved
France	10 April Y+1 (renewable fuels reported monthly or quarterly[86])	Timeline not specified	**5.** General Directorate of Customs (quantities, tax benefits) **6.** Direction générale de l'énergie et du climat (DGEC) (durability of credits)
Spain	10 April Y+1 (provisional renewable fuels reported monthly)	1 June Y+1	Ministerio para la Transición Ecológica (MITECO)
Italy	31 January Y+1	**7.** By 31 March Y+1: GSE releases the certificates **8.** April - October Y+1: trade of credits **9.** 1 to 31 October Y+1: GSE verifies compliance	GSE: Monitoring and verification All operations take place via the BIOCAR digital platform.

Source: Frontier Economics, NESTE

[84] Renewable fuels have to be reported monthly see https://www.ble.de/SharedDocs/Downloads/DE/Klima-Energie/Nachhaltige-Biomasseherstellung/Fragen.pdf?__blob=publicationFile&v=7, p. 14. Fuel suppliers have to report the total quantity of fossil fuels and biofuels sold to final customers the previous year (this includes any biofuel credits bought from third parties), see Section 37c (1) BImschG (Federal Immission Control Act)

[85] Claims of renewable fuels are verified by an independent third party, see https://www.emissionsauthority.nl/topics/claiming-deliveries---energy-for-transport/year-end-closing-of-energy-for-transport-claims.

[86] https://www.douane.gouv.fr/service-en-ligne/operation-sur-les-produits-energetiques-isope

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