streamSAVE Dialogue Groups

Priority Action:

Electric Vehicles

Minutes of Meeting 3

Tuesday 23 November 2021

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www.streamsave.eu
contact@streamsave.eu

Short summary

This meeting presented and discussed the calculation methodologies developed by streamSAVE and other studies about energy savings from Electric Vehicles. Key points highlighted in the discussions:

- Sources are available to provide indicative values for both, reference (baseline) and efficient vehicles. However, it is recommended to use national data whenever possible, especially for parameters such as distances travelled or emission factors associated with the electricity mix.
- Rebound effects might be relevant to consider, but cannot be addressed with EU indicative values. It requires empirical data (e.g., surveys).
- The way the electricity mix is considered (e.g., average or marginal emission factors) can have a major impact on the calculation of CO_2 savings.
- Beyond the scope of the EED, it is relevant to consider multiple indicators when assessing transport technologies. A single indicator cannot capture the various impacts to be considered.
- Similarly, it is important to make explicit the cycle considered (whole lifecycle, well-to-wheel, tank-to-wheel). For example, the charging losses should not be neglected.

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(All times are in CET)

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Part 1: the streamSAVE methodology

Presentation by Pedro Moura (ISR-UC, Portugal) about the final streamSAVE methodology for EVs

(*See presentation file available on the streamSAVE Knowledge and support facility*)

Pedro Moura reminded the scope and objective of the methodology, focused on savings calculation from fuel switching from conventional to electric vehicles.

The calculation is based on the differences in specific energy consumption of the vehicles (in kWh/100 km), then requiring assumptions on the average distances travelled.

A slightly different formula is used in the case of hybrid vehicles.

The methodology also includes indicative values. However, it is recommended to use national or more specific values whenever available. The indicative values provide a starting point or benchmark.

The main sources of indicative values include the European legislation, European Environmental Agency, ACEA or JRC reports, as listed below.

About unitary emissions per type of reference vehicle (in gCO_2/km):

- EC (2021) CO_2 Emission Performance Standards for Cars and Vans: https://ec.europa.eu/clima/policies/transport/vehicles/regulation_en
- EEA (2021) Monitoring of CO_2 emissions from passenger cars Regulation 2019/631: https://www.eea.europa.eu/data-and-maps/data/co2-cars-emission-18
- EEA (2021) Monitoring of CO_2 emissions from vans Regulation 510/2011: https://www.eea.europa.eu/data-and-maps/data/vans-14
- ACEA (2020) CO_2 emissions from heavy duty vehicles Preliminary CO_2 baseline (Q3 Q4 2019) estimate: https://www.acea.be/uploads/publications/ACEA_preliminary_CO2_baseline_heavy duty_vehicles.pdf

About Net Calorific Value and Specific CO_2 Emissions:

- Annex VI of the Regulation on the monitoring and reporting of greenhouse gas emissions (2018/2066/EU): https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.334.01.0001.01.ENG

About specific energy consumption per type of efficient vehicle:

- Cars -JEC (2020) Tank-to-Wheels Report v5: Passenger cars https://publications.jrc.ec.europa.eu/repository/handle/JRC117560
- Vans -EV-database (2021) Energy consumption of full electric vehicles. Electric Vehicle Database: https://ev-database.org/cheatsheet/energy-consumption-electric-car
- Truck and Bus -JEC (2020) Tank-to-Wheels Report v5: Heavy duty vehicles https://publications.jrc.ec.europa.eu/repository/handle/JRC117564

About distances travelled:

- Road traffic statistics by type of vehicles Eurostat (2021) Transport Database. https://ec.europa.eu/eurostat/web/transport/data/database
- Number of vehicles by type ACEA (2021) Vehicles-in-use-Europe 2021. European Automobile Manufacturers' Association: https://www.acea.be/uploads/publications/report-vehicles-in-use-europe-january-2021.pdf

About investment and maintenance costs:

- LeasePlan (2020). 2020 Car Cost Index: https://www.leaseplan.com/en-es/blog/2020-car-cost-index/accessed on 2021/06/17

The indicative values on distances travelled are based on Eurostat data, and show important differences among countries. Using national values for this parameter is thus strongly recommended.

About the indicative values on investment and maintenance costs, it should be noted that these data are without tax, as taxes on vehicles can strongly vary between countries.

The possibility to consider behavioural aspects, especially direct rebound effects, is discussed (e.g., choosing more powerful or heavier vehicles, longer distances travelled, higher speed). These effects and related studies are mentioned in the methodology, but not directly integrated into the indicative values, since these effects can be very specific to the technology, the drivers, and also depending on fuel prices, etc. It is therefore recommended to assess these effects with empirical data (e.g., surveys, on-board monitoring devices).

Q&A on the streamSAVE methodology

- Are the indicative cost data for reference or new vehicles?

There are data available for both reference and new vehicles (in the streamSAVE methodology).

- Discussion on the values of specific energy consumption that seem rather low, because the losses from the plug to the batteries (and motors) are not taken into account (cf. about 20 kWh/100 km for Car BEV)

It also depends on the size of the vehicles considered. The values presented here are average values. But indeed, the manufacturers' data do not always consider the losses between the plug and batteries.

Experience shows that 12.5 kWh/100 km for standard EV models seems realistic but that corrections might be needed to take into account charging losses.

The data from the JEC reports are from 2016, based on the old reference cycle (simulation-based). These numbers are indeed lower than actual consumption. The difference with actual driving practices can be 20 to 30% (actual consumption being higher than simulated one).

The issue of the charging losses is different between cars and heavy duty vehicles.

- Question about using the average or the marginal emission factors for electricity in these evaluations? Using the marginal emission factor can lead to negligible savings, or even higher emissions sometimes, from electric vehicles (compared to vehicles with internal combustion engines).

The methodology uses the average emission factors. Indeed, using marginal emission factors might give different results, depending on how many vehicles are considered. The effect would be negligible for a small number of EVs. It can become significant in the case of a large fleet of EVs, depending on the electricity mix of the country and the charging patterns.

There was also a discussion about lifecycle emissions according to the type of electricity generation, for example, to take into account that PV and wind do generate CO_2 emissions when considering their whole lifecycle.

- Question about the evaluation in the methodology of early replacement of scrapped vehicles

In the case of scrapping there is the need of considering two different periods with different energy consumption for the reference vehicle:

  - in the first period considering as reference the consumption of the scrapped vehicle, and
  - in the second period considering the consumption of the alternative available in the market.

Part 2: Experience sharing about energy savings from EVs

Presentation by Matteo Prussi (DENER, Politecnico di Torino, Italy) about "Well-to-Wheels analysis of future automotive fuels and powertrains in the European context"

(*See presentation file available on the streamSAVE Knowledge and support facility*)

Mattei Prussi coordinated the last version V5 of the JEC Well-to-Wheels report.

The JEC (JRC EUCAR Concawe) is a long-standing collaboration between researchers, car manufacturers and fuel suppliers, to provide technical information to decision makers.

The WTW (Well-to-Wheels) study has been used as a reference in various reports and studies of the European Commission and also for the IPCC.

The different scope of emissions are reminded:

- Well-to-Tank (WTT) provides data about the supply chain of fuels (especially for biofuels and electricity).
- Tank-to-Wheels provides data about the chain from the tank (e.g., gas station, plug) to the end-use of distances travelled (including loading losses in case of EVs).

It is not a full LCA (cf. vehicles' manufacturing and end of life are not included), and is focused on GHG emissions.

The V5 report provides information about the current situation (2016-2018) and the next decade (2030 horizon).

The report covers a very large variety of combinations (in terms of fuel pathways and types of vehicles).

The WTT data enables to take into account the possible "negative emissions" from biogenic CO_2 in the production of biofuels.

Matteo Prussi then presented the main results about heavy duty vehicles. Looking at TTW results, fully electric and fuel cell alternatives offer significantly higher energy efficiency, up to 2.5 times for catenary electric vehicles (CEV, electric).

When discussing the assumptions used, the study clearly shows that the impact on GHG emissions of EVs compared to diesel vehicles strongly depends on the source of electricity (i.e., the national electricity mix). In the worst cases, emissions can be higher.

It reminds that electricity (and hydrogen as well) is an energy vector. Therefore the CO_2 emissions mostly depend on the primary source of energy used to generate electricity. Therefore, the link with RES is of utmost importance.

This issue is critical for hydrogen. Considering hydrogen would reduce the emissions is assuming that hydrogen would be produced from electrolysis (electricity), which is a very minor share of the H_2 production currently.

The system perspective is also essential to consider the conversion losses and the overall energy efficiency (e.g., from primary to final energy). Depending on the methodology used, the CO_2 metric can be misleading.

Q&A

- What about the indicator of final energy consumption?

It has to be part of the discussion, for example in line with the objective of energy security. However, it should not be a single indicator. It should come together with the CO_2 emissions, and/or also consider the conversion losses from primary to final energy.

- What electricity mix is considered in the study?

The study considered the average European mix.

Data on electricity mix are most often public (at country level), so it is also possible (and even recommended) to do calculations based on national conditions.

- Discussions on data limitations and European average.

The results are based on European averages and therefore it is possible to find very different results in several countries. However, data limitations do not allow more detailed assessments at the country level.

Part 3: Full demo of the streamSAVE Training Module

Demo done on the case of Electric Vehicles by Maria Lopez Arias (CIRCE, Spain)

Maria Lopez Arias presented the Training Module, providing first an overview of the methodologies already included, and then making a demo with the methodology for the case of energy savings from Electric Vehicles.

Practical guidance can be downloaded about how to use the tool, as well as Excel spreadsheets that can be used offline.

The calculations can be done using either indicative or national/specific values.

A set of options need to be selected to specify the reference/baseline situation and the action(s) implemented.

When all the data needed are entered, several options are available to see or export the results. Your results can be saved in your account on the platform. You can delete them at any time.

A “Give methodology feedback” button is also available to download a feedback form to provide comments or suggestions that will be taken into account to improve the tool and methodologies.

List of participants

30 participants

Name	First name	Organisation	Country
Ayeridis	Georgios	CRES	Greece
Bakas	Rimantas	Lithuanian energy institute	Lithuania
Delgado	Joaquim	DEE-ESTGV do IPV	Portugal
Esteves	Pedro	PNAEE	Portugal
Giakoumi	Argyro	CRES	Greece
Gynther	Lea	MOTIVA	Finland
Kostadinov	Lyudmil	SEDA	Bulgaria
Kyprou	Stelios	CEA (Cyprus Energy Agency)	Cyprus
Magyar	Jan	Slovak Innovation and Energy Agency	Slovakia
Masiulionis	Ričardas	Lithuanian Energy Agency	Lithuania
Millán	Gema	CIRCE	Spain
Prussi	Matteo	Politecnico di Torino (IT)	Italy
Santiago	André	ENSE	Portugal
Savva	Savvas	CEA (Cyprus Energy Agency)	Cyprus
smeets	Niels	FPS Economy	Belgium
Sousa	José	Instituto Politécnico de Setubal	Portugal
Stonienė	Agnė	Lithuanian Energy Agency (LEA)	Lithuania
Thenius	Gregor	Austrian Energy Agency	Austria
van Rooijen	Bonny	Netherlands Enterprise Agency	Netherlands
Vieira	João	PNAEE	Portugal
Zarzuela	Miguel	AUVE	Spain
Žuraulis	Vidas	Vilnius Gediminas Technical University	Lithuania
Project dialogue team (organisation)			
Moura	Pedro	ISR - University of Coimbra	Portugal
Fonseca	Paula	ISR-UC	Portugal
Patrão	Carlos	University of Coimbra	Portugal
Jezdinsky	Tomas	European Copper Institute	Germany
Lopez	Maria	CIRCE	Spain
Broc	Jean-Sébastien	IEECP	France
Šebek	Václav	SEVEn	Czechia
Pušnik	Matevž	JSI	Slovenia

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