PRIORITY ACTION FOUR

stream SAVE

ELECTRIC VEHICLES

WHAT ARE ELECTRIC VEHICLES AND CHARGING INFRASTRUCTURE?

Electric vehicles—such as two-wheel vehicles, cars, trucks, buses, trains, ships and airplanes—use electricity to power their motors. While hybrid models only partially depend on electricity, electric vehicles are fully dependent. Charging infrastructure consists of public and private systems of stations established to recharge electric vehicles.

WHAT ARE THE BENEFITS OF THE ENERGY SAVINGS ACHIEVED?

Electric motors are efficient, require low maintenance, make little noise and ensure higher air quality by producing no local emissions. Because the primary energy used for charging is increasingly decarbonised, electric vehicles ensure an overall reduction in primary energy consumption and greenhouse gas emissions.

WHAT ARE THE ENERGY SAVINGS OPPORTUNITIES?

Electric vehicles are more energy efficient than conventional vehicles and their dependence on electricity, rather than fossil fuels, greatly reduces greenhouse gas emissions resulting from vehicle use. In addition, electricity used to charge electric vehicles is increasingly generated from renewable resources, as opposed to fossil fuels.

WHAT MAKES CALCULATING ENERGY SAVINGS CHALLENGING?

It is difficult to calculate savings for different types of vehicles without a uniform methodology or reliable historical data regarding energy consumption. Also, fuel switching, between electricity and fossil fuels, is not currently evaluated, and hybrid options of vehicles are not taken into account either.

WHAT IS NEEDED TO IMPROVE ENERGY SAVINGS CALCULATIONS?

In order to establish baselines to measure the consumption of different vehicles and the typical distance traveled, reliable data is needed. There is also a need for methodologies to evaluate savings not only associated with higher efficiency, but in the context of fuel switching in both fully electric vehicles and hybrid vehicles.

The streamSAVE project received funding from the Horizon 2020 Programme under grant agreement N° 890147.

Welcome and Agenda

Please rename yourself in zoom: Name (organisation, country code)

Agenda

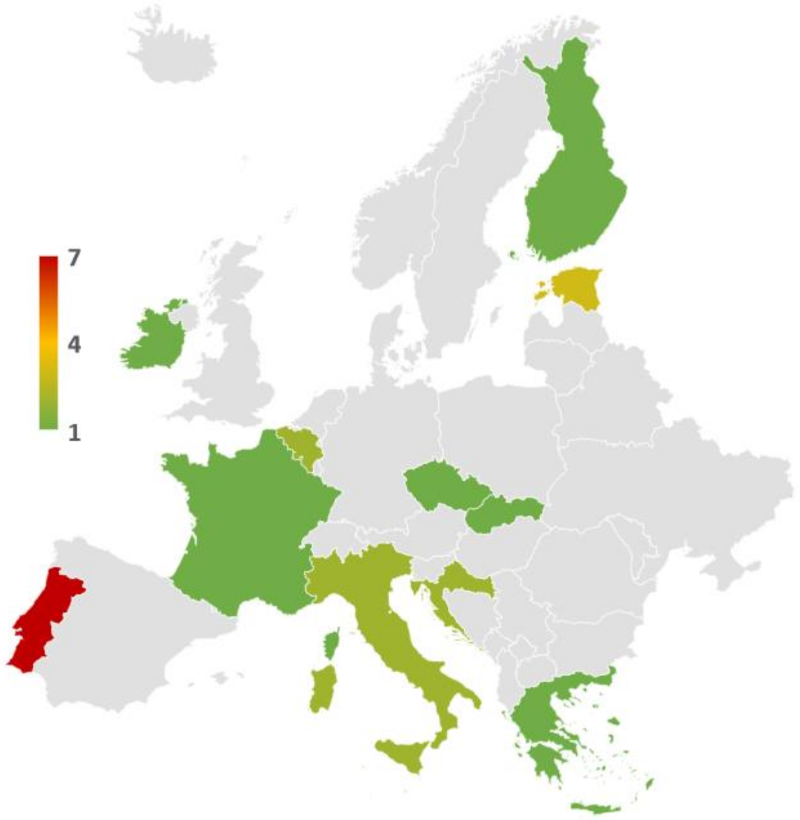
15:00 – 15:05 Welcome to participants

15:05 – 15:25 Overview of the energy savings calculation methodology developed for "Fuel Switching with Electric Vehicles"
by Pedro Moura (ISR-UC)

15:25 – 15:55 Questions and Answers (Q&A) with open debate with participants:
- Feedback about the presented methodology;
- Key issues for the calculation methodology: discussion about sources of information for baseline definition, indicative values, costs and country specific data.

Moderated by Pedro Moura (UC) and Tomas Jezdinsky (ECI)

15:55 – 16:00 Conclusions and next steps



Electric Vehicles and Related Infrastructure

Status of methodology for "Fuel Switching with Electric Vehicles"

Pedro Moura, Carlos Patrão, Paula Fonseca,

ISR-UC, 15 June 2021

This project has received funding from the Horizon 2020 programme under grant agreement n°890147. The content of this presentation reflects only the author's view. The European Commission is not responsible for any use that may be made of the information it contains.

Scope of the methodology

Target

- Fuel switching between conventional and electric vehicles
- Savings ensured with higher conversion efficiency
- Fuel switching between fossil fuels and electricity, which is increasingly generated based on renewable resources

Objective

- To develop a common uniform methodology to calculate the savings with electric vehicles (fuel switching)
- Considering different types of vehicles (cars, vans, buses, trucks) and different options of fuel (including hybrid options)
- Evaluation mainly focused on final energy savings (TtW) to (Article 7) and not a detailed WtW assessment

Calculation of Final Energy Savings (Article 7)

Calculation of final energy savings (Article 7)

Final Energy Savings

$$TFES = \left(sFEC_{ref} - sFEC_{eff}\right) * \frac{DT}{100} * n * f_{BEH}$$

Reference Vehicle	Efficient Vehicle	Distance & Quantity	Behavioural Effects

$TFES$	Total final energy savings [kWh/a]
$sFEC_{ref}$	Specific final energy consumption of the reference vehicle [kWh/100 km]
$sFEC_{ref}$	Specific final energy consumption of the efficient vehicle [kWh/100 km]
DT	Average yearly distance traveled with the vehicle [km/a]
n	Number of efficient vehicles purchased [dmnl]
f_{BEH}	Factor for correction of behavioural effects [%]

Calculation of final energy savings (Article 7)

Conversion of Fuel Consumption

- Including Hybrid Options

$$sFEC = \underbrace{sFC * NCV}_{\text{Fuel Consumption}} * \left(1 - Share_{DT,E}\right) + \underbrace{sEC}_{\text{Electricity Consumption}} * \underbrace{Share_{DT,E}}_{\text{Share of the Demand}}$$

$sFEC$	Specific final energy consumption of the vehicle [kWh/100 km]
sFC	Specific fuel consumption of the vehicle [l/100 km]
sEC	Specific electricity consumption of the vehicle [kWh/100 km]
NCV	Net Calorific Value for the fuel used in the vehicle [kWh/l]
$Share_{DT,}$	Share of the distance traveled using electricity in the vehicle [%]

Calculation of final energy savings (Article 7)

Indicative Values

- Based on the CO_2 emission standards

Year	Cars gCO_2/km	Vans gCO_2/km
2020	95.0	147
2025	80.8	125
2030	59.4	103

EC (2021) CO_2 Emission Performance Standards for Cars and Vans. https://ec.europa.eu/clima/policies/transport/vehicles/regulation_en

- The methodology ensures a regular update of values and the most recent data of monitoring of CO_2 emissions can be used

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

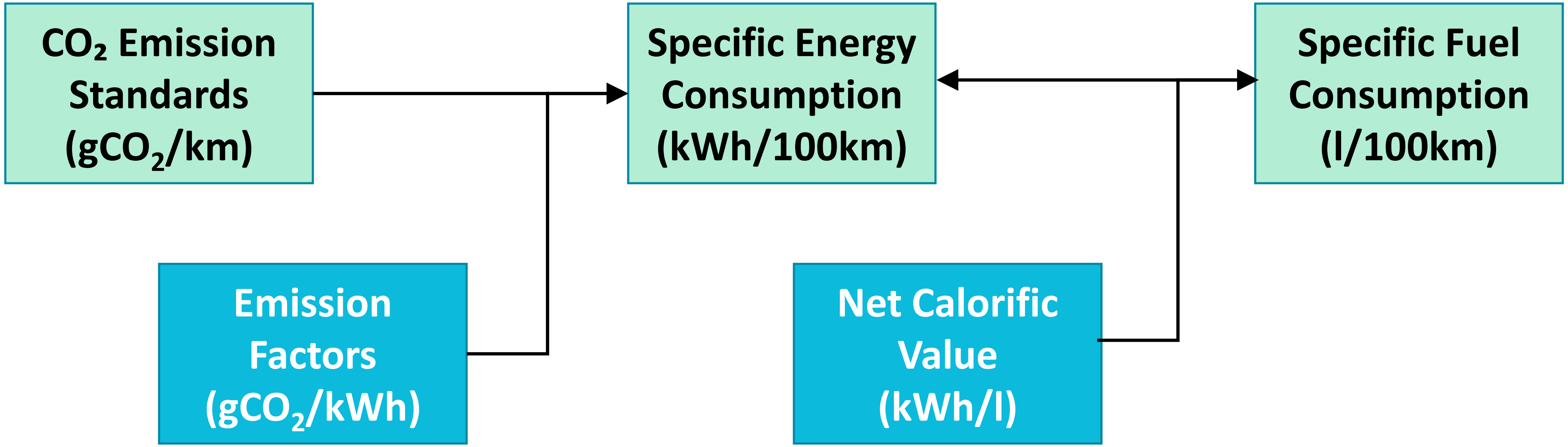
- For buses and trucks, the preliminary average CO_2 baseline for heavy-duty vehicles was used (56 gCO_2/tkm)

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

Calculation of final energy savings (Article 7)

Indicative Values

- The CO_2 emissions values can be replaced by national values or even by specific values for the replaced vehicles
- The specific energy consumption can also be calculated with fuel consumption data
- An excel tool will be provided to ensure the savings calculations and the use of national values



Calculation of final energy savings (Article 7)

Indicative Values

NCV	[kWh/l]
Petrol	9.23
Diesel	10.27
Liquefied petroleum gases	7.23
Natural gas liquids	6.25

Net Calorific Value

$f_{GHG,ec}$	[g CO_2e/kWh]
Motor gasoline	249.48
Gas/Diesel oil	266.76
Liquefied petroleum gases	227.16
Natural gas liquids	231.12
Electricity	133.3

Specific CO_2 Emissions

Data Source

- 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

Calculation of final energy savings (Article 7)

Indicative Values

$sFEC_{ref}$	[kWh/100 km]
Car – Petrol (2020)	38.08
Car – Diesel (2020)	35.61
Car – LPG (2020)	41.82
Car – LNG (2020)	41.10
Car – PHEV (2020)	25.29
Car – Petrol (2025)	32.39
Car – Diesel (2025)	30.29
Car – LPG (2025)	35.57
Car – LNG (2025)	34.96
Car – Petrol (2030)	23.81
Car – Diesel (2030)	22.27
Car – LPG (2030)	26.15
Car – LNG (2030)	25.70
Van - Diesel (2020)	55.11
Van - Diesel (2025)	46.86
Van - Diesel (2030)	38.61
Truck and Bus - Diesel	312.53

Specific energy consumption of the reference vehicle

Calculation of final energy savings (Article 7)

Indicative Values

$sFEC_{eff}$	[kWh/100 km]
Car BEV	12.4
Van BEV	24.6
Truck and Bus BEV	130.2

Specific energy consumption of the efficient vehicle

Data Sources

- 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

Calculation of final energy savings (Article 7)

Indicative Values

DT	[km/a]
Car	13740
Van	17480
Bus	55570
Truck	77800

Distance traveled

Data Sources

- 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

Calculation of Impact on Energy Consumption (Article 3)

Calculation of impact on energy consumption (Article 3)

- Final Energy Consumption of the Reference Vehicle

$$FEC_{ref} = sFEC_{ref} * \frac{DT}{100} * n * f_{BEH}$$

- Final Energy Consumption of the Efficient Vehicle

$$FEC_{eff} = sFEC_{eff} * \frac{DT}{100} * n * f_{BEH}$$

Calculation of impact on energy consumption (Article 3)

Final Energy Savings

$$TFES = \left(sFEC_{ref} - sFEC_{eff}\right) * \frac{DT}{100} * n * f_{BEH}$$

Primary Energy Savings

$$TPES = FEC_{ref} * \sum_{ec}\left(share_{ec} * PEF_{ec}\right) - FEC_{eff} * \sum_{ec}\left(share_{ec,} * PEF_{ec}\right)$$

$share_{ec}$	Share of final energy carrier on final energy consumption [dmnl]
PEF_{ec}	Primary Energy Factor of the used energy carrier [dmnl]

Calculation of Greenhouse Gas Emissions Savings

Calculation of Greenhouse Gas Emissions Savings

Greenhouse Gas Emissions Savings

$$GHGSAV = FEC_{ref} * \sum_{ec} \left(share_{ec,ref} * f_{GHG,ec} \right) - FEC_{eff} * \sum_{ec} \left(share_{ec,eff} * f_{GHG,ec} \right)$$

$share_{ec}$	Share of final energy carrier on final energy consumption [%]
$f_{GHG,ec}$	Emission factors of final energy carrier [t CO_2e/kWh]

Challenges Addressed by the Methodology

Challenges Addressed by the Methodology

Data collection:

- It is suggested that MS develop and maintain a database with the characteristics of the replaced and new vehicles.
- However, indicative are provided with typical data for the main types of vehicles

Definition of baseline:

- The methodology suggests indicative values that will harmonize the baseline calculations among all MS, based on the standards and monitored data for CO_2 emissions.

Approach to additionality:

- The requirements of the EU regulations will be introduced into the specific final energy consumption of the reference vehicles for fulfilling the criterion of additionality.

Challenges Addressed by the Methodology

- Prevention of double counting of savings:
  - The methodology is specific for electric vehicles, and there is the risk of double savings counting.

- Assessment of behavioral aspects:
  - The methodology does not directly evaluate behavioral aspects, but the formula includes the option to consider behavioral aspects, such as rebound, spill-over and free-rider;
  - There’s no sufficient data available for proposing indicative values at the EU level.

Q&A / Open debate

Methodology for “Fuel Switching with Electric Vehicles”

2nd Dialogue Group meeting

15 June 2021

Q&A and Open debate

- Q&A

  => Feedback on methodology and data sources

  - Results and open debate

If there is further information or formulas, or ..., you are always welcome to share via chat, e-mail or Forum on streamSAVE platform.

Conclusions

Methodology for “Fuel Switching with Electric Vehicles”

2nd Dialogue Group meeting

15 June 2021

Next steps

Methodology for “Fuel Switching with Electric Vehicles”

2nd Dialogue Group meeting

15 June 2021

Next steps

- Meeting minutes
  - please feel free to send us your suggestions
- All information will be included on the platform
  - in case you are not registered yet, we will show you how
- Next round: late autumn 2021
- Suggestions for topics or want to share policy practices?

Next Dialogues Group

- Dates for the next Dialogue Groups web meetings

☑ 18.05.2021	Changed date 29.06.2021	☑ 01.06.2021	15.06.2021	22.06.2021
				
BUILDING AUTOMATION & CONTROL SYSTEMS	REFRIGERATION SYSTEMS	LIGHTING SYSTEMS	ELECTRIC VEHICLES	HEAT RECOVERY

All web-meetings will be from **3.00 to 4.00 pm CEST.**

- Subscribe via: [REGISTRATION LINK]
  or send an email to: dialogues@streamsave.eu

Feedback

- Please, fill out our quick feedback survey

- You may also leave us a longer message
  - Via forum on the streamSAVE platform
  - Via the anonymous form (link in the chat)
  - Via dialogues@streamsave.eu
    - Please accept as sender

- To receive more info → register on the streamSAVE platform: https://streamsave.flexx.camp/signup-0818ml

Thank you!

Pedro Moura, Carlos Patrão, Paula Fonseca,

ISR-UC, 15 June 2021

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