

Overall Assessment in LCA of Electric Vehicles

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From Inventory Analysis to Impacts of Electric Vehicles

Online Expert Workshop

October 13 – 14, 2021

Virtually organised:



Introduction

Electric vehicles have the potential to substitute for conventional vehicles to contribute to the sustainable development of the transportation sector worldwide, for example, in the reduction of greenhouse gas (GHG) and particulate emissions. There is international consensus that the improvement of the sustainability of electric vehicles can only be analysed on the basis of life cycle assessment (LCA) (Figure 1), which includes the production, operation, and the end-of-life treatment of the vehicles and the fuel cycle. All environmental impacts must include the whole value chain, and - if relevant - interactions from recycling in the dismantling phase to the production phase, if recycled materials are used to produce new vehicles or other products.

The Implementing Agreement on “Hybrid and Electric Vehicle (HEV)” of the International Energy Agency (IEA) is operating the Task 30 “Assessment of Environmental Effects of Electric Vehicles” to examine the environmental effects of vehicles with an electric drivetrain based on life cycle analyses. The Task 30 started in 2016 and the end 2021. The main activities influencing the environmental impacts of electric vehicles on a life cycle basis are:

- 1) Production and life time of the battery,
- 2) Electricity consumption of the vehicle in the operation phase, incl. e.g. energy demand for heating,
- 3) Source of the electricity, only additional renewable electricity maximizes the environmental benefits and
- 4) End of life treatment of the vehicle and its battery (e.g. reuse, material recycling).

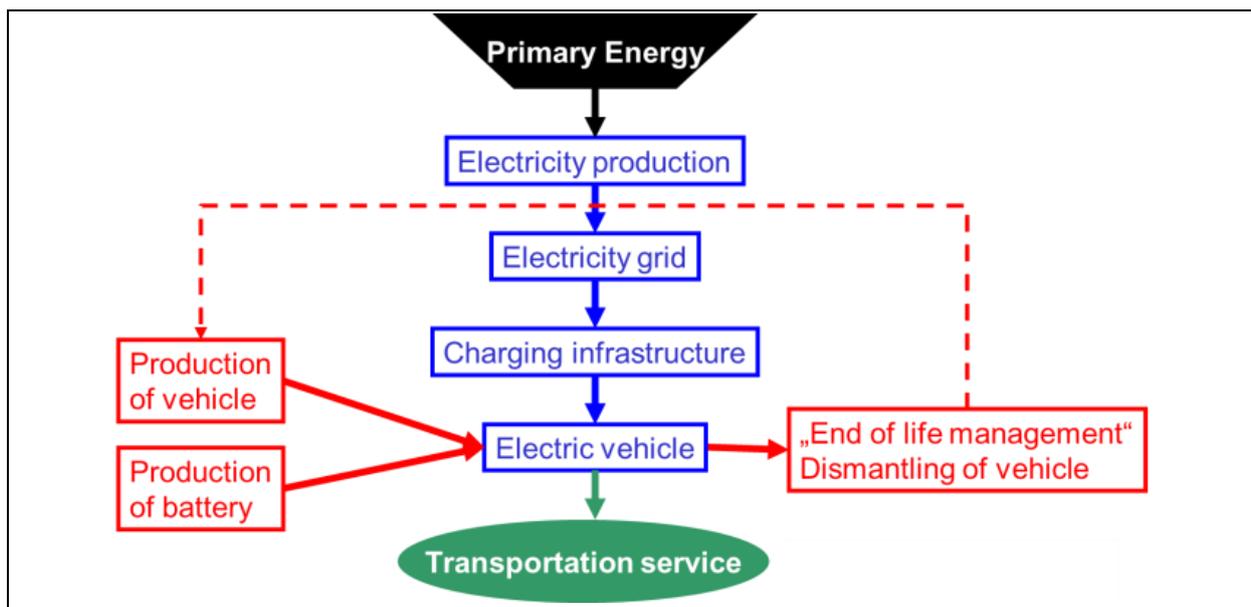


Figure 1: Key elements of the life cycle assessment of vehicles with an electric drive train

		<p>Task 30 “Assessment of Environmental Effects of Electric Vehicles”</p>
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Aim of the workshop

The aim of the expert workshop of Task 30 is to analyse and assess different Impact Assessment methodologies of battery electric vehicles (BEV) and conventional vehicles with an internal combustion engine (ICE). Based on the inventory analysis of Life Cycle Assessment (LCA) different impact categories beyond global warming and primary energy consumption are relevant. The way from Inventory Analysis to Impact Assessment is via mid- and end-point indicators, which will be analysed and discussed in the workshop.

The aim of the workshop is to present and discuss the status and the future perspectives of the Impact Assessment and its impact categories relevant for LCA of vehicles.

Based on presentations from invited experts and members from the task the key issues on Impact Assessment are identified and discussed in a group work among the different stakeholders. The result is a summary statement on the status of Impact Assessment methodologies and its future perspectives for electric and conventional vehicles.

The main topics for the workshop are:

1. LCA methodologies on Impact Assessment
2. Selection of impact categories
3. Necessary inventory data
4. Case studies of EVs, ICEs, batteries, electricity and conventional fuel production
5. Identification of key issues on overall impact assessment
6. Findings and Recommendations

The format of the workshop is based on presentations, discussion and group work.

The workshop is online and virtually hosted by IREC, Spain, October 13&14, 2021

		<p>Task 30 “Assessment of Environmental Effects of Electric Vehicles”</p>
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PROGRAMM

October 13, 2021

Brussels Time ZONE

11:00 Welcome and **Introduction** - Aims of the Workshop

11:10 – 11:30: **IEA HEV Task 30 “Assessment of Environmental Effects of Electric Vehicles”** Gerfried Jungmeier, JOANNEUM RESEARCH, AT

Key Notes

11:30 – 12:15: **LCA of EV and ICE - Human Toxicity Potential, Abiotic Resource Depletion and Water- Scarcity**, Nikolas Hill, Ricardo Energy & Environment, UK

12:15 – 13:00: **Assessment Concept of Protection Areas - Human Health, Natural Resources and Natural Environment**, Fulvio Ardenete, JRC, Ispra, IT

13:00 – 13:45: **LCA of Passenger Vehicles - Impacts Beyond Climate Change**, Christian Bauer, PSI, CH

13:45 – 14:00: discussion

14:00 – 14:30: Break

14:30 – 15:15: **LCA of Electricity in Europe to 2050 - Beyond GHG and Primary Energy**, Nabil Abdalla, IFEU, DE

15:15 – 16:30: **Overview of the Commonly Used LCIA and LCI indicators in the Automotive LCA Studies in North America- Status-quo, Limitations and Future Perspective**, Lindita Bushi, Argonne, USA

16:30 – 16:45: discussion

17:00 End of day 1



Task 30 “Assessment of Environmental Effects of Electric Vehicles”

Highlights of LCA of EVs from Task 30 partners

October 14, 2021

Brussels Time ZONE

11:00 Welcome and **Introduction** - Aims of the Workshop

11:15 – 11:45: **Benefits of Vehicle Electrification - GHG Emission of Vehicle Charging**, Tugce Yuksel, Sabanci University, Turkey

11:45 – 12:15: **New Vehicle Concepts and Scenarios**, Simone Ehrenberger, DLR, Germany

12:15 – 12:45: **Dynamic LCA for BEV Introduction and Development of Vehicle Fleet in Austria 2010 to 2050**, Gerfried Jungmeier, JOANNEUM RESEARCH, Austria

12:45 – 13:00: discussion

13:00 – 13:30: Break

LCA and Impact Assessment in the USA/North America

13:30 – 14:15: **Cradle to Grave Lifecycle GHG and Cost Analysis of Current and Future Light Duty Vehicles in the United States**, Jarod C. Kelly, Argonne National Laboratory, USA

**) Tool for the Reduction and Assessment of Chemical and other environmental Impacts*

14:15 – 14:45: **TRACI*)**: **Current Status and Future Direction**, Jane Bare, EPA, USA

14:45 – 15:00: discussion and group formation

15:00 – 15:15: Break

Group work of LCA experts

15:15 – 16:15 **Identification of key issues on Impact Assessment** (Group work)

- Selection of Impact categories and assessment methodologies
- Most relevant impacts for comparing EVs and ICE

16:15 – 17:00: Presentation and discussion of Group work

17:00: Summary and conclusions

17:15 End of workshop

		<p>Task 30 “Assessment of Environmental Effects of Electric Vehicles”</p>
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REGISTRATION

For registration please send an e-mail to latest by October 1, 2021

gerfried.jungmeier@joanneum.at

There is no registration fee for this online Workshop.

Further information and the access link will be sent to you after registration close before the workshop.

For questions, please contact

Gerfried Jungmeier

Operating Agent of IEA HEV Task 30 „Assessment of Environmental Effects of EVs”

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Task 30 “Assessment of Environmental Effects of Electric Vehicles”

Members: Austria, Canada, Germany, Spain, South Korea, Turkey, USA

Electric vehicles have the potential to substitute for conventional vehicles to contribute to the sustainable development of the transportation sector worldwide, for example, in the reduction of greenhouse gas (GHG) and particle emissions. There is international consensus that the improvement of the sustainability of electric vehicles can only be analyzed on the basis of life cycle assessment (LCA), which includes the production, operation, and the end-of-life treatment of the vehicles and the fuel cycle. All environmental impacts must include the whole value chain and - if relevant - interactions from recycling in the dismantling phase to the production phase, if recycled material is used to produce new vehicles.

The aim of Task 30 (2016 – 2021) is to analyze and assess environmental effects of electric vehicles (EVs) on water, land use, resources and air based on life cycle assessment in a cooperation of the participating countries in the International Energy Agency (IEA).

Task 30 is using the results of the completed Task 19 “Life Cycle Assessment of Electric Vehicles” (2011 – 2015, www.ieahev.org/tasks/task-19-life-cycle-assessment-of-evs/, led by JOANNEUM RESEARCH) as a foundation to subsequently examine the environmental effects – benefits and impacts - of vehicles with an electric drivetrain (EVs), based on life cycle assessment (LCA). With an eye on the three phases of LCA, such as production, operation and dismantling of EVs, various environmental effects of EVs on water, land use, resources and air, among others, will be analyzed and assessed. Thereby a strong accent is put on the comparison of environmental effects between pure battery EVs (BEV) and Plug-in hybrids (PHEVs) on one hand and conventional ICE vehicles using gasoline and diesel on the other side.

In recent years the focus in environmental assessments of electric vehicles was on global warming and primary energy consumption. But now it is recognized that other impacts gain additional relevance and must be addressed by life cycle based comparisons like water, land use, resource consumption, local PM and NO_x-emissions. Therefore Task 30 will focus on following topics covering methodologies, data and case studies:

- Effects of EVs on water (emissions to water, waste water, “Water Footprint” of EVs)
- Effects on EVs on land use-resources-waste (land use, occupation and degradation, demand of renewable and fossil resources, recycling)
- Effects on EVs on air (local emissions and effects of NO_x, PM and C_xH_y, human health effect and non-energy related emissions from tires and brakes)
- Overall environmental effects and their assessment (comparing and assessing different impact categories, single score methodologies, stakeholder involvement).

Within the Task, methodologies for helping countries implement EVs by identifying possibilities to maximize the environmental benefits will be developed. Besides, various case studies will

be analyzed and networking combined with information exchange will be supported within the Task’s frames (Figure 1). The Task will proceed by holding a series of expert workshops addressing the following objectives:

- Methodologies on assessment of environmental effects
- Analyses of necessary and available data
- Overview of international studies/literature
- Analyses of current knowledge and future challenges
- Overview of key actors and stakeholders and their involvement
- Communication strategies to stakeholders
- Summarizing further R&D demand

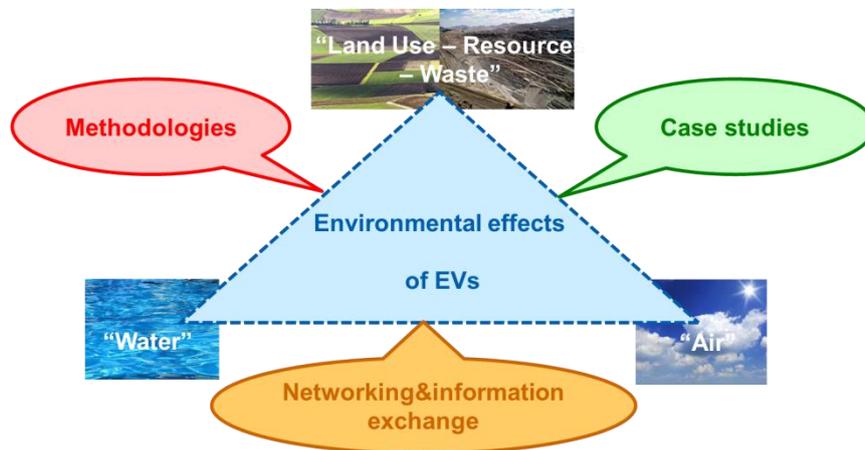


Figure 1: Working method in Task 30

Members in this Task will compile a list of environmental benefits and impacts of EVs with the goal to increase their overall acceptance by providing facts and figures on the environmental effects of EVs. Thus, numerous advantages of EVs compared to conventional vehicles will be shown. These results should help the industry and government to support further development and employment of EVs in all transport modes. The results will document and summarize the state of current knowledge and future challenges (incl. methodologies and case studies) on

- Effects of electric vehicles on water
- Effects of electric vehicles on Land use – resources – waste
- Effects of electric vehicles on air
- Overall environmental effects and their assessment of EVs
- R&D demand.

In addition to these technical and scientific results a glossary on “Frequently asked questions” (FAQ), a framework for Communication strategies to stakeholders and dissemination activities (e.g. proceedings, reports, papers, notes, presentations) will be available.

	<p>Task 30 “Assessment of Environmental Effects of Electric Vehicles”</p>
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Contact Details of the Operating Agents

For further information, please contact the Task 30 Operating Agent:

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www.ieahev.org/tasks/task-30-assessment-of-environmental-effects-of-electric-vehicles/