



Feasibility analysis and development of on-road charging solutions  
for future electric vehicles

## System Level LCA

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# Life Cycle Assessment (LCA)

1. ISO 14040:2006
2. ISO 14044:2006
3. EN 15804:2011
4. ILCD HANDBOOK



# Outline



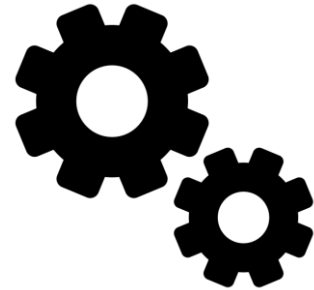
VEHICLES

Preliminary study



E-ROADS

D53.1, D53.4



SYSTEM LEVEL

D55.3

# Workplan



1. Preliminary study: Comparative Life Cycle Assessment (LCA) of a Light Duty Vehicle (LDV) with three different powertrains (CNG, Diesel, Electric Plug-in) ✓ **COMPLETED**
2. LCA of e-roads: in progress, preliminary results obtained. To be presented in upcoming deliverable D53.4 ~ **IN PROGRESS**
3. System level: LCA model to be defined as a function of scenarios To be presented in D55.3 🕒 **WAITING FOR SCENARIOS VALIDATION**

# LCA of e-road – Structure



LCA stages according to ISO standards:

1. Goal and scope
2. Life Cycle Inventory (LCI)
3. Life Cycle Impact assessment (LCIA) – preliminary results
4. Interpretation

# Goal and scope



1. Goal:
  - «This LCA aims to evaluate the long-life E-road predictions defined in Tasks 5.3.3 and 5.3.5 and Task 5.3.4 in terms of energy usage, fuel usage and emissions» (FABRIC DoW)
  
2. Scope:
  - Product system:
    - one e-corridor (single lane) of 25 km on a highway
    - three technologies (SAET, POLITO, *Qualcomm*)
    - construction technique: trench-based construction
  
  - *System boundary*
  - *Temporal system boundary*
  - *Functional unit and reference flow*
  - *Data quality*
  - *Impact assessment*

# Scope: system boundary



System boundary

## Construction

Surface layer removal

Trench excavation

WPT components production and installation

Asphalt deposition and compaction

Traffic delay

## Maintenance

WPT components replacement

Pavement maintenance

Traffic delay

## Operation

Routine activity related to WPT components

## End of Life

Road dismantling

WPT components dismantling/ recycling/ reuse

# Scope (D53.1)



1. Temporal system boundary: 20 y
2. Functional unit FU (declared unit\*): 1 km of e-corridor, lasting for 20 years
3. Data quality:
  - primary data: WPT components; construction methods and geometry of the trench
  - Secondary data: components production, machinery fuel consumption
4. Impact categories:
  - cumulative energy demand (CED)
  - fossil fuels consumption (Abiotic depletion –fossil fuels from CML)
  - climate change (GW IPCC 2013 100y)
  - Acidification?

\*declared unit: used instead of a functional unit when the precise function of the product is not stated or known



# Scope (D53.1)



1. Primary Data sources:
  - Road construction: TRL provided geometry and techniques
  - WPT technology: SAET and POLITO provided layout and components
2. Secondary data: EcolInvent database version 3.3
3. Assumptions:
  - parametric transport distances (the analysis is for a general e-road rather than a specific one)
  - Wear layer removal accounted in the analysis
4. To do:
  - Traffic delay in Construction and Maintenance phases as for D53.1 (scenario to be defined, how to account for traffic emissions)
  - Maintenance: to be included as for D53.1 (data to be collected, source?)
  - Operation phase: activities to be defined
  - End-of-Life: to be included? (not in D53.1); if yes, data to be collected, source?

# LCIA – preliminary results



## Impact Assessment

Construction	Global Warming [ton CO <sub>2,eq</sub> /FU]	CED [GJ/FU]	AD - fossil fuels [GJ/FU]
Surface layer removal			
Trench excavation	6 (2%)	450 (4%)	436 (4%)
Asphalt deposition and compaction			
WPT components production and installation	300 (98%)	10'113 (96%)	9'377 (96%)
Traffic delay			

# Scenarios: how to include in LCA



Using consequential approach

“A system modelling approach in which activities in a product system are linked so that activities are included in the product system to the extent that they are expected to change as a consequence of a change in demand for the functional unit<sup>a</sup>”

Future scenarios should take into account:

- Battery downsizing
- Changing in the daily Energy demand wrt EV without WPT? Increasing the peak demand?
- Marginal electricity mix
- Increased number of EVs (also the non WPT equipped) wrt traditional ones (ICEVs)
- Increased e-road travel demand (due to lower operational costs? Rebound effect)
- Traffic congestion ( dedicated line? Different maximum speed?)
- Other relevant aspects? To be discussed

<sup>a</sup>Glossary and definitions <https://consequential-lca.org/glossary/#consequential>



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# Thank you!

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