



HEALROAD Symposium

ENVIRONMENTAL IMPACT OF THE NEW TECHNOLOGY (LCA)

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1. LIFE CYCLE ASSESSMENT

Life Cycle Assessment (LCA) is a standardized method for measuring and comparing the environmental aspects and potential impacts associated with the manufacture, use and disposal of a product, process or service

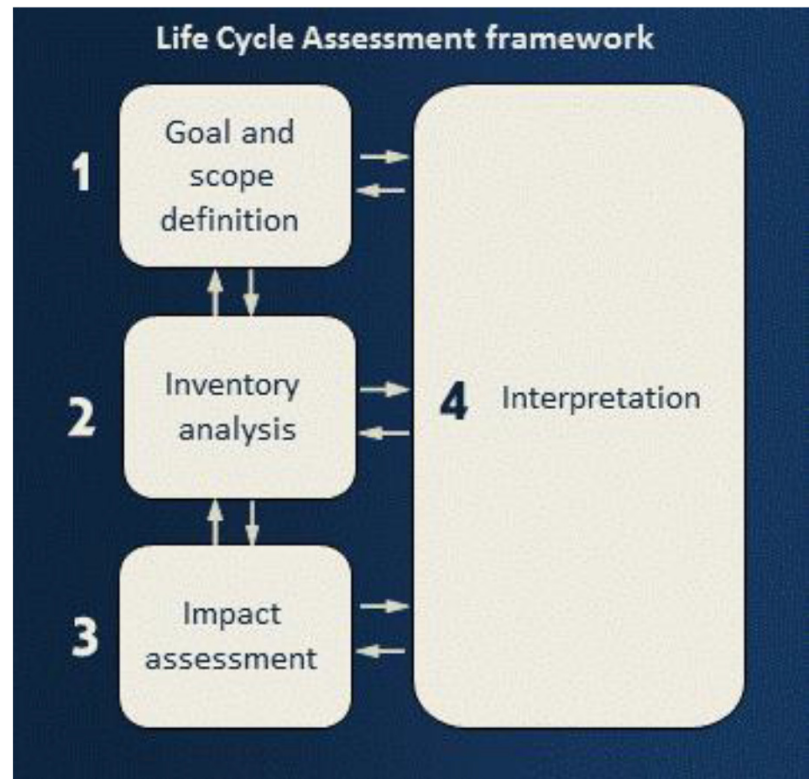


Figure source: ISO 14040

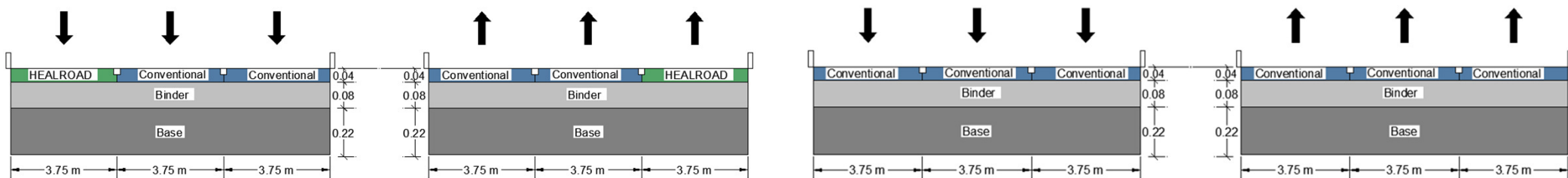


2. GOAL AND SCOPE

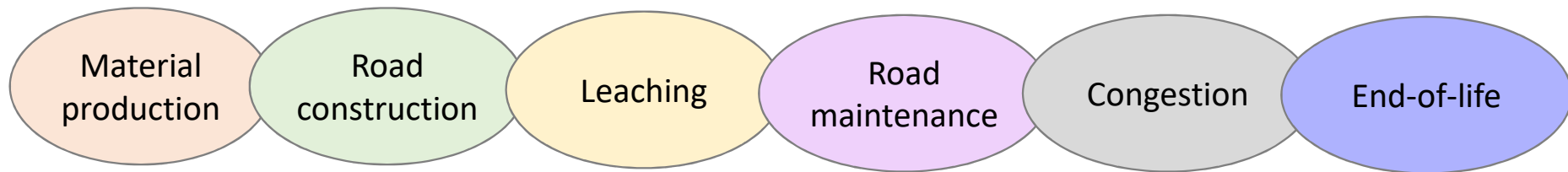
- **Goal:** To demonstrate the sustainability of the induction heated asphalt mixture by comparing the environmental impacts this technology produces with the ones caused by traditional mixtures.

- **Functional unit**

QR 36



- **Analysis period:** 30 years
- **System boundaries:**





3. LIFE CYCLE INVENTORY

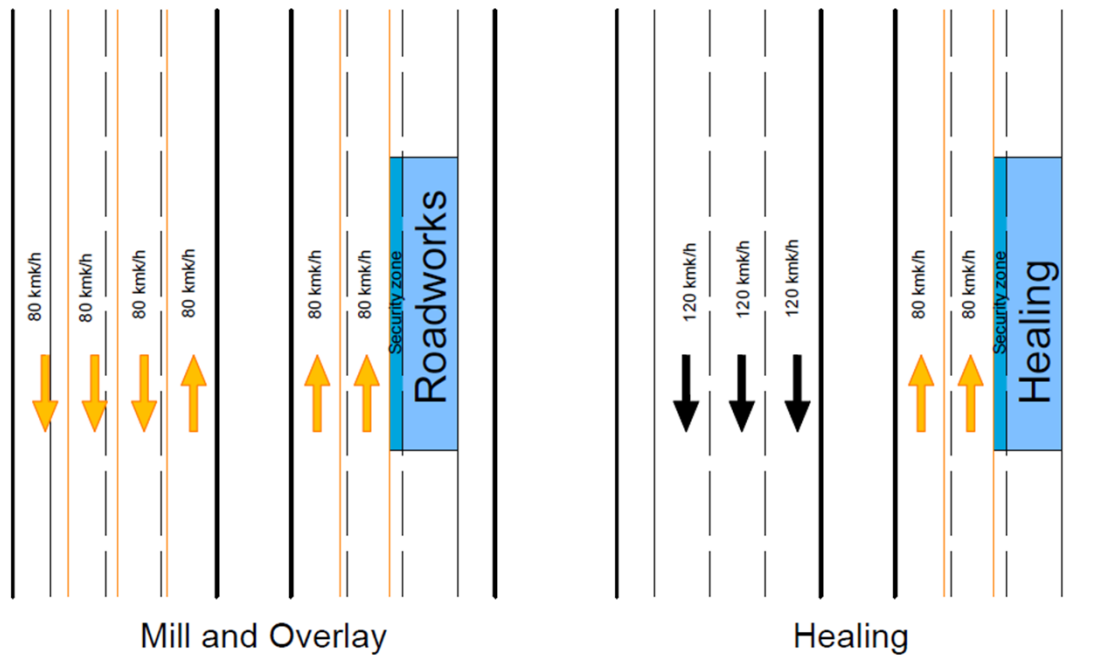
- **Primary Data inventories**
 - GaBi V8.1
 - HEALROAD project data
 - Literature reviewed
- **Maintenance schedule**

Year	HEALROAD		Conventional	
	Main lane	Adjacent lanes	Main lane	Adjacent lanes
0	Initial construction	Initial construction	Initial construction	Initial construction
5				
10	Induction healing		Mill and overlay	
15	Mill and overlay	Mill and overlay		Mill and overlay
20			Mill and overlay	
25	Induction healing			
30	Mill	Mill	Mill	Mill



3. LIFE CYCLE INVENTORY

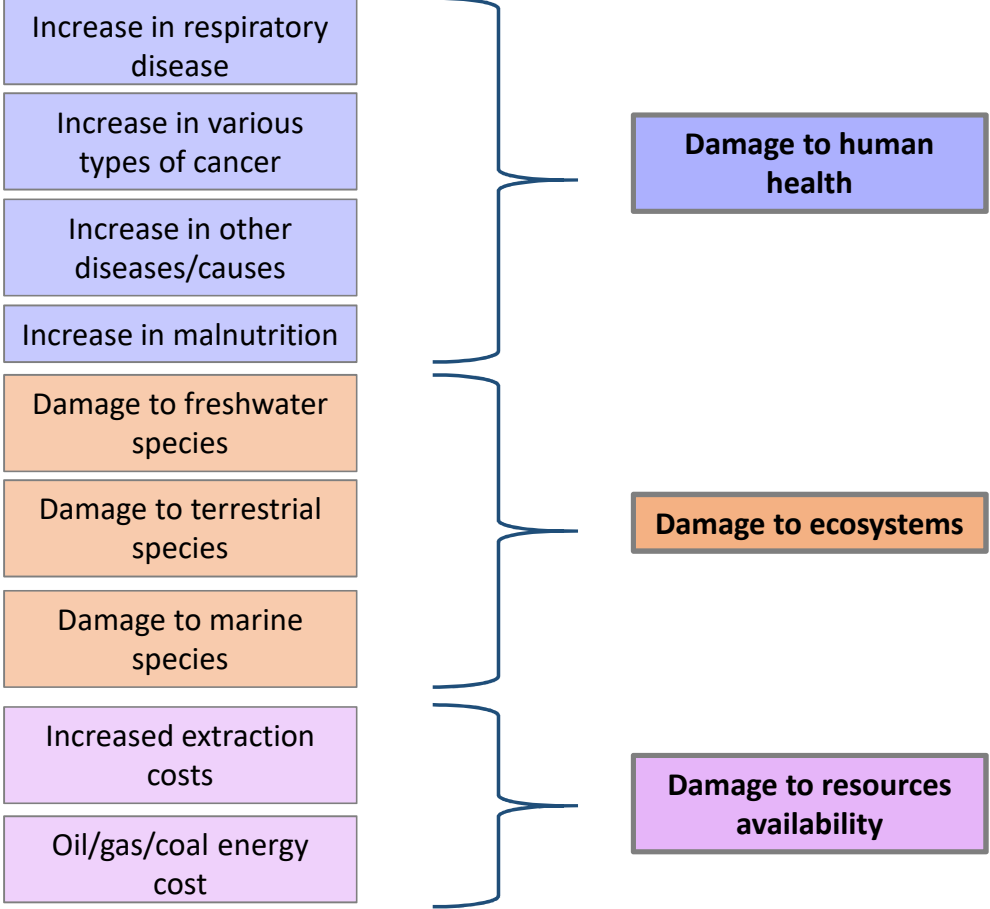
- **Traffic affection**
 - Tools used to calculate traffic emissions
 - Kentucky Highway User Cost Program (KyUCP) v.1.0
 - MOVES





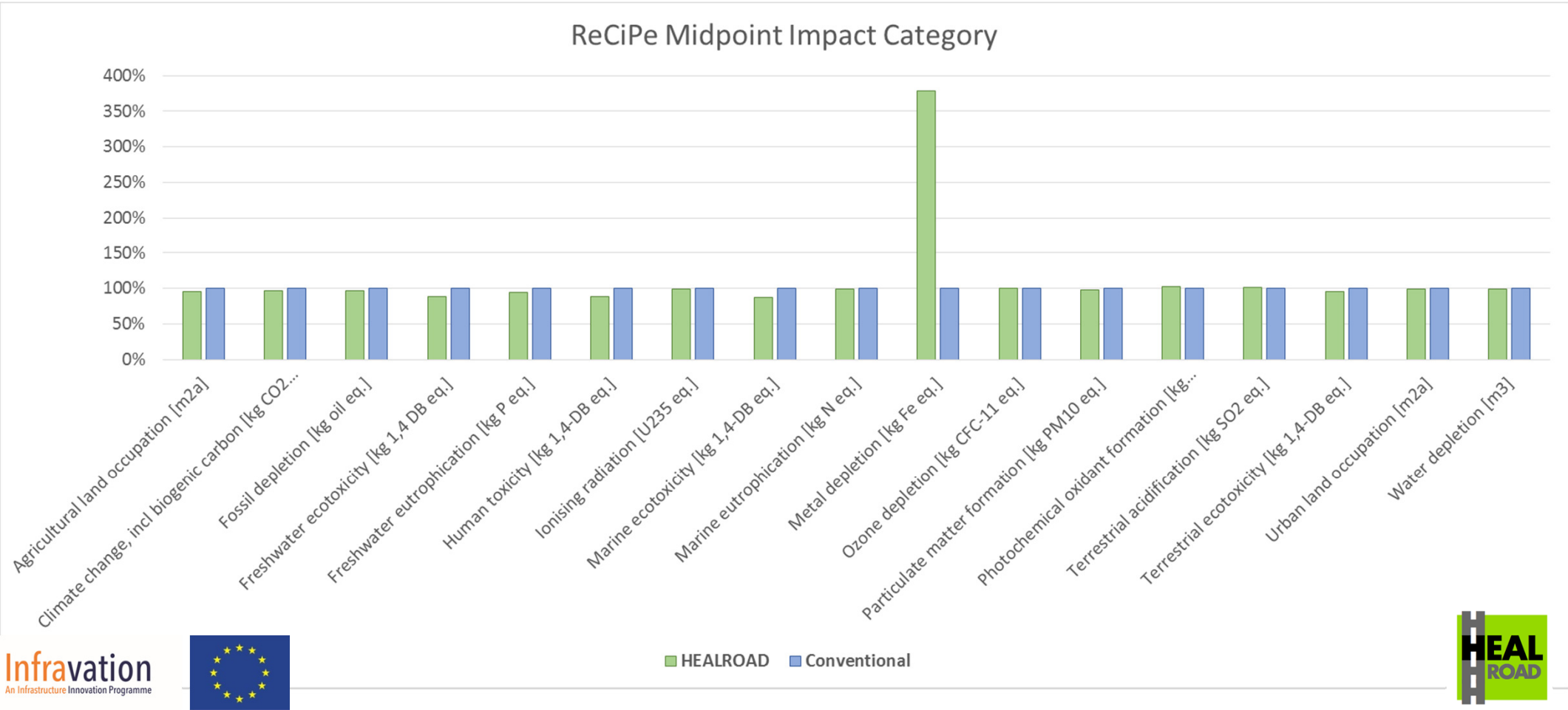
4. IMPACT ASSESSMENT (RECIPE CHARACTERIZATION METHOD)

- Climate Change (CC)
- Ozone Depletion (OD)
- Terrestrial Acidification (TA)
- Freshwater Eutrophication (FE)
- Marine Eutrophication (ME)
- Human Toxicity (HT)
- Photochemical Oxidant Formation (POF)
- Particulate Matter Formation (PMF)
- Terrestrial Ecotoxicity (TET)
- Freshwater Ecotoxicity (FET)
- Marine Ecotoxicity (MET)
- Ionising Radiation (IR)
- Agricultural Land Occupation (ALO)
- Urban Land Occupation (ULO)
- Natural Land Transformation (NLT)
- Water Depletion (WD)
- Mineral Resource Depletion (MRD)
- Fossil Fuel Depletion (FD)



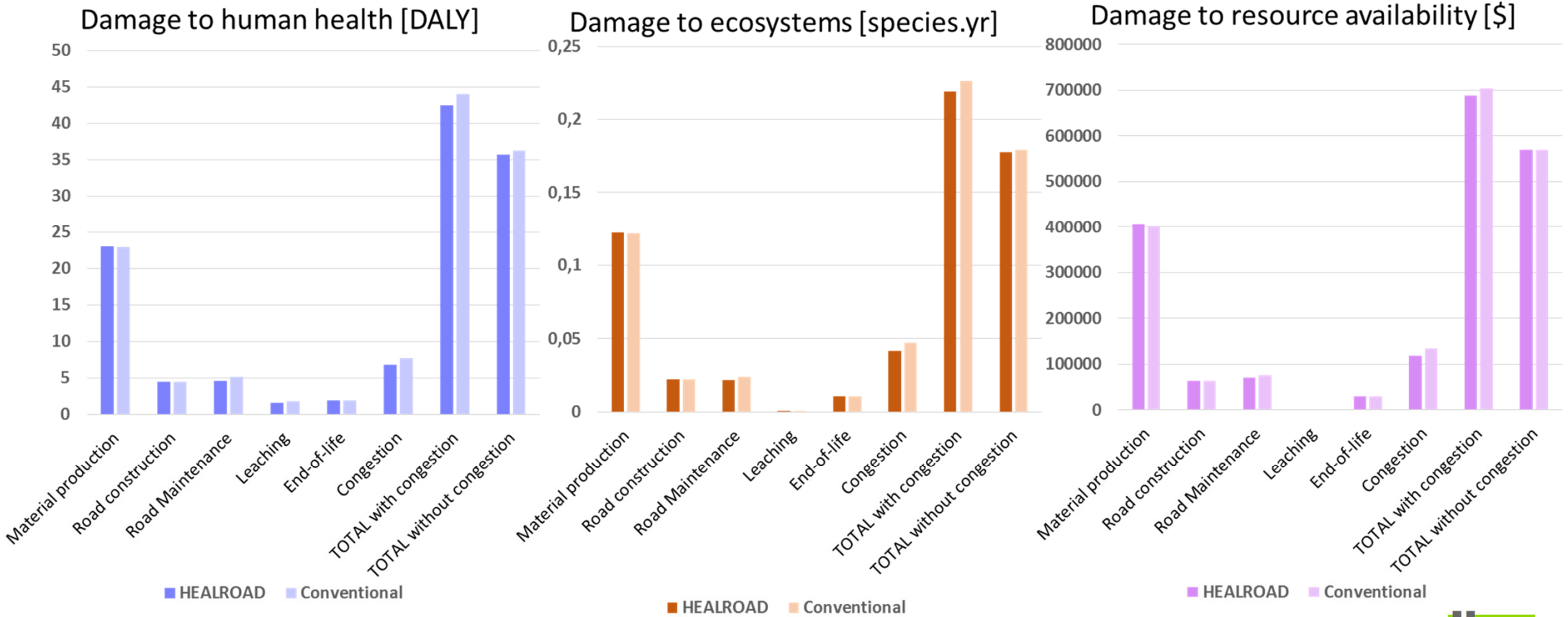


4. IMPACT ASSESSMENT (QR 36 section)





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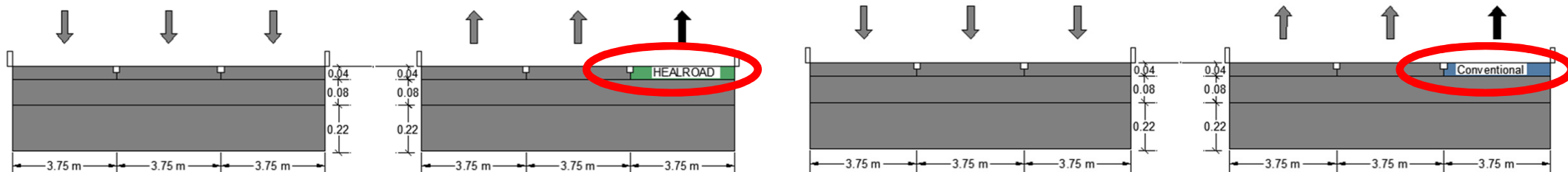




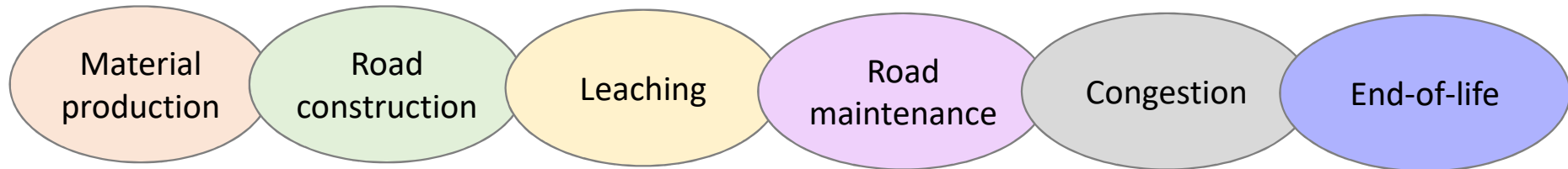
4. IMPACT ASSESSMENT (HEALROAD VS Conventional mixture)

- **Goal:** To demonstrate the sustainability of the induction heated asphalt mixture by comparing the environmental impacts this technology produces with the ones caused by traditional mixtures.

- **Functional unit**

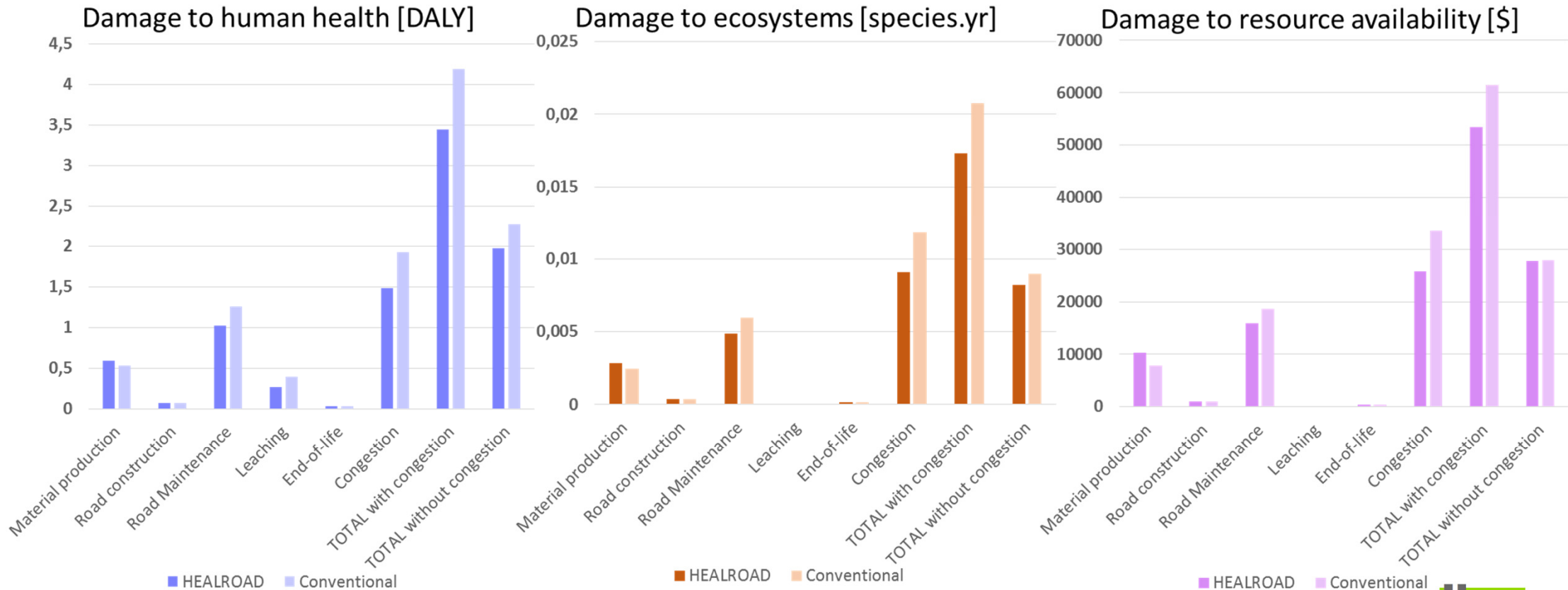


- **Analysis period:** 30 years
- **System boundaries:**





4. IMPACT ASSESSMENT (HEALROAD VS Conventional mixture)





5. SENSITIVITY ANALYSIS

- **Variability of the generated impacts changing:**

- The amount of RAP

0% → 40%

- The induction heating machine's diesel consumption

100% → 60%

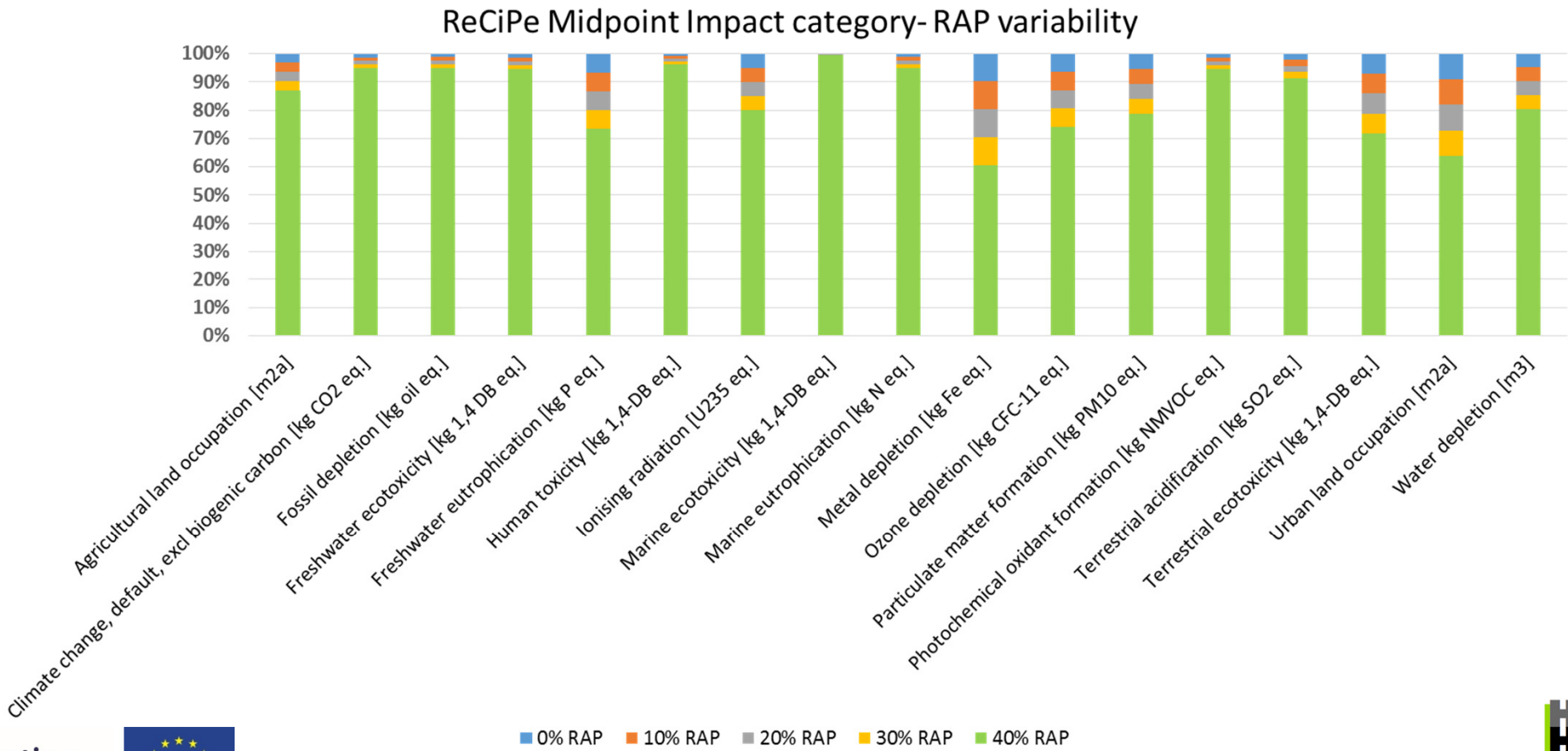


Figure source: www.fhwa.dot.gov



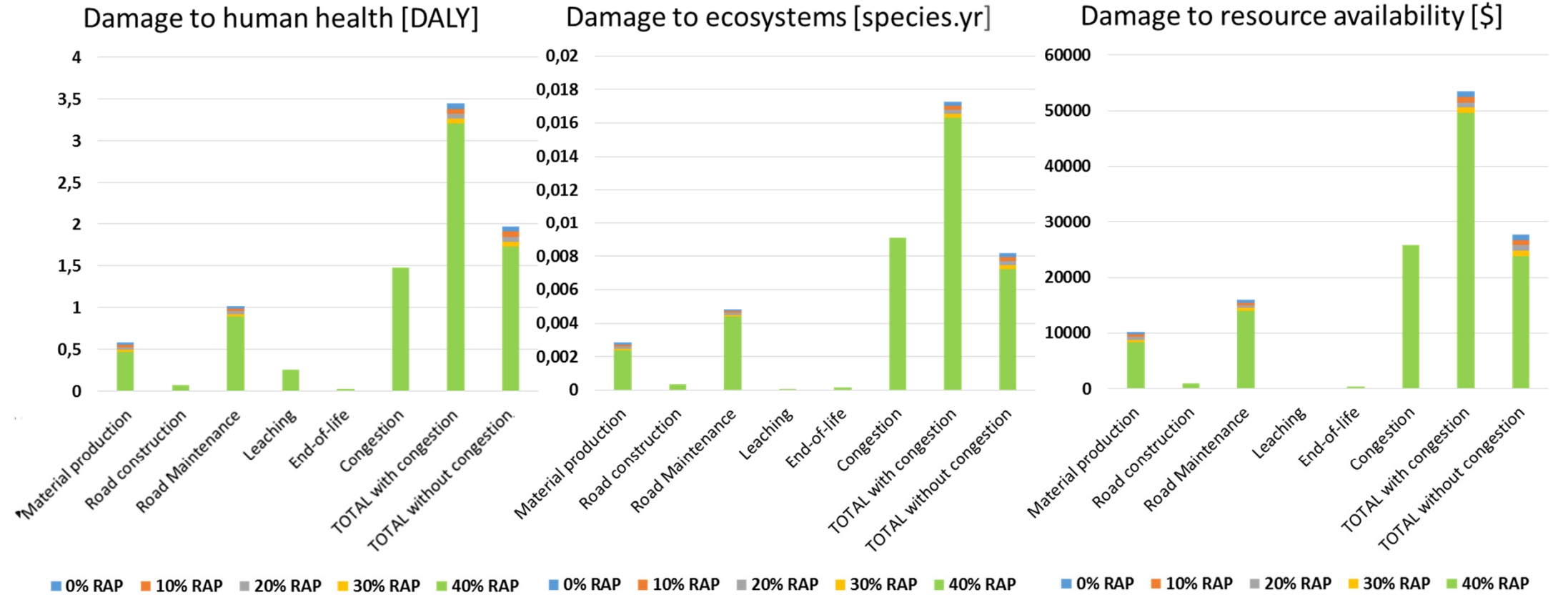


5. SENSITIVITY ANALYSIS (RAP variation)





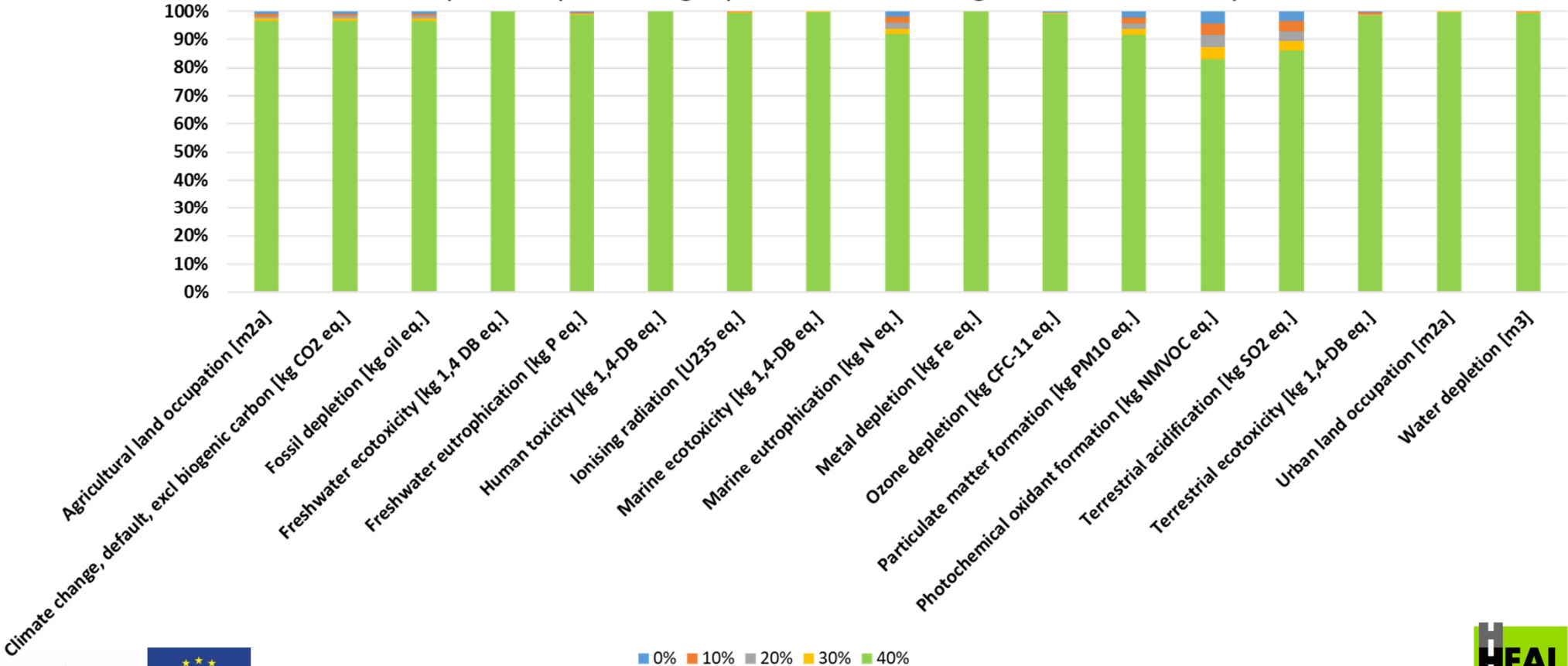
5. SENSITIVITY ANALYSIS (RAP variation)





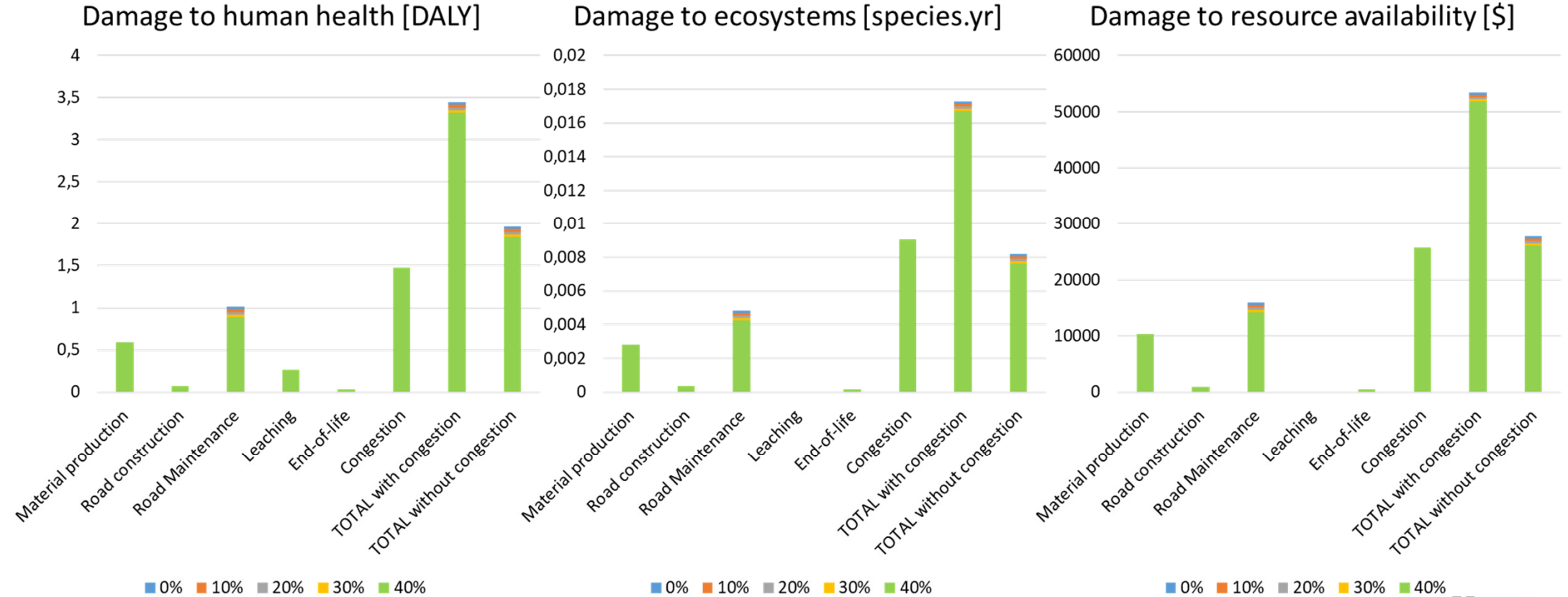
5. SENSITIVITY ANALYSIS (Induction-heating machine consumption variation)

ReCiPe Midpoint Impact category. Induction-heating machine variability





5. SENSITIVITY ANALYSIS (Induction-heating machine consumption variation)





6. CONCLUSIONS

- The **HEALROAD** technology has a **better performance in 14 of the 17** midpoint impacts and **in all the endpoint impacts**.
- A **reduction between 13% and 18%** in the endpoint impacts is possible with the HEALROAD technology.
- When considering the whole road section the material production phase is the most important one, however, under the same conditions, congestion is more critical.
- **Leaching** effect is **negligible** when analyzing the “Damage to ecosystems” and “Damage to resource availability” impacts.
- The improvement in the induction-heating machine efficiency in terms of diesel consumption is less effective than increasing the amount of RAP



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Infravation
An Infrastructure Innovation Programme

