SH2E & eGHOST projects

Javier Dufour
Professor, Rey Juan Carlos University
Head of Systems Analysis Unit, IMDEA Energy

European Hydrogen Sustainability and Circularity Panel

Clean Hydrogen Partnership

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SH2E

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Clean Hydrogen Partnership

This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (now Clean Hydrogen Partnership) under Grant Agreement No 101007163. This Joint Undertaking receives support from the European Union's Horizon 2020 Research and Innovation program, Hydrogen Europe and Hydrogen Europe Research.

PROJECT OVERVIEW

Participant	Country
Fundación IMDEA Energía (IMDEA Energy)	Spain
GreenDelta GmbH (GD)	Germany
Forschungszentrum Jülich GmbH (FZJ)	Germany
Commissariat à l’énergie atomique et aux énergies alternatives (CEA)	France
Fundación para el Desarrollo de las Nuevas Tecnologías del Hidrógeno en Aragón (FHa)	Spain
Symbio (SYM)	France
Institute of Applied Energy (IAE)	Japan

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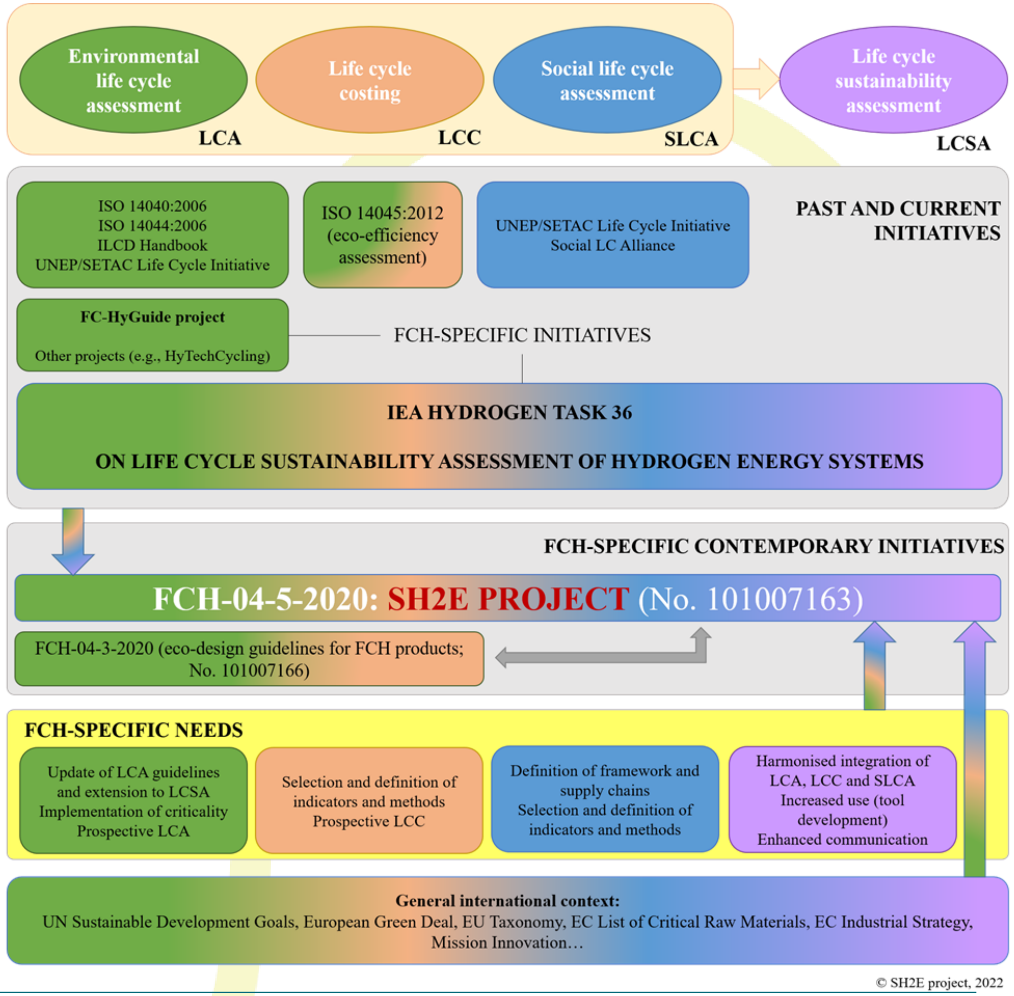
PROJECT SUMMARY

- To provide a well-defined, validated and practical framework for LCSA of FCH systems.
- To facilitate robust decision-making processes in the field of FCH by adding sustainability criteria to the characterisation and benchmarking of FCH systems.
- Development and application of specific guidelines for the environmental, economic and social life cycle assessment of FCH systems, and their consistent integration into a sound LCSA framework.



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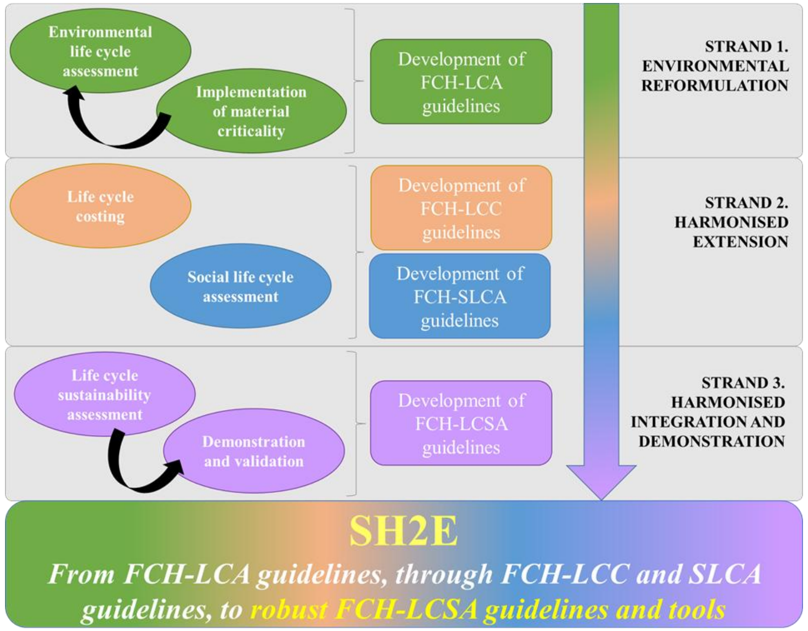
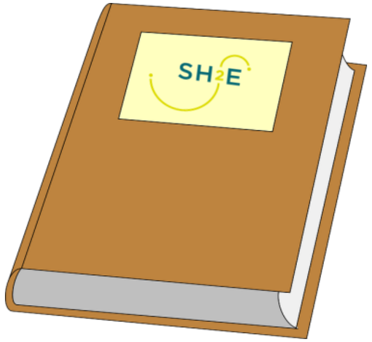
FCH-LCSA GUIDELINES



- 1 document of FCH-LCA guidelines
- 1 material criticality indicator
- 1 document of FCH-LCC guidelines
- 1 document of FCH-SLCA guidelines
- 1 document of FCH-LCSA guidelines



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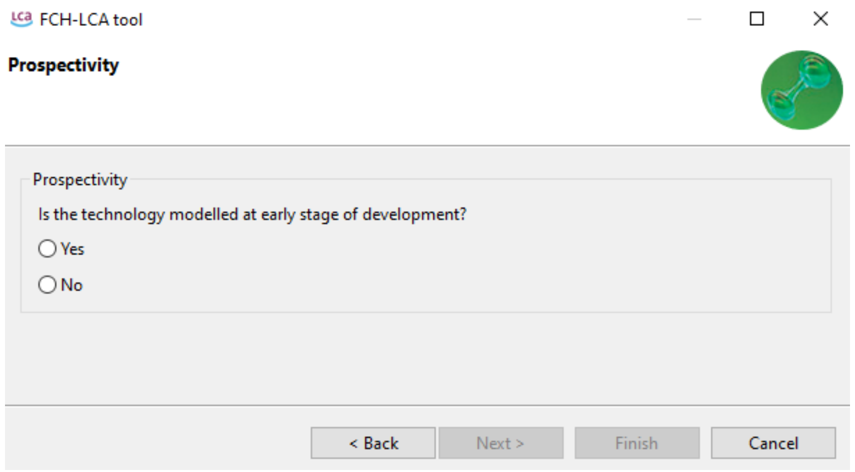
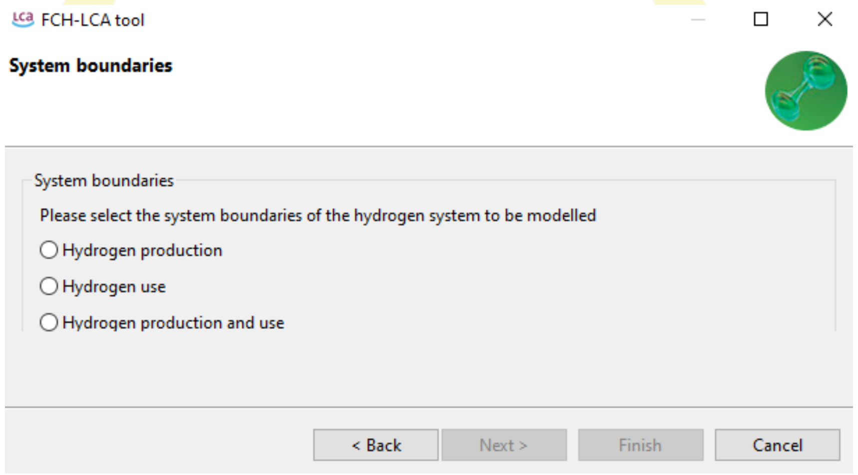
FCH-LCSA TOOL

- 1 integrated FCH-LCA/LCC/SLCA/LCSA software tool





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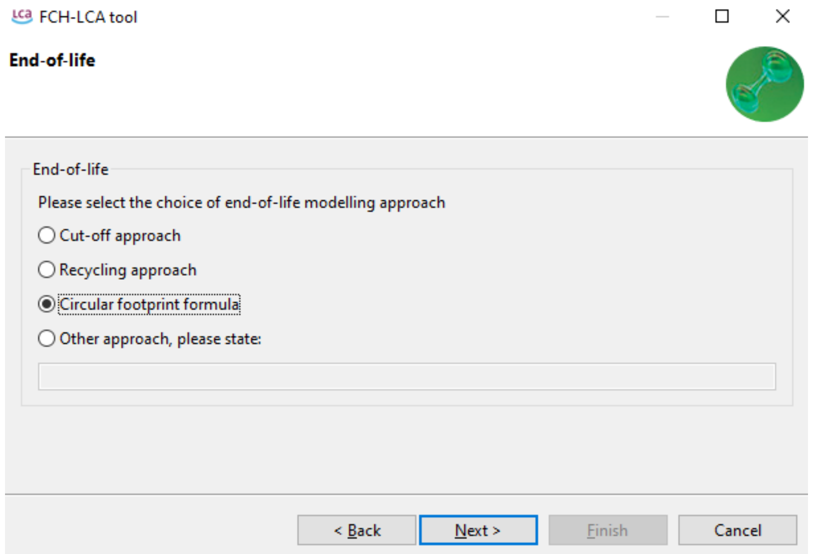

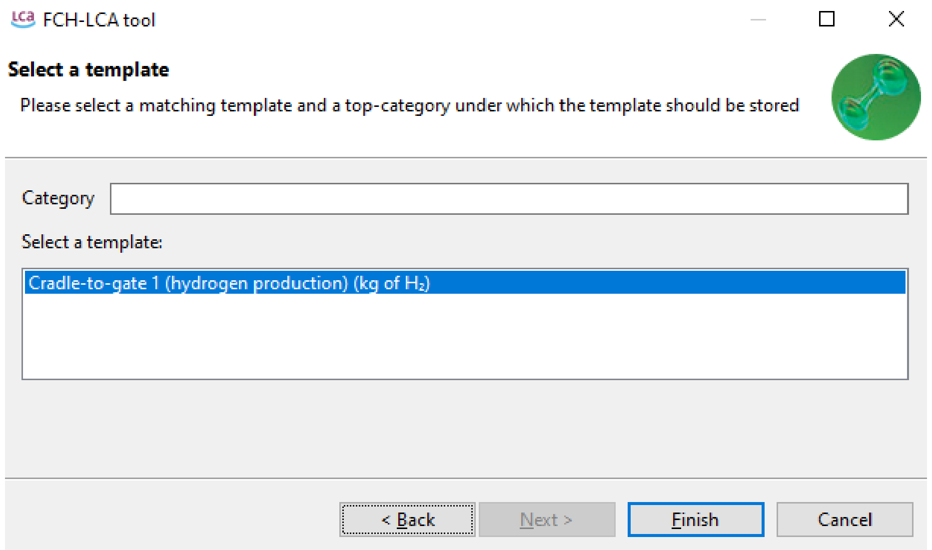

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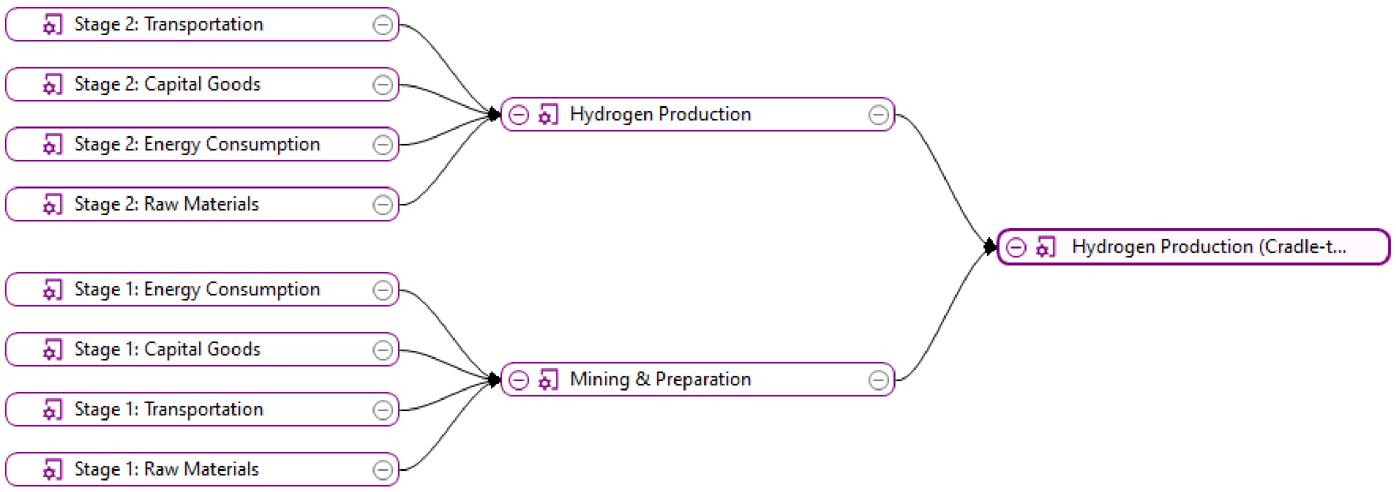

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eGHOST

eco-design

Guidelines for Hydrogen Systems and Technologies

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French Alternative Energies and Atomic Energy Commission (CEA)	France
University of Ljubljana (UL)	Slovenia
Institute of Applied Energy (IAE)	Japan
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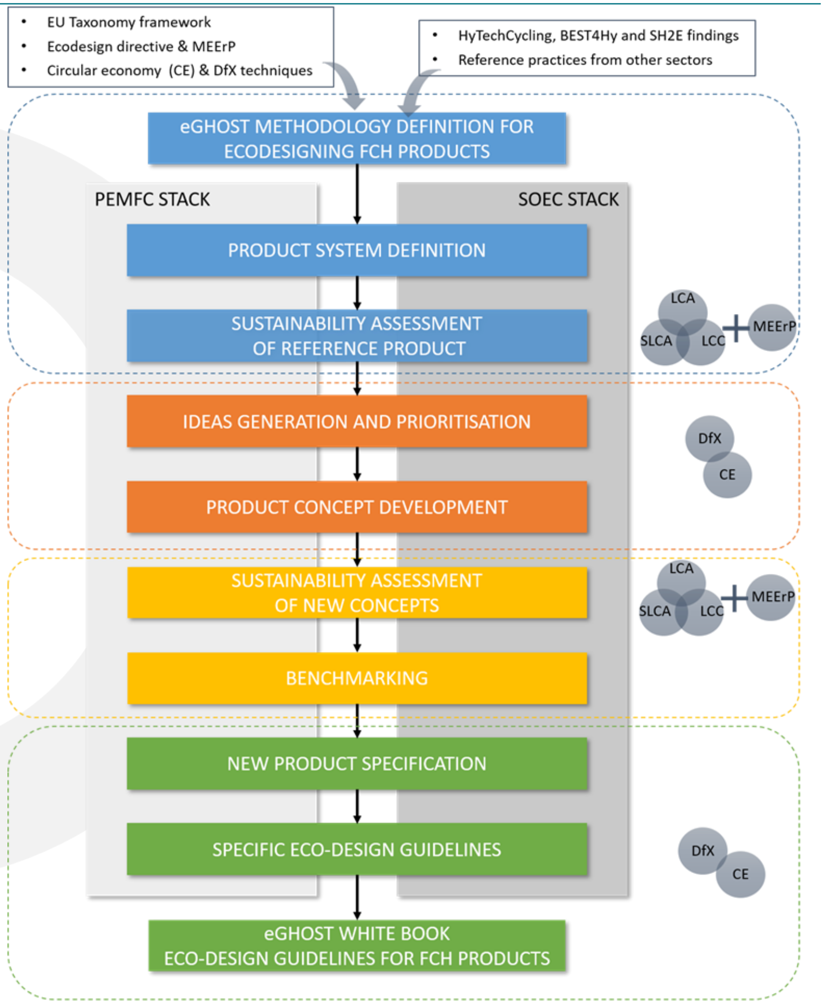
eGHOST

Objectives

- First milestone in the eco-design of FCH products.
- First preparatory study under Eco-design Directive.
- To provide robust eco-design guidelines for FCH products at different levels of development.
- Towards sustainable-by-design FCH products.
- Specific guidelines for two different products: PEMFC stack and SOE stack.



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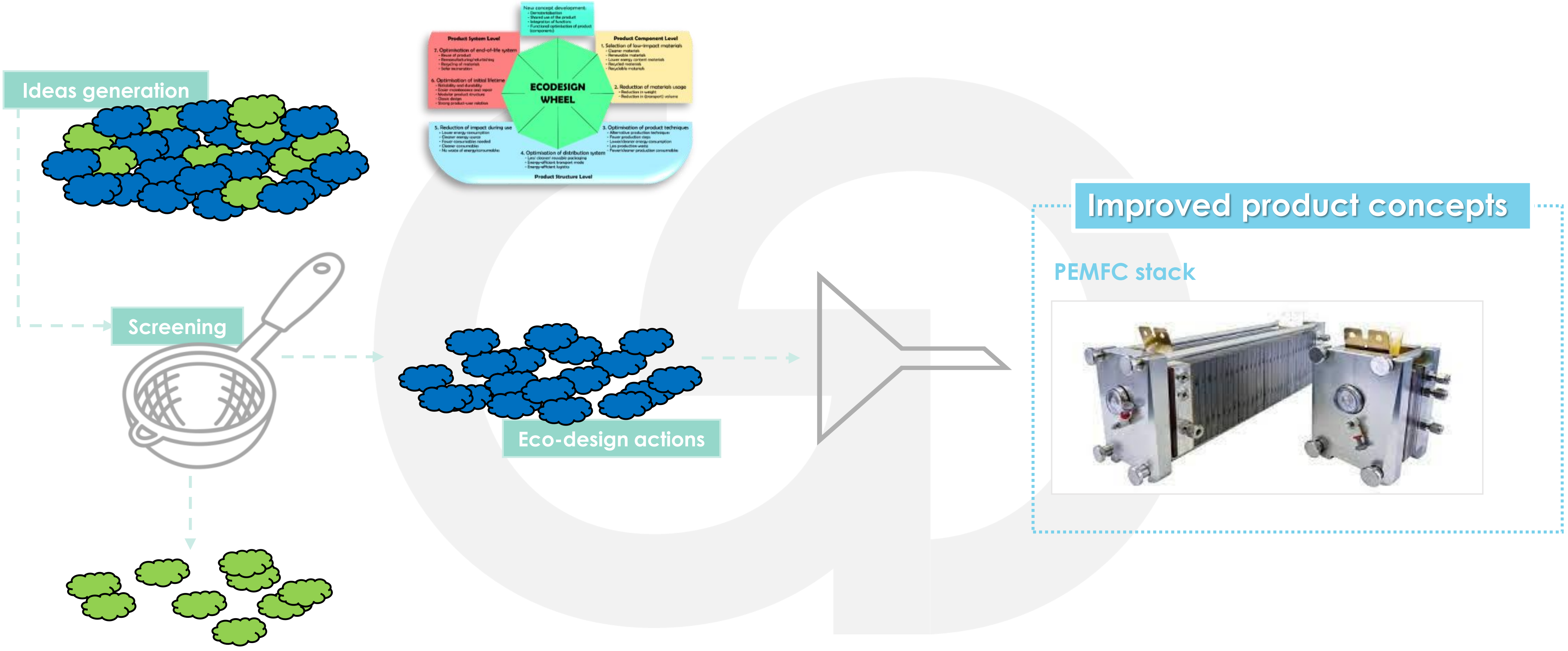
Re-design methodology



E. Bargiacchi et al. Life cycle sustainability assessment of eco-designed solid oxide. II CIBIQ, Buenos Aires, 2023

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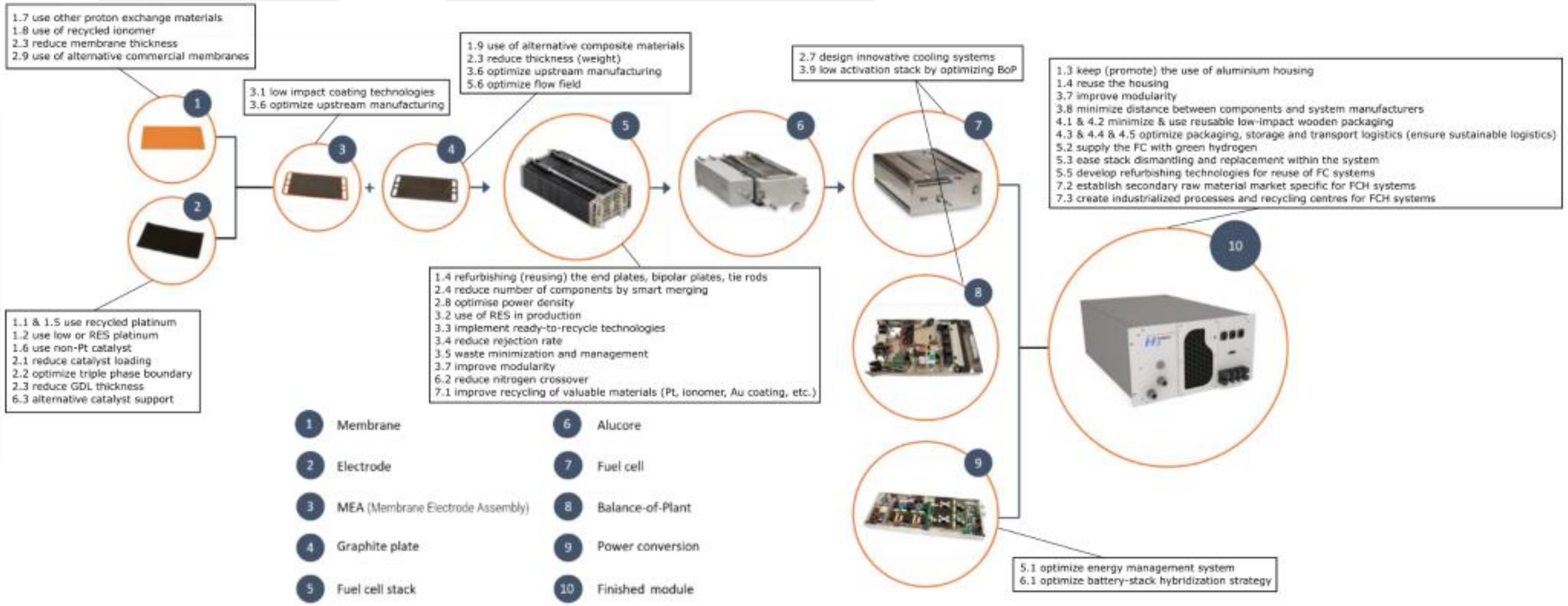
New product concepts

- Base case
- Product concepts:
  - **Realistic** product concept
  - Short-term
  - Medium-to-long-term
  - **Optimistic** product concept
  - **Disruptive** product concept



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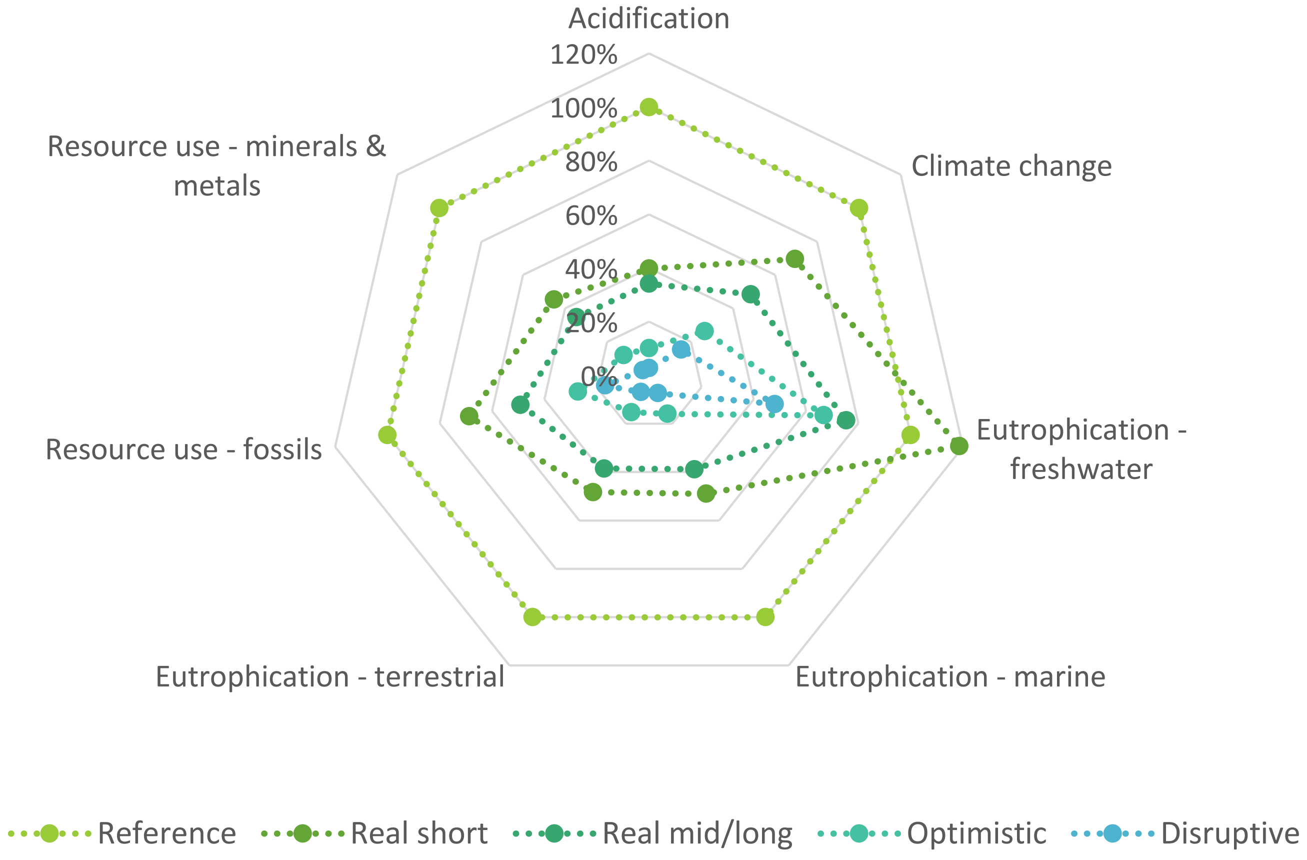
Sustainability assessment of new product concepts

- Average reductions:
  - Short-term concept: **- 37%**
  - Mid/Long-term concept: **- 54%**
  - Optimistic concept: **- 75%**
  - Disruptive concept: **- 86%**
- **Freshwater eutrophication** is the only impact category where **ecodesign actions increase** the environmental **impact** (due to the platinum recycling process – TRL5)
- Climate change reductions:
  - Short-term concept: - 31%
  - Mid/Long-term concept: - 52%
  - Optimistic concept: - 74%
  - Disruptive concept: - 85%



Gramc et al (2024) https://doi.org/10.1016/j.ijhydene.2024.08.020

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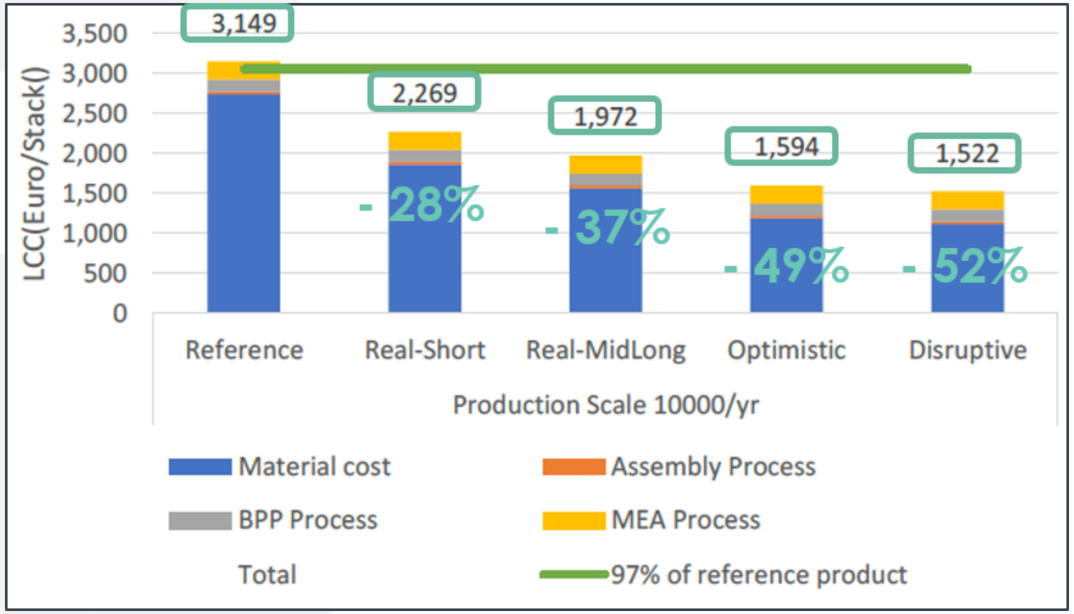
Sustainability assessment of new product concepts

- **Production scale increase (from 100 to 50,000 stacks/yr.)** causes **significant cost reductions**:
  - from **-93%** (reference case) to **-96%** (disruptive concept)
- Cost **reduction** due to the **ecodesign** (at 10,000 stacks/year):
  - Short-term concept: **- 28%**
  - Mid/Long-term concept: **- 37%**
  - Optimistic concept: **- 49%**
  - Disruptive concept: **- 52%**



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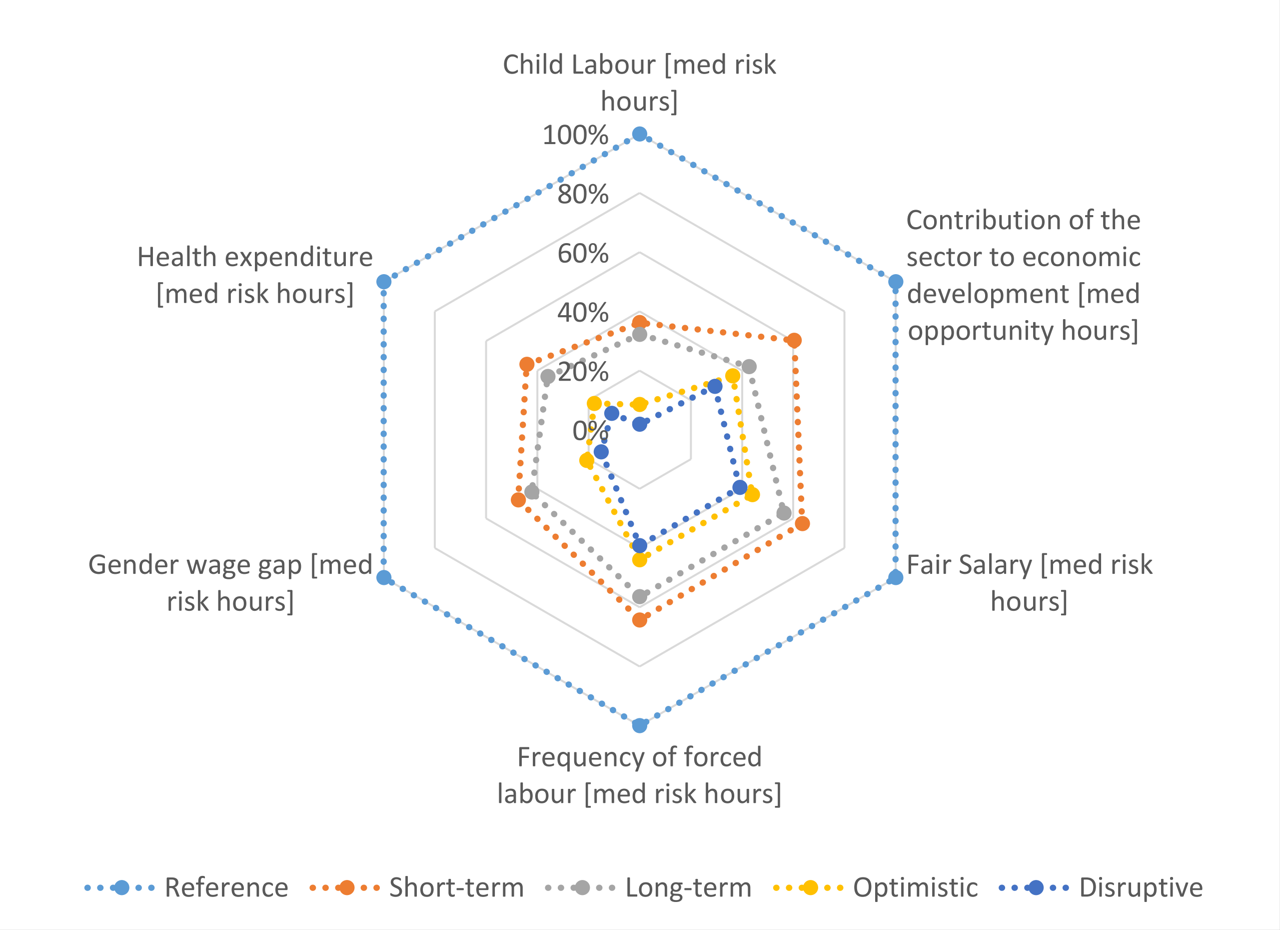
Sustainability assessment of new product concepts

- Average **reductions** with ecodesign concept:
  - Short-term concept: **-47%**
  - Mid/Long-term concept: **-56%**
  - Optimistic concept: **-71%**
  - Disruptive concept: **-77%**



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Mass-based reduction (capital goods)

- *Lesson 1.* The push to the technical limits in the size of sub-components.
- *Lesson 2.* The push to technical limits at the technology level, including factors such as current density and power density.
- *Lesson 3.* Reduction applied to the usage of electrocatalyst materials precious versus non-precious.
- *Lesson 4.* Leading to increased efficiency and performance in FCH products (enhanced consumption at the operational phase).

Materials impacts and availability

- *Lesson 5.* Implementation of EoL strategies.

Methodological aspects

- *Lesson 6.* Inclusion of the social component.
- *Lesson 7.* (S)SbD approach.
- *Lesson 8.* Prospective approach.
- *Lesson 9.* Continuous process and collaborative efforts.

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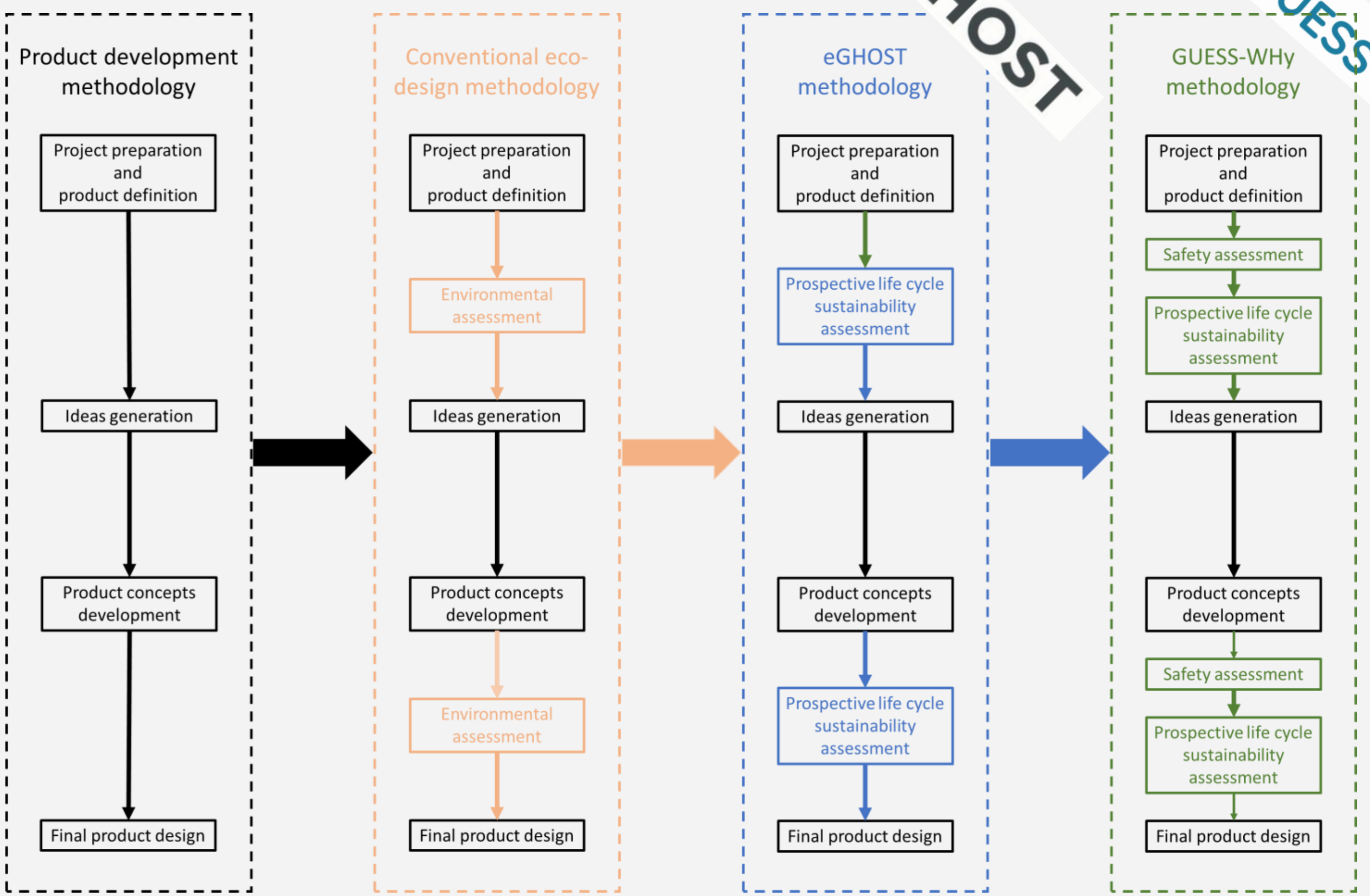
Guess Why SSbD methodology



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Thanks!!!

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Javier Dufour

IMDEA Energy

Rey Juan Carlos University

(javier.dufour@imdea.org)

www.energy.imdea.org