BEVSIM TOOL | FLAMINGO WEBINAR

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21-APRIL-2022

BEVSIM | PART OF WP1 ALMA PROJECT

BATTERY ELECTRIC VEHICLE SUSTAINABILITY IMPACT ASSESSMENT MODEL

INTRODUCTION

VALUE PROPOSITION

CAPABILITIES

SIMULATION WORKFLOW

RESULTS EXAMPLES

CLOSING REMARKS

TNO innovation for life

BEVSIM
INTRODUCTION & FEATURES

Battery Electric Vehicle Sustainability Impact Assessment Model (BEVSIM)

- Web-based tool based on TNO's DIAMONDS platform with R Shiny programming suite and built-in database on lifecycle impacts.
- Best-in-class LCA models for materials production, processing, Use Phase, EoL fate and EoL recycling processes.
- BEV versus ICE comparison possible for segment C and D passenger cars.
- Customisable → Model a full car, a sub-system, or a part for LCA, LCC, Circularity Analysis
- Possibility to include customer, user specific datasets
- Download Word report and extended Excel results
- Version control possible and easy to update LCI datasets

Compare Design Alternatives

Designed For NON-LCA Experts

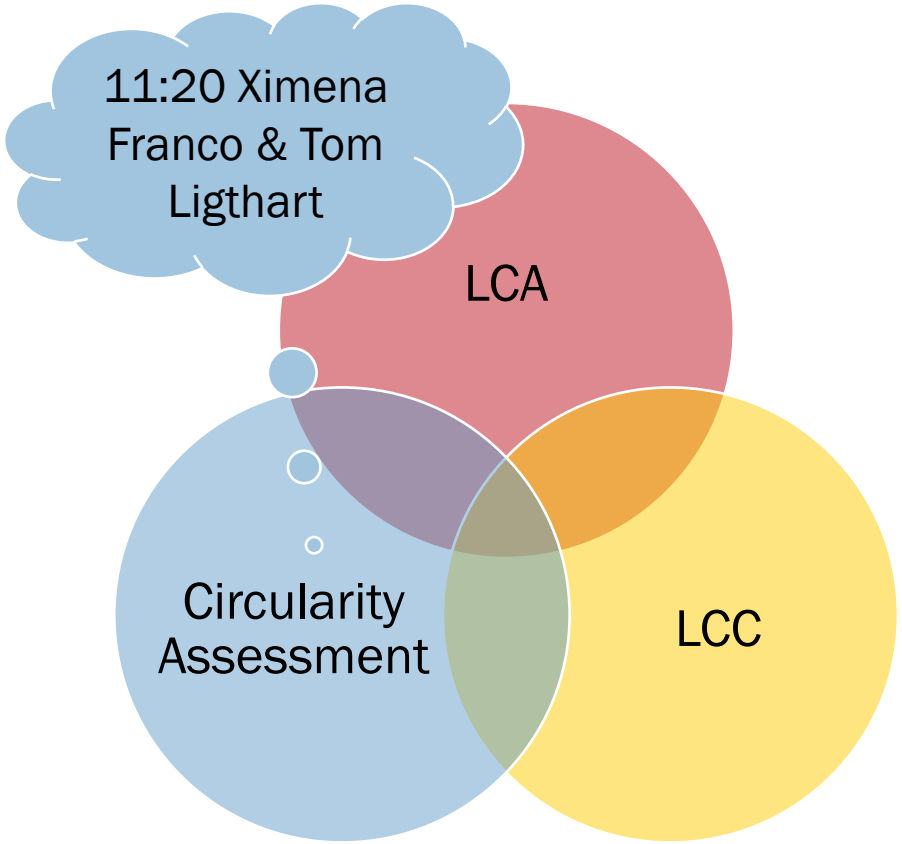
Early Sustainability Evaluation

Faster LCA Results

Scenarios

BEVSIM
CAPABILTIES

Single Tool



Measure Impacts

- Lightweight
- Design Alternatives
- Sub-system & Parts Choice
- Material Choice
- Use Phase
- Recycling
- End of Life
- Scenarios

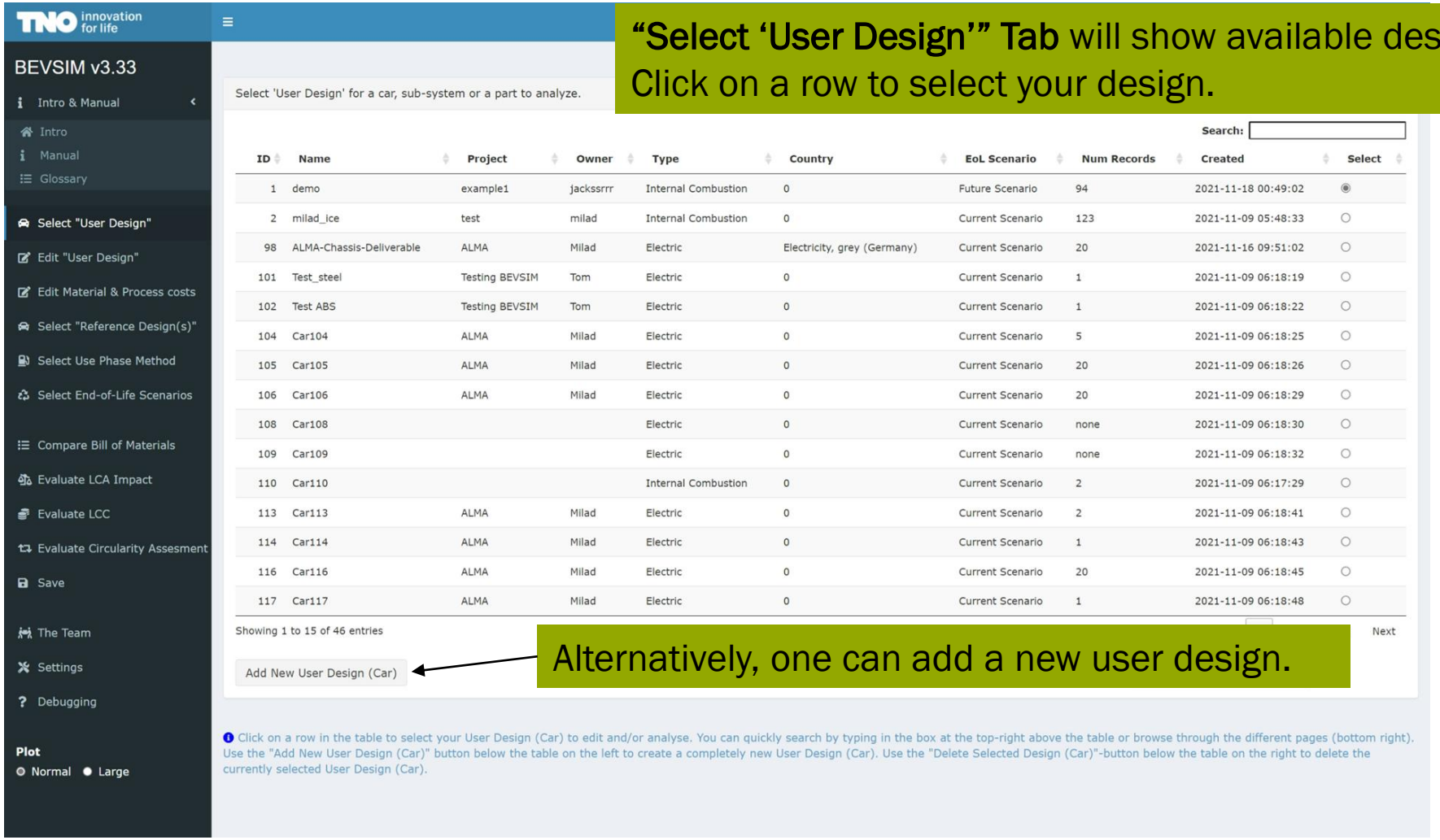
BEVSIM

LIFE CYCLE PHASES

Raw Materials	• Plastic granules, plastic pellets, mineral fillers, glass fibre, carbon fibre, cold rolled steel sheets, rods, aluminium sheets, Al rods, metals in finished form before part production, acids, materials for batteries.
Processing and Part Production	• For Plastics → Injection moulding, blow moulding, compounding, painting, , PU foam production, • For Metals → Casting, stamping, cutting, polishing, carburizing, machining, painting • For Batteries → battery production • Tires → tire production from SBR rubber, steel and thread
Assembly	• "Gate to Gate" boundary of automotive manufacturing plant e.g. Ford, VW assembly line. • Assembly of parts, components of complex parts, assembly of sub-systems.
Use Phase	• Use phase of the car / car part, consumables, maintenance emissions.
EoL	• EoL Scenario for EoL treatment: Incineration, Landfill, Recycling (**mechanical, pyrolysis, solvolysis**) • Dismantling, Shredding, EoL treatment
Avoided Production	• Avoided production of energy, materials and products (going to spare parts)

SIMULATION WORKFLOW

STEP 1: SELECT “USER DESIGN”

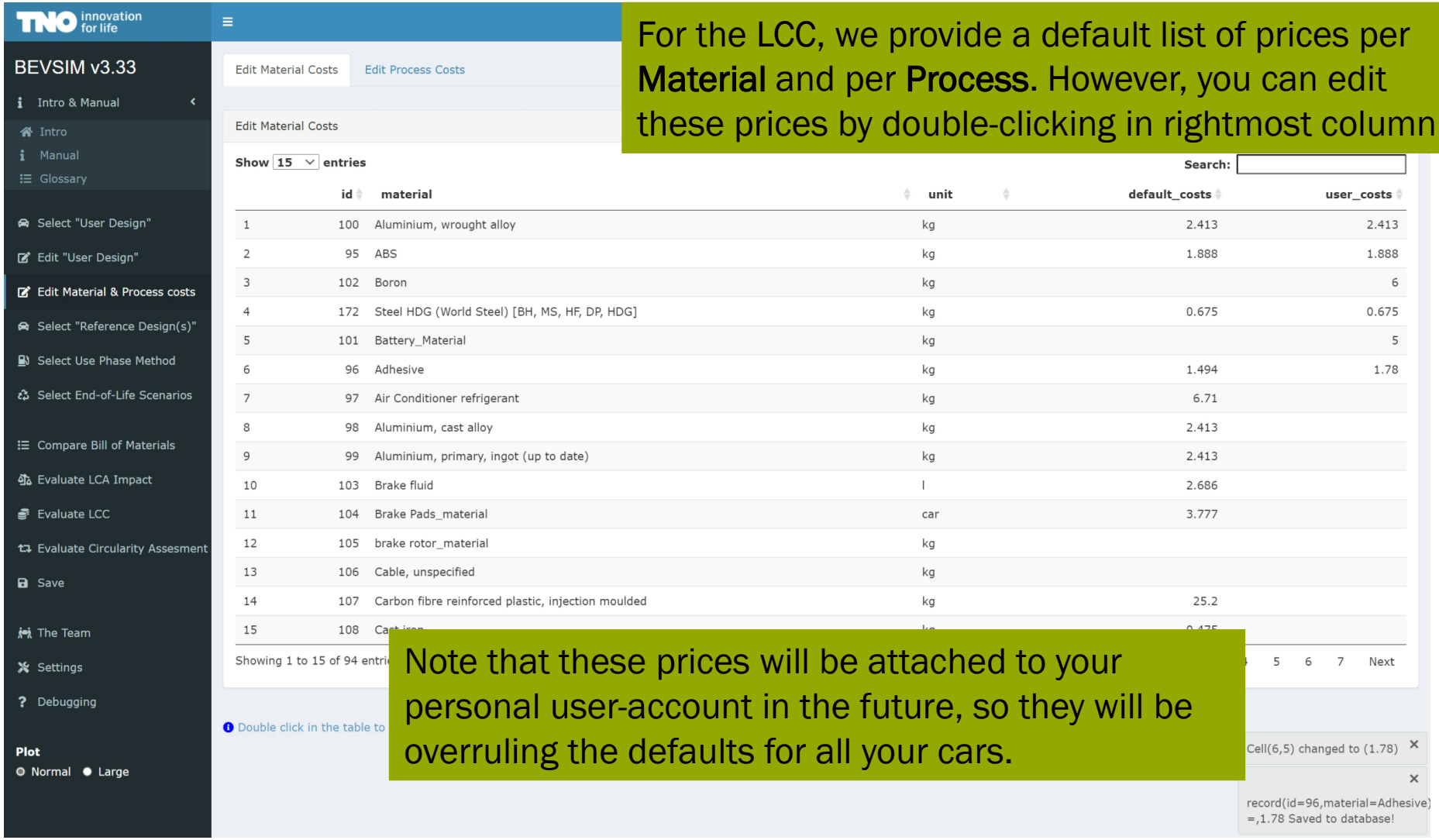


“Select ‘User Design’” Tab will show available designs.
Click on a row to select your design.

Alternatively, one can add a new user design.

LIFE CYCLE COSTING DATA

STEP 2: EDIT “USER DESIGN”

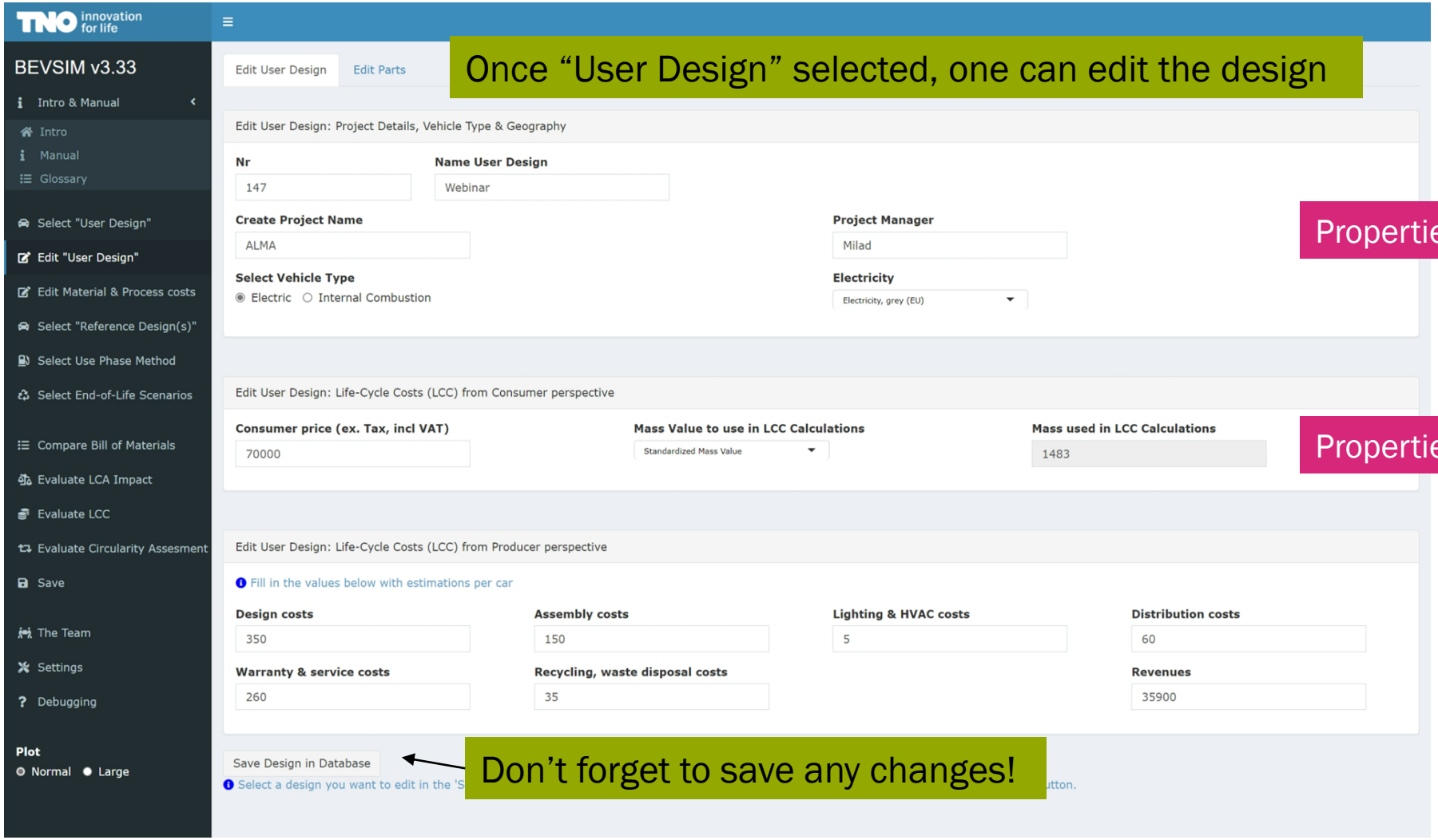


For the LCC, we provide a default list of prices per **Material** and per **Process**. However, you can edit these prices by double-clicking in rightmost column.

Note that these prices will be attached to your personal user-account in the future, so they will be overruling the defaults for all your cars.

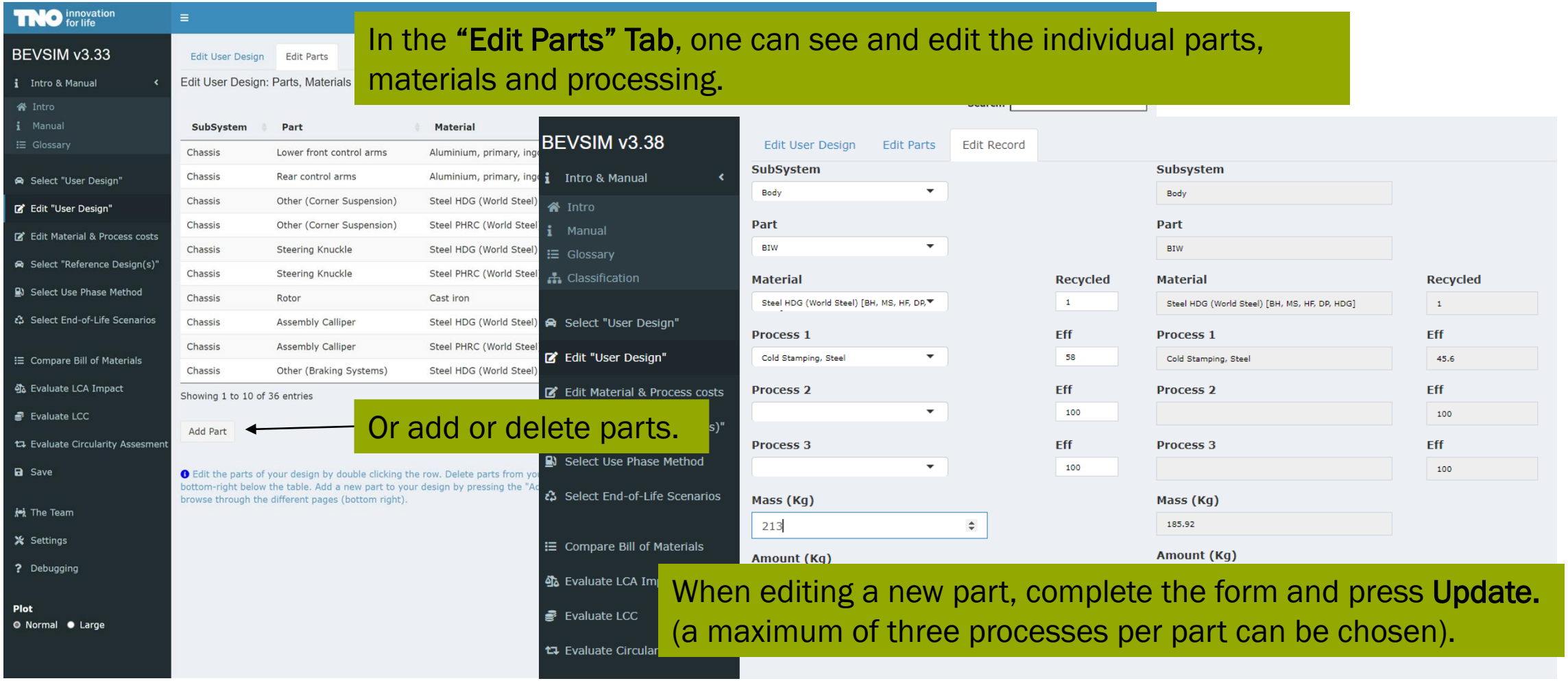
SIMULATION WORKFLOW

STEP 2: EDIT “USER DESIGN”



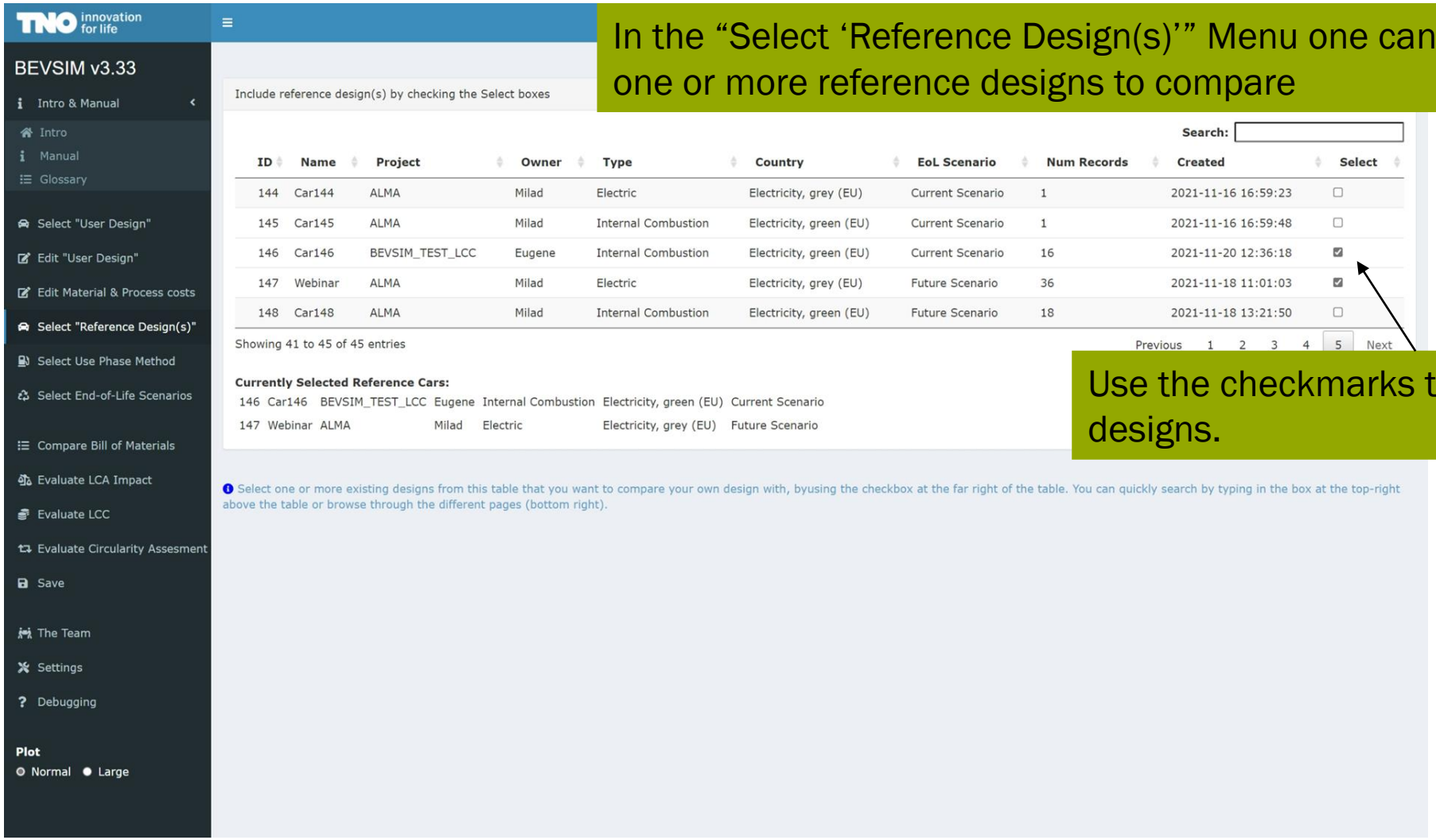
SIMULATION WORKFLOW

STEP 2: EDIT “USER DESIGN”



SIMULATION WORKFLOW

STEP 3: SELECT “REFERENCE DESIGN(S)”

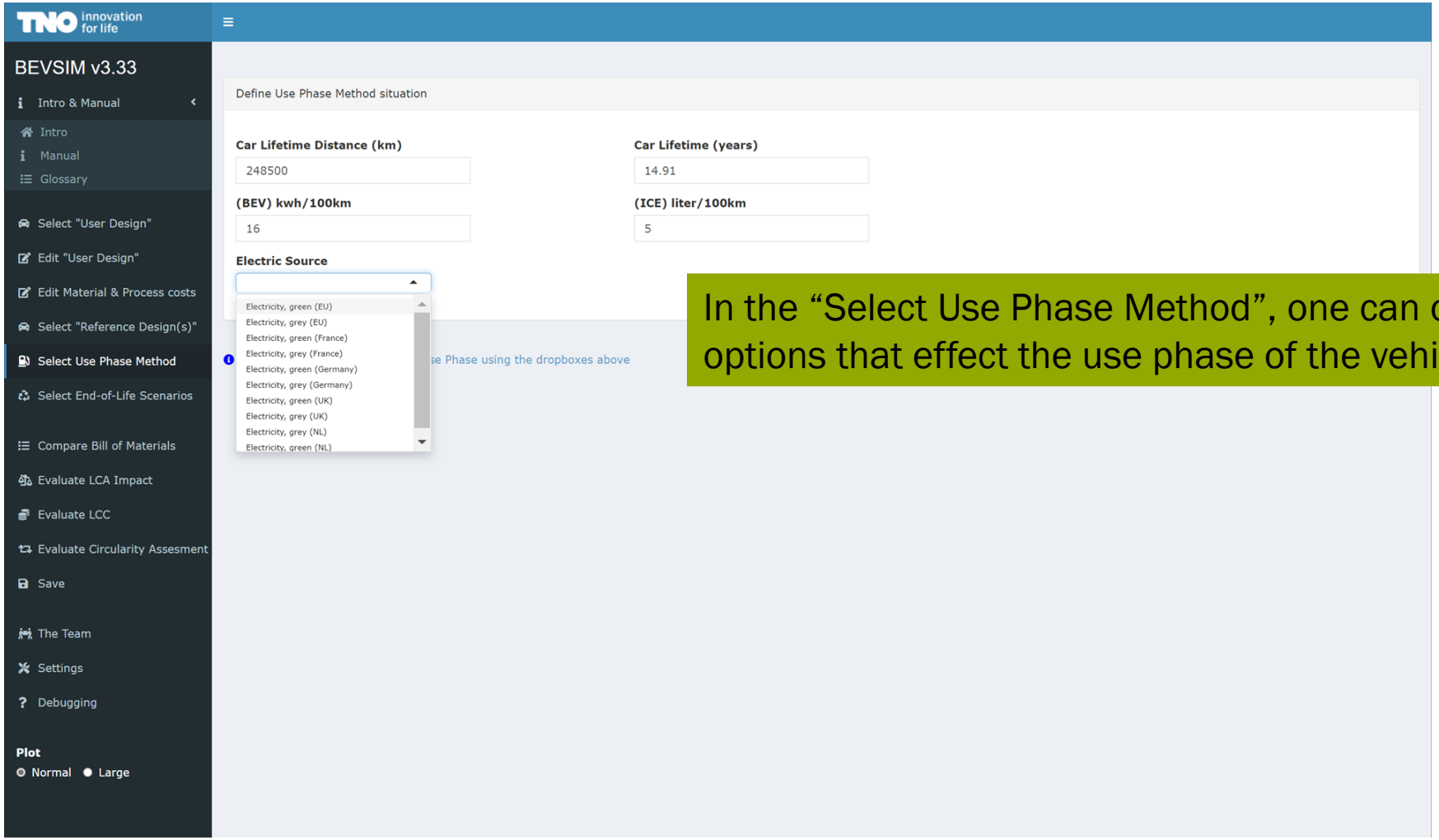


In the “Select ‘Reference Design(s)’” Menu one can select one or more reference designs to compare

Use the checkmarks to select reference designs.

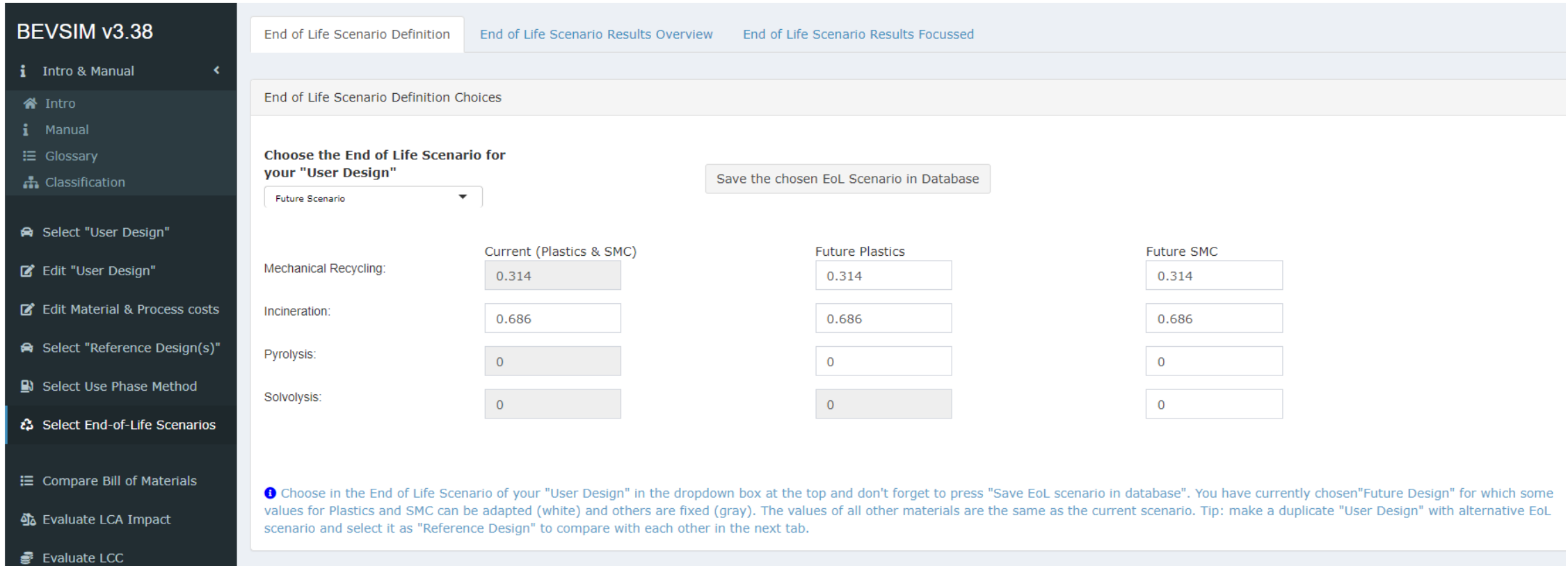
SIMULATION WORKFLOW

STEP 4: SELECT USE PHASE METHOD



In the “Select Use Phase Method”, one can change important options that effect the use phase of the vehicle.

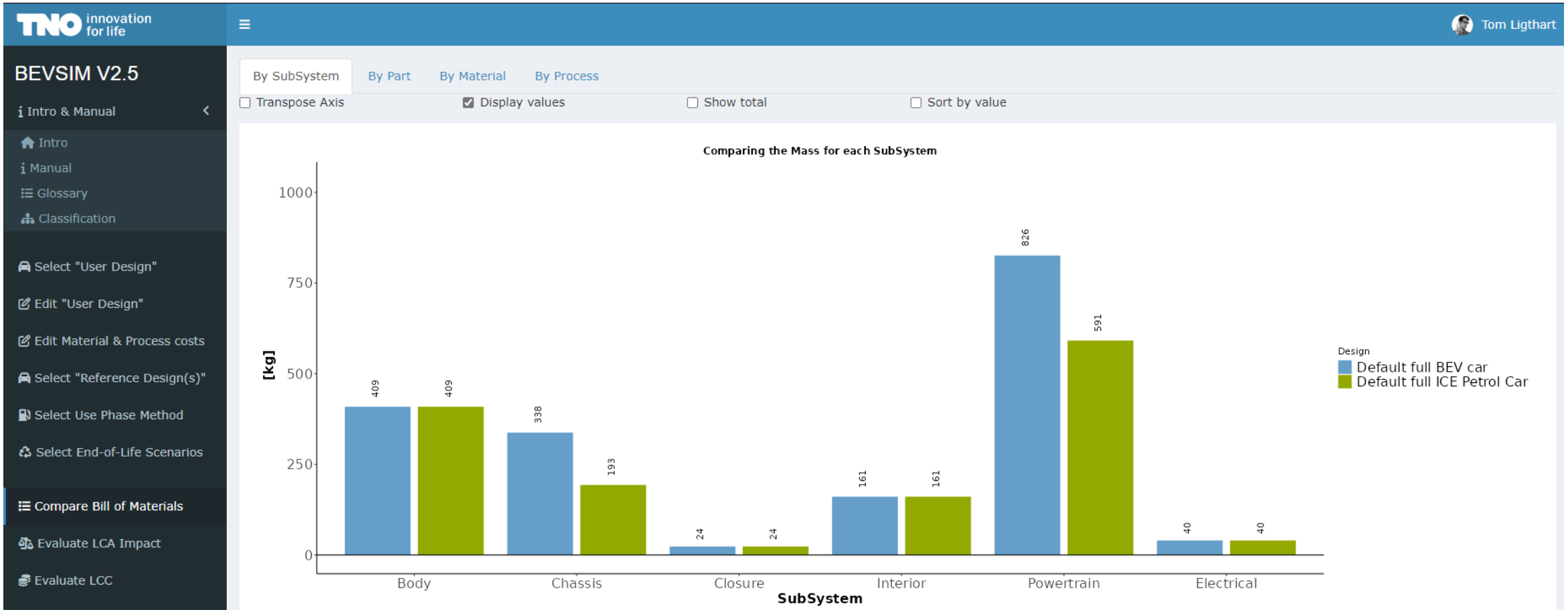
SIMULATION WORKFLOW
STEP 5: SELECT EOL SCENARIOS



In the **“Select End-of-Life Scenarios” menu** and **“Definition” Tab** one can choose “Current Scenario” or “Future EoL scenario”.

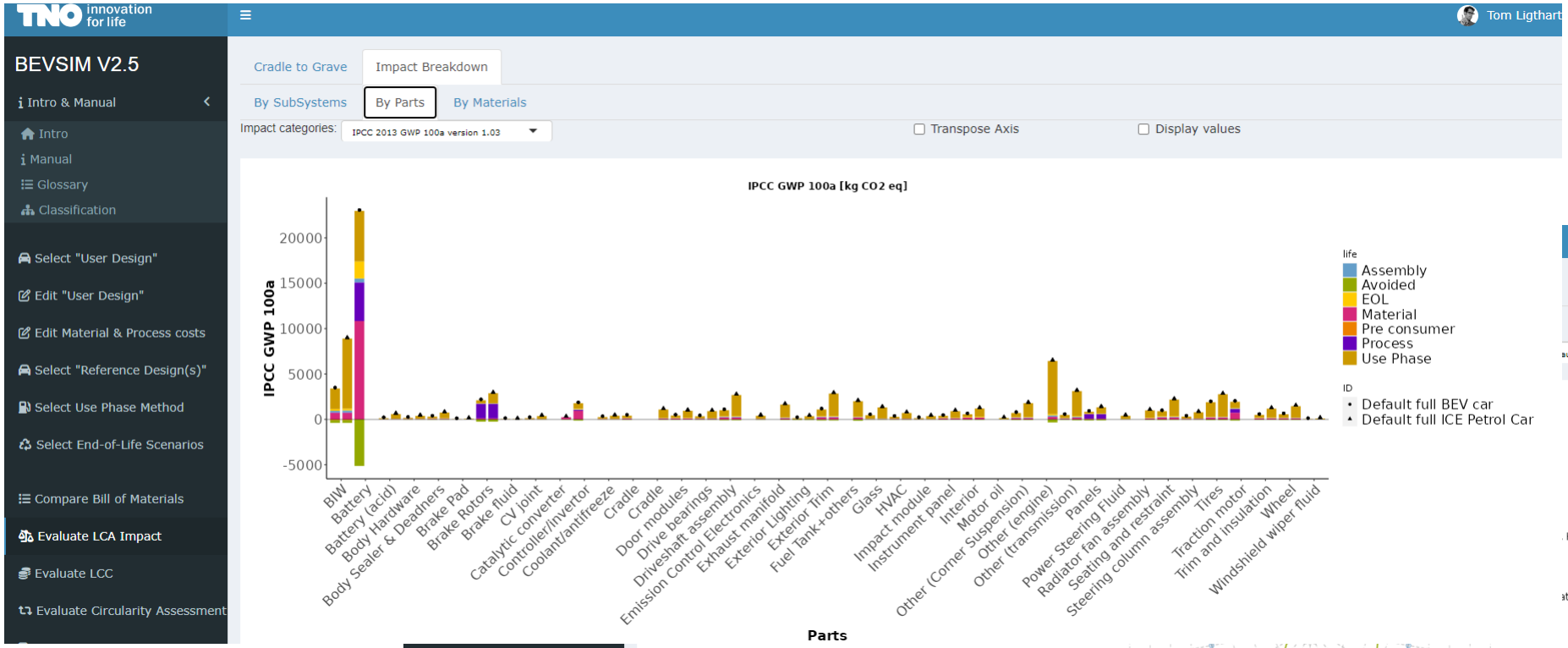
SIMULATION WORKFLOW

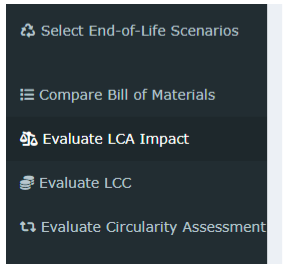
STEP 6: COMPARE “USER DESIGN” WITH “REFERENCE DESIGN(S)”

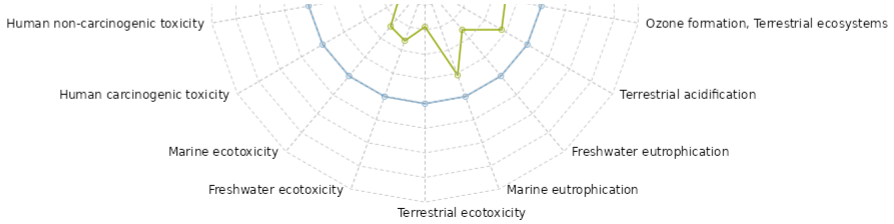


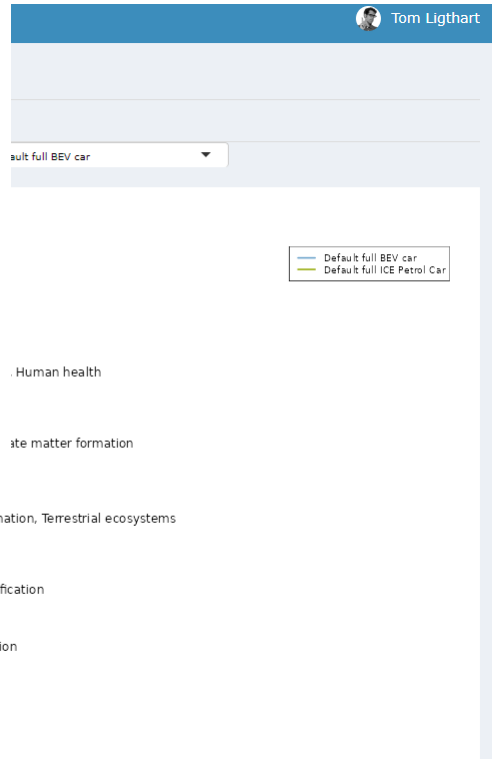
SIMULATION WORKFLOW

STEP 7: EVALUATE SUSTAINABILITY IMPACTS









LIFE CYCLE COSTING PERSPECTIVES

- Two scopes for the Life Cycle Costing have been used:
  - **Consumer's perspective** including all the costs and revenues for the consumer. It includes among others acquisition and use costs.
  - **Producer's perspective** including all the costs and revenues for the producer of the car. Material and process costs are included as well as the sales revenues.

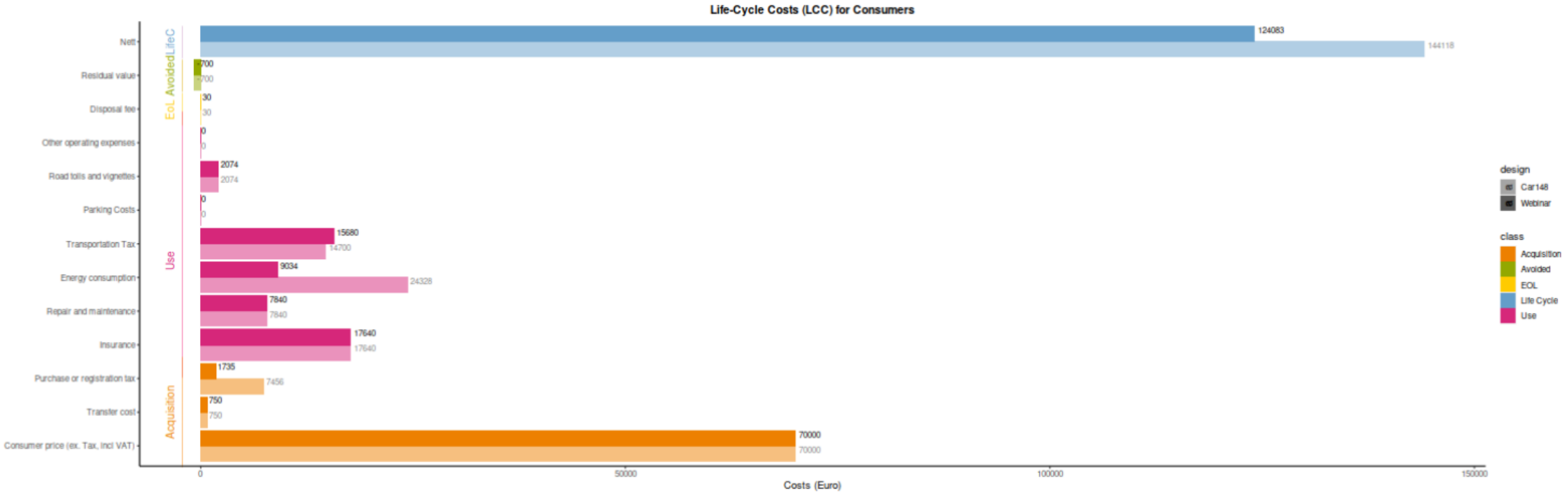
SIMULATION WORKFLOW

STEP 7: EVALUATE LIFE CYCLE COSTS (CONSUMER)

LCC Consumer Visualization | LCC Consumer Table | LCC Producer Visualization | LCC Producer Table

LCC Consumer Visualization

☑ Show total ☑ Display values ☑ Transpose Axis



Bar graph showing the diverse Life-Cycle Costs (LCC) for consumers, grouped and colored by life cycle stages.

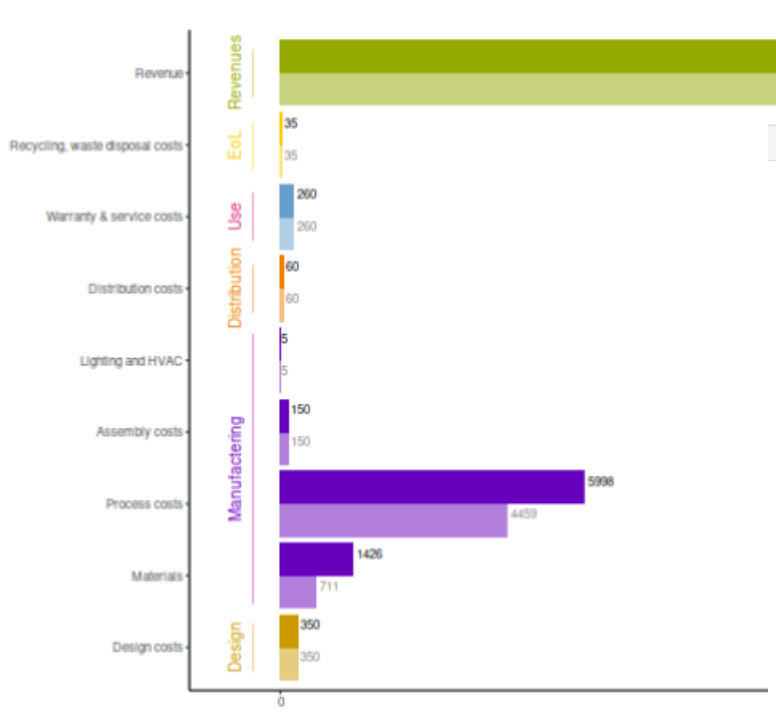
SIMULATION WORKFLOW

STEP 7: EVALUATE LIFE CYCLE COSTS (PRODUCER)

LCC Consumer Visualization | LCC Consumer Table | LCC Producer Visualization | LCC Producer Table

LCC Producer Visualization

☐ Show total ☑ Display values ☑ Transpose Axis



LCC Producer Table

Show 25 entries Search:

	car_id	category	name	value
1	147	Total	Total	-27616
2	147	Revenues	Revenue	35900
3	147	EoL	Recycling, waste disposal costs	35
4	147	Use	Warranty & service costs	260
5	147	Distribution	Distribution costs	60
6	147	Manufactoring	Lighting and HVAC	5
7	147	Manufactoring	Assembly costs	150
8	147	Manufactoring	Process costs	5998
9	147	Manufactoring	Materials	1426
10	147	Design	Design costs	350
11	148	Total	Total	-29870
12	148	Revenues	Revenue	35900
13	148	EoL	Recycling, waste disposal costs	35
14	148	Use	Warranty & service costs	260
15	148	Distribution	Distribution costs	60
16	148	Manufactoring	Lighting and HVAC	5
17	148	Manufactoring	Assembly costs	150
18	148	Manufactoring	Process costs	4459
19	148	Manufactoring	Materials	711
20	148	Design	Design costs	350

Bar graph showing the diverse Life-Cycle Costs (LCC) for producers, grouped and colored by li

CLOSING REMARKS

- BEVSIM is designed to assess the environmental, circularity, and economic impacts of passenger vehicles across the entire life cycle
- Automotive application specific tool with simpler design that offers significant savings in time and effort for performing LCA studies
- Designed for non-LCA experts for early screening of design alternatives in R&D phase
- Consistency across LCA studies
- Lower total cost of ownership compared to full suite LCA software

- Can I have access to BEVSIM?
  - **Yes**, on a case to case basis! Please reach out to us by email (tom.ligthart@tno.nl) to discuss your specific requirements.

TNO innovation for life

BEVSIM

(Battery Electric Vehicle Sustainability Impact assessment Model)

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ALMA is an EU Commission funded project with a global ambition.

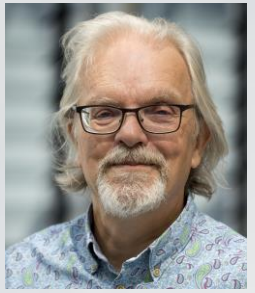
The ALMA Project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No: 101006675

Alma

THANK YOU FOR YOUR TIME

YouTube

Online launch:
https://almaproject.eu/media/



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