

IMPLEMENTATION OF ENVIRONMENTAL CONSIDERATIONS IN THE INNOVATION PROCESS OF COMPLEX SYSTEMS: GROUPE PSA CASE STUDY

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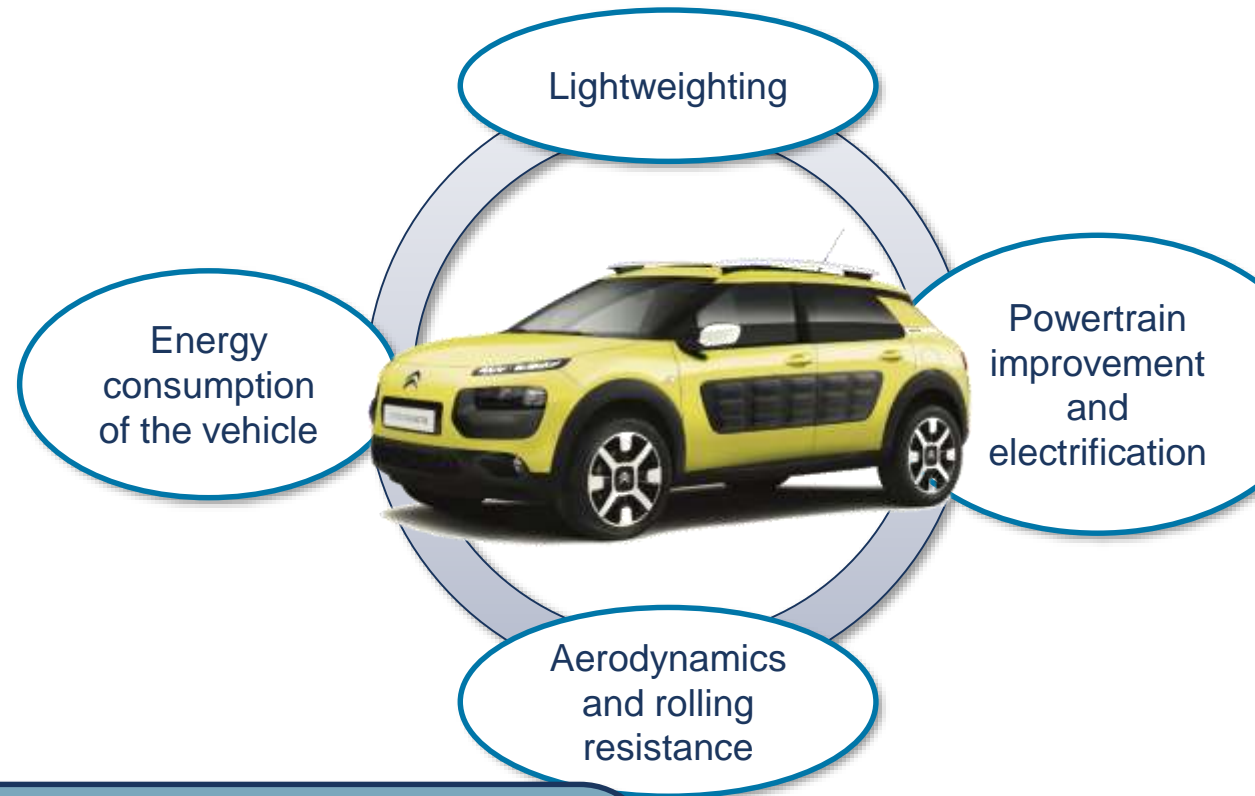
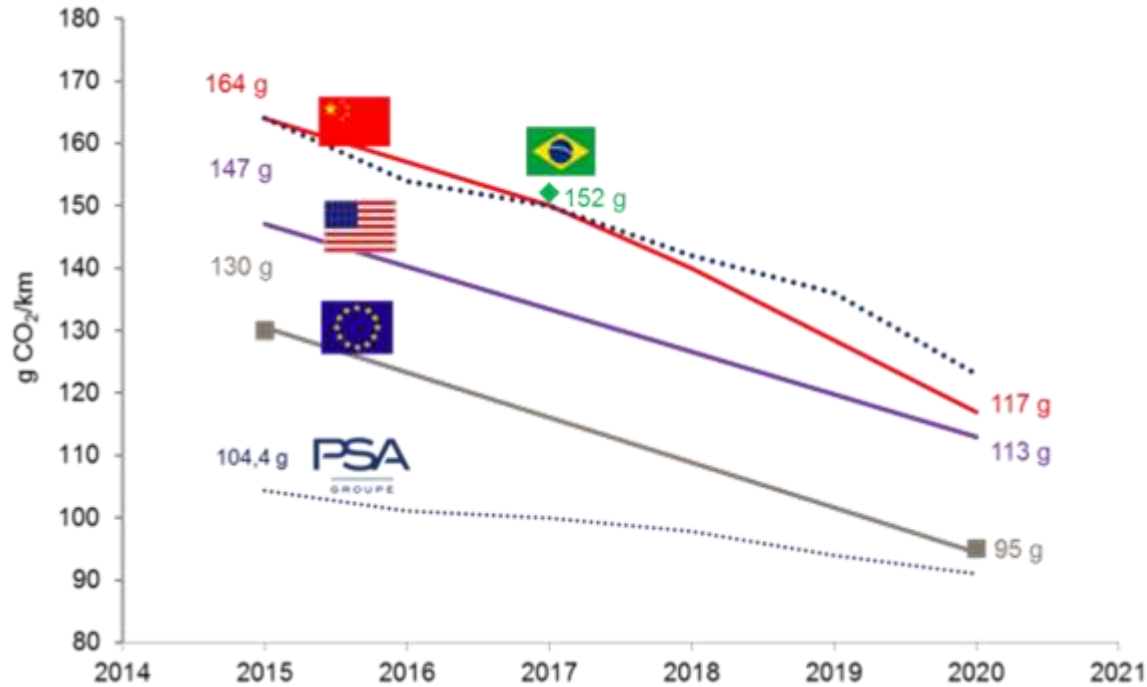
LCM 2017, Luxembourg, 03-06.09.2017



Context – Increase in the severity of regulations on tailpipe emissions

Reach 2020 CO₂/km target & reduce pollutants emissions

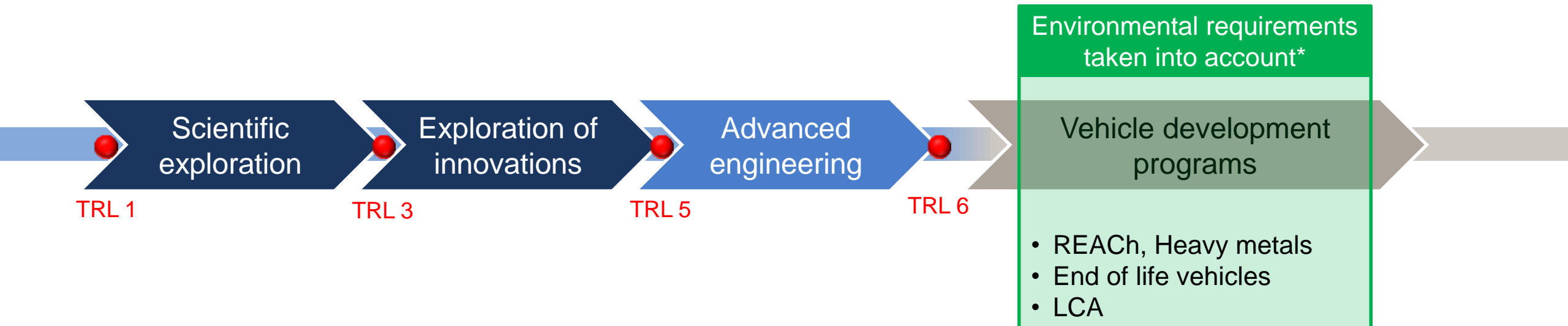
Main Research and Development strategies



Need for a global approach to take into account the Environment Dimension during innovation

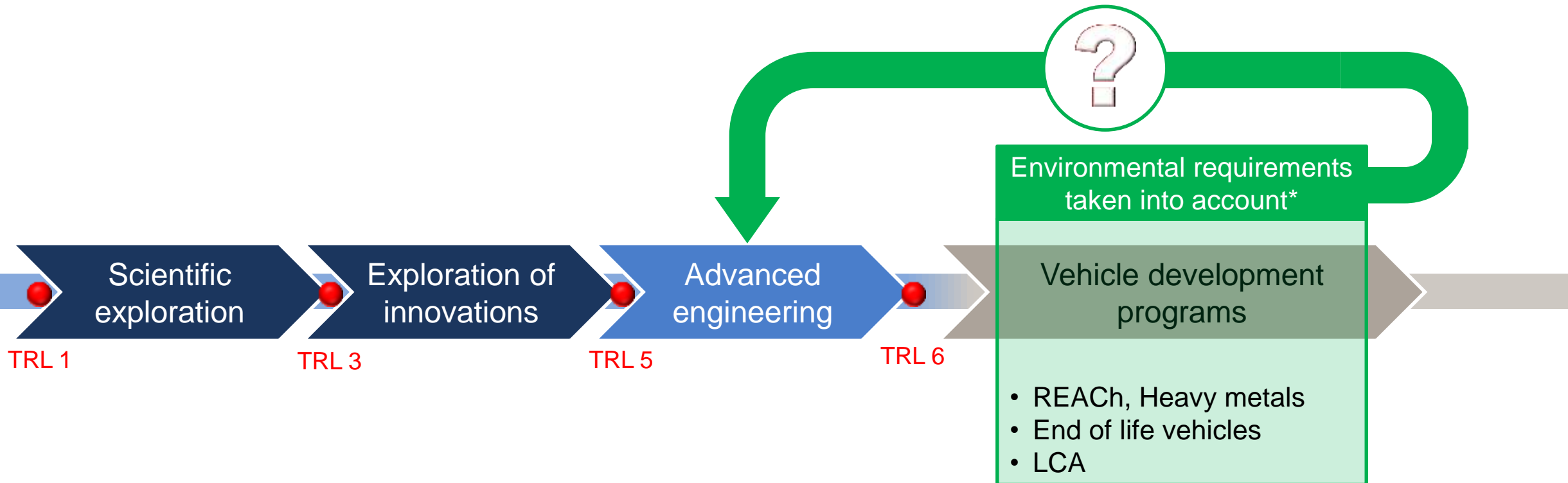
Context – Research, innovation, and development structures

- Different processes and tools are used in *Research and Innovation step* and *Development step*
- Environmental requirements are well integrated within vehicle development programs



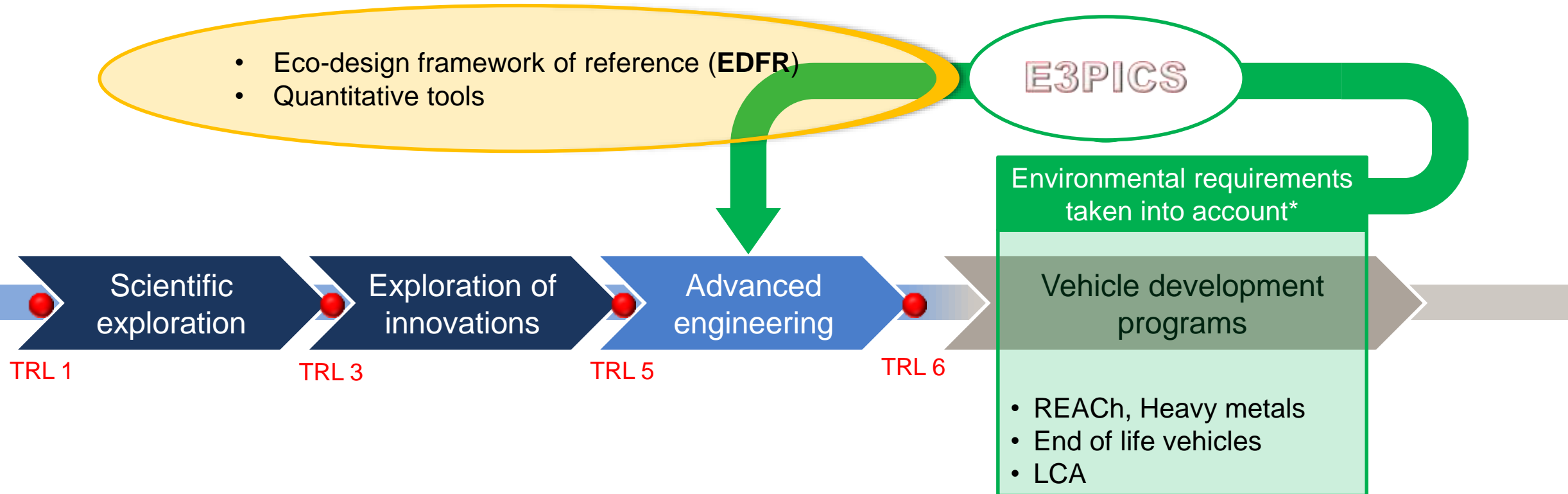
**Consumption, CO₂ and pollutant emissions are managed with other processes*

- **Issue:** How to integrate an eco-design approach within the innovation processes?



**Consumption, CO₂ and pollutant emissions are managed with other processes*

■ **E3PICS:** Methodology of an **E**volutive integration of the **E**valuation of the **E**nvironmental **P**erformances of **I**nnovative **C**omplex **S**ub-systems



*Consumption, CO₂ and pollutant emissions are managed with other processes

■ 9 requirements to be taken into account in the innovation processes within the **EDFR**

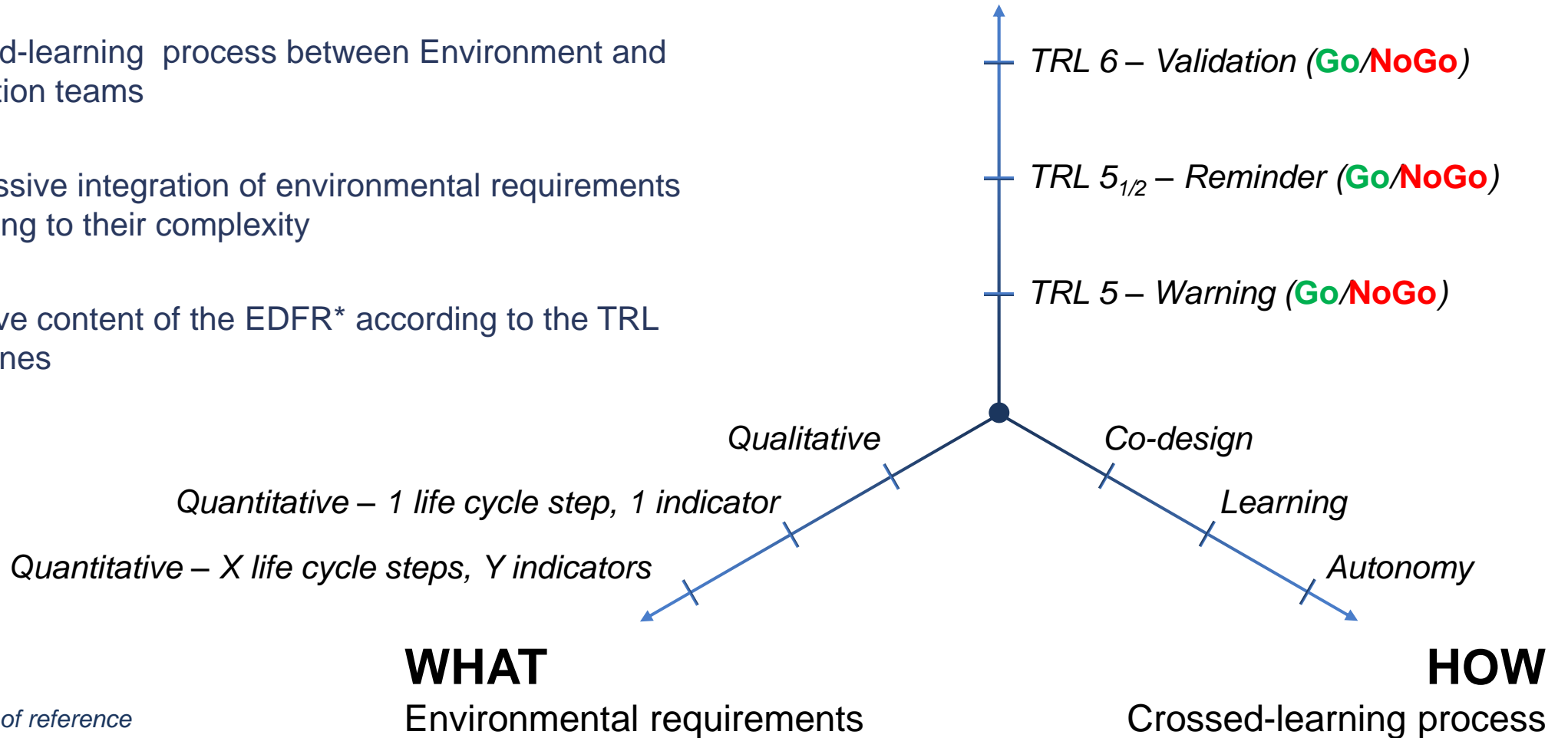


■ E3PICS methodology regarding the EDFR deployment

- Crossed-learning process between Environment and Innovation teams
- Progressive integration of environmental requirements according to their complexity
- Evolutive content of the EDFR* according to the TRL milestones

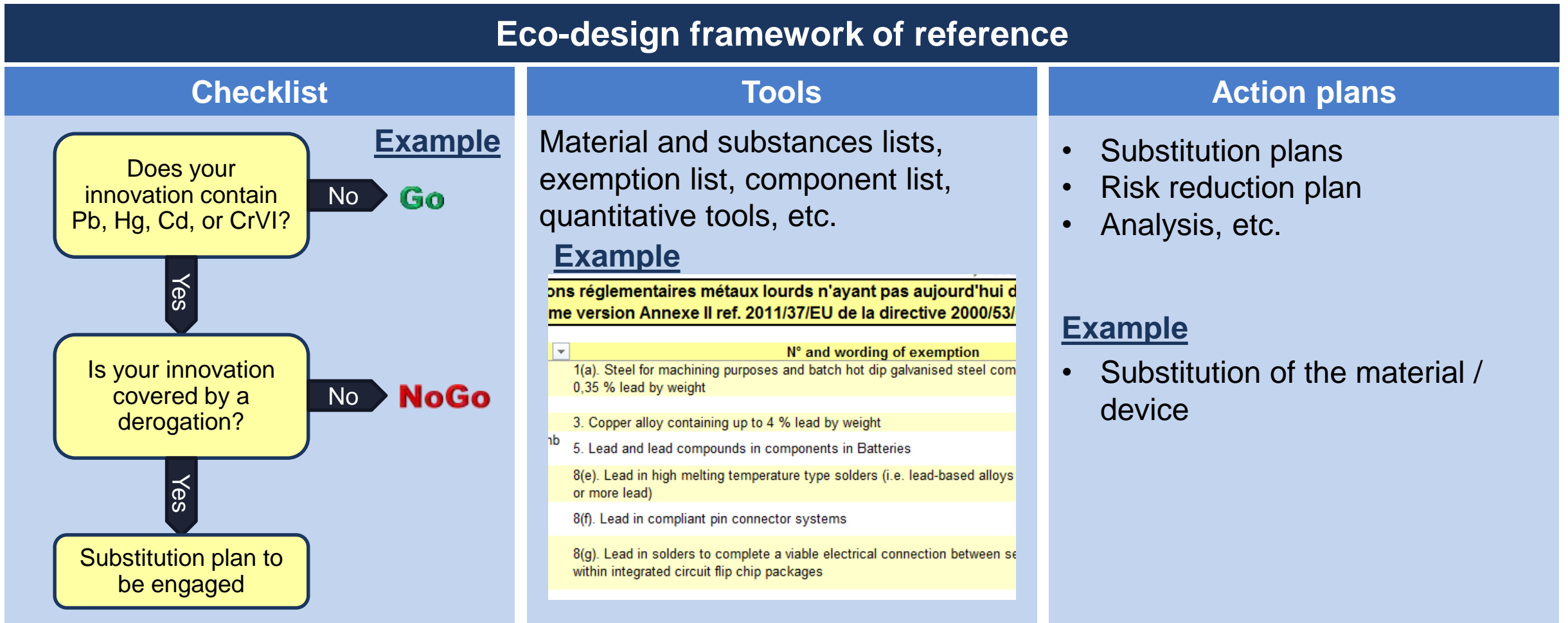
WHERE / WHEN

In the innovation processes



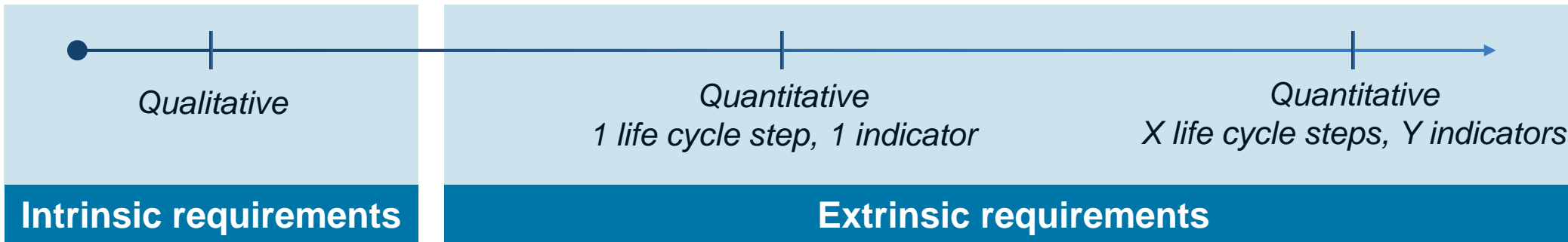
*EDFR: Eco-design framework of reference

■ Structure of the EDFR



Quantitative tools for extrinsic requirements

- Development of quantitative tools to answer to the increase in complexity of the environmental requirements



WHAT
Environmental requirements

Recoverability



Outil de Simulation de l'Impact sur la Recyclabilité des Innovations

Garcia et al. (2015) "A tool to evaluate the impacts...", IJVD

Life cycle impacts



Tool for Evaluating the Eco-Performance of Innovations

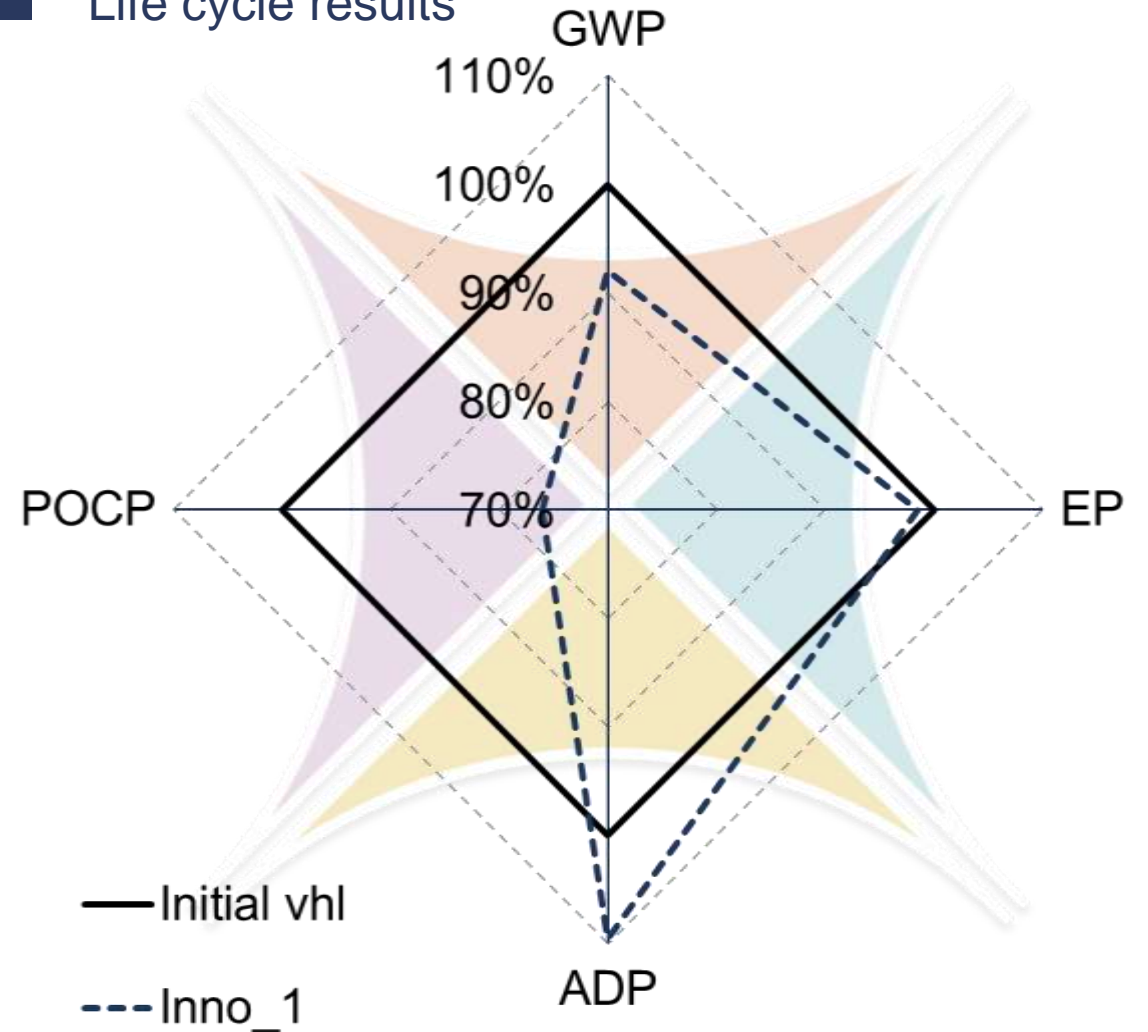
Garcia et al. (2015) "Construction of evolving models...", IJSE

■ Inno_1: Fuel + Electricity

- Weight gross: +42%
- Diesel consumption reduction: -11%

Vhl parameters	Inno_1
Type	B
Shape	Sedan
Finish	Average
Gearbox	Manual
Fuel	Diesel
Consumption [L/100 km]	3,8
Assembly plant	AP_A

■ Life cycle results



TEEPI case study: Micro-hybridization systems

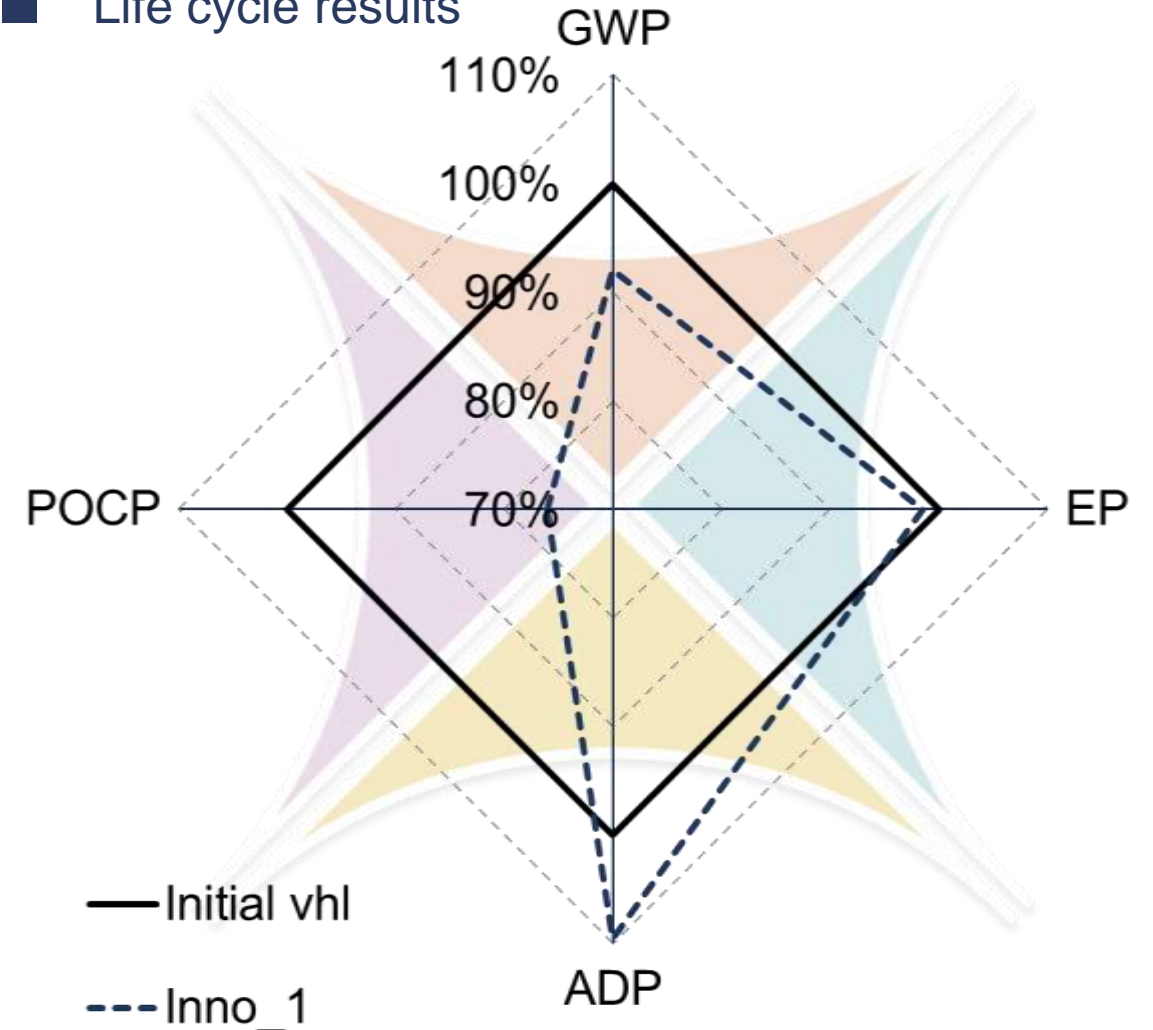
■ Inno_1: Fuel + Electricity

- Weight gross: +42%
- Diesel consumption reduction: -11%

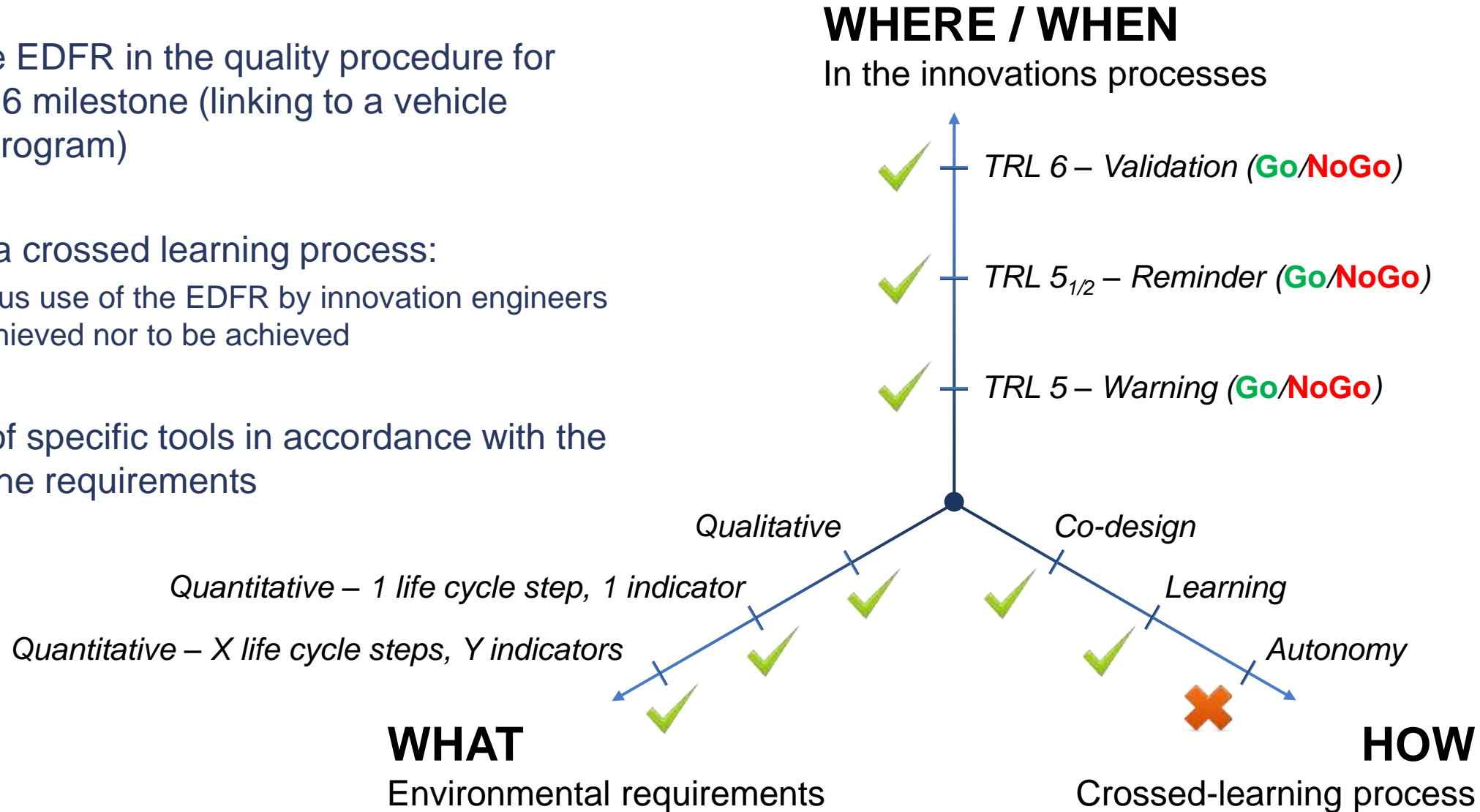
■ Conclusion

- Despite the weight increase, air and water impacts are reduced
- Resource impacts are increased because of the use of a heavier lead battery
- TEEPI aims to evaluate innovations at TRL 6 following 3 criteria (mass, material change, fuel consumption) and results are coherent with full LCA

■ Life cycle results



- Inclusion of the EDFR in the quality procedure for validating TRL 6 milestone (linking to a vehicle development program)
- Generation of a crossed learning process:
 - Autonomous use of the EDFR by innovation engineers neither achieved nor to be achieved
- Development of specific tools in accordance with the complexity of the requirements



Thank you for your attention!

QUESTIONS / ANSWERS

TEEPI case study: Micro-hybridization systems

■ Inno_1: Fuel + Electricity

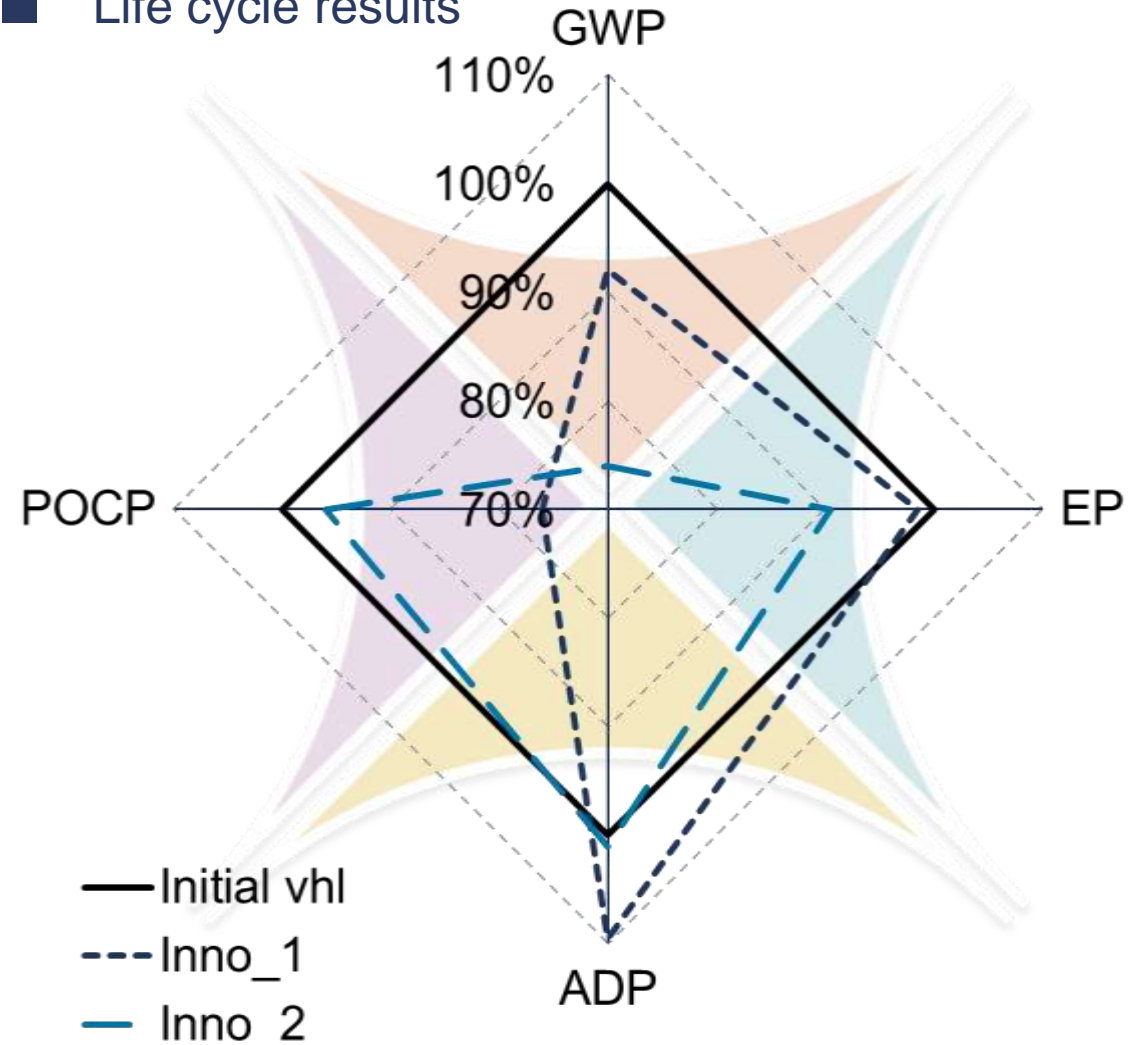
- Weight gross: +42%
- Diesel consumption reduction: -11%

■ Inno_2: Fuel + Compressed air

- Weight growth: 151%
- Gasoline consumption reduction: -35%

Vhl parameters	Inno_1	Inno_2
Type	B	B
Shape	Sedan	Sedan
Finish	Average	Average
Gearbox	Manual	Manual
Fuel	Diesel	Gasoline
Consumption [L/100 km]	3,8	4,5
Assembly plant	AP_A	AP_A

■ Life cycle results



TEEPI case study: Micro-hybridization systems

■ Inno_1: Fuel + Electricity

- Weight gross: +42%
- Diesel consumption reduction: -11%

■ Inno_2: Fuel + Compressed air

- Weight growth: 151%
- Gasoline consumption reduction: -35%

■ Conclusion

- Despite the weight increase, air and water impacts are reduced for both innovations
- Resource impacts are increased for Inno_1 because of the use of a heavier lead battery
- TEEPI aims to evaluate innovations at TRL 6 following 3 criteria (mass, material change, fuel consumption) and results are coherent with full LCA

■ Results

