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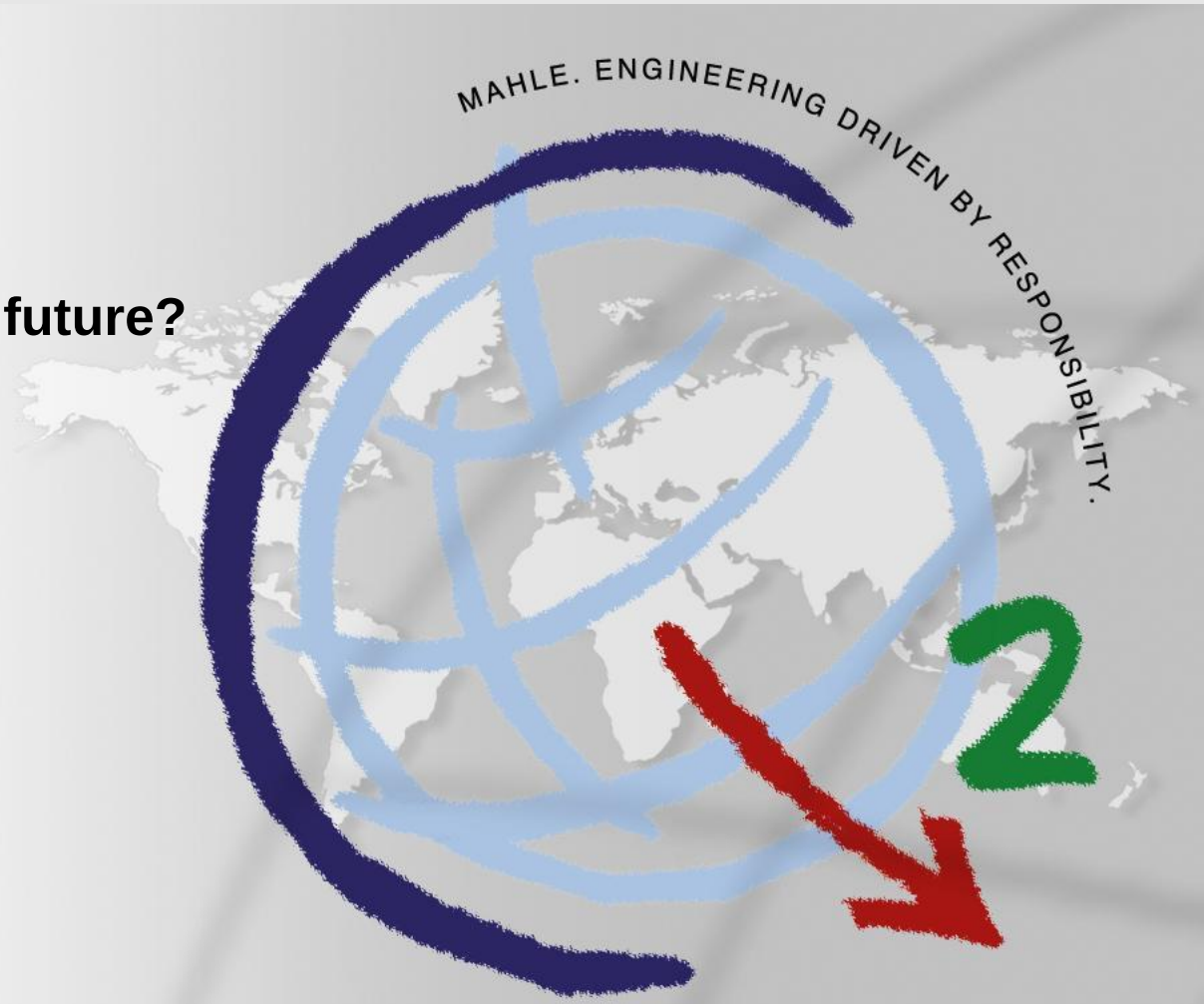
EVS30

Big Batteries – Solution for the future?

Dr. Otmar Scharrer



+2°C Climate Target: Historical and Future CO_2 Emissions

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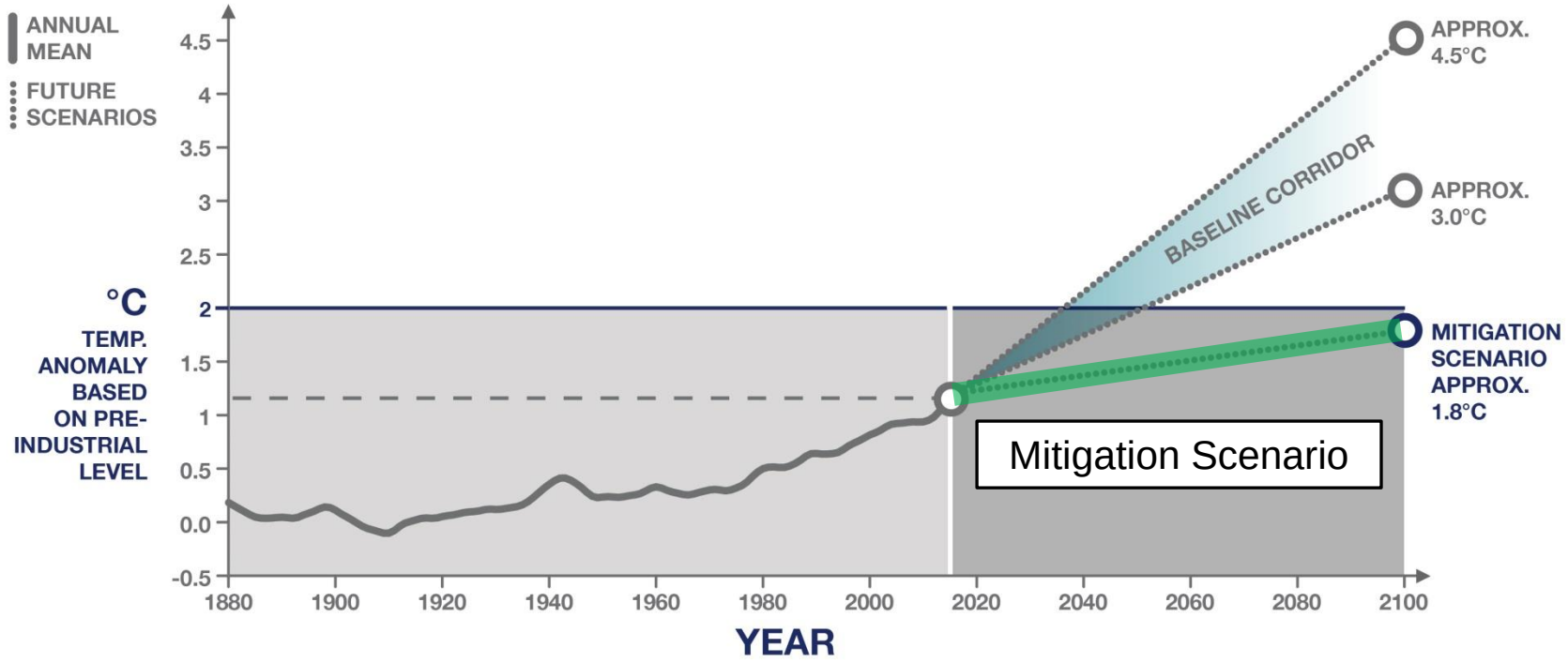

<2°C Target achievable with Mitigation Scenario

+2°C Climate Target: Historical and Future CO_2 Emissions

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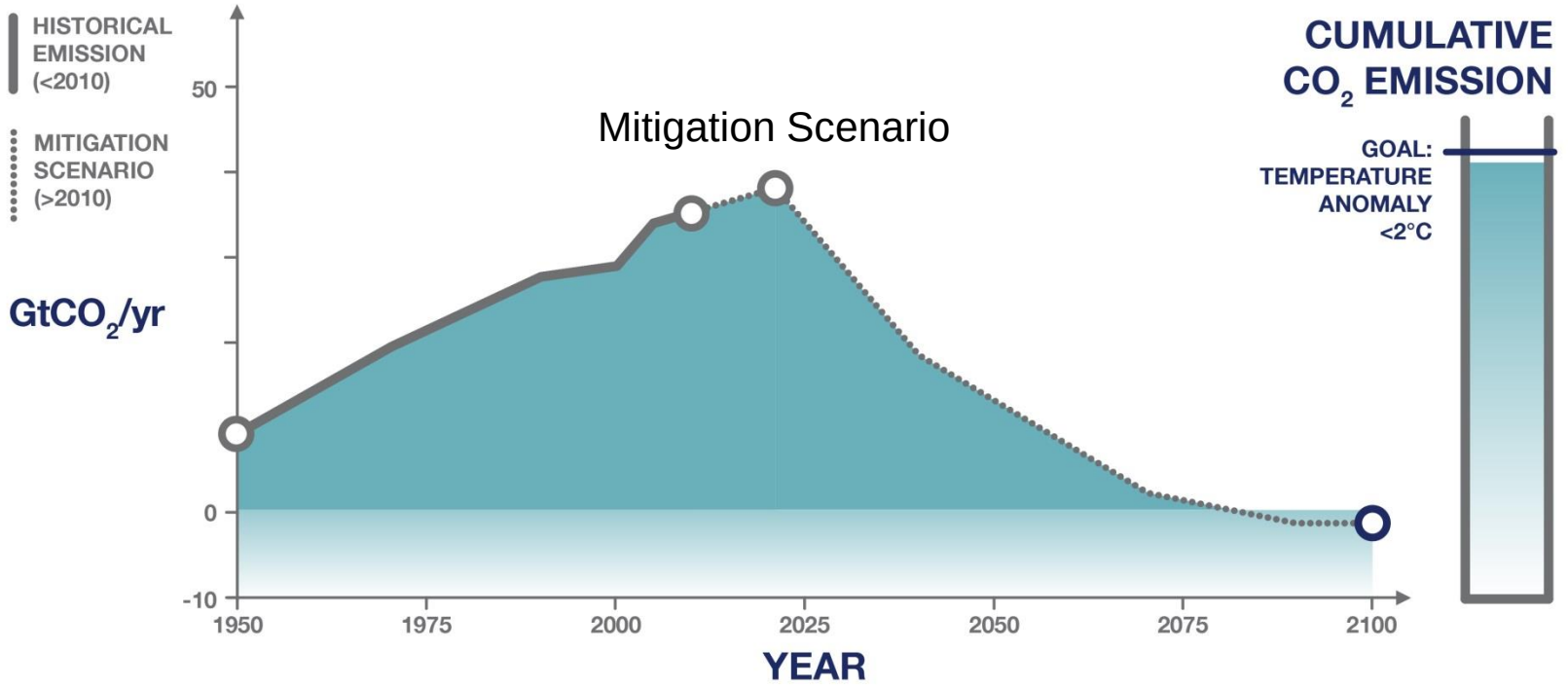

Contribution from Battery Electric Vehicle (BEV) and Green Electricity necessary!

Acceptance of BEV

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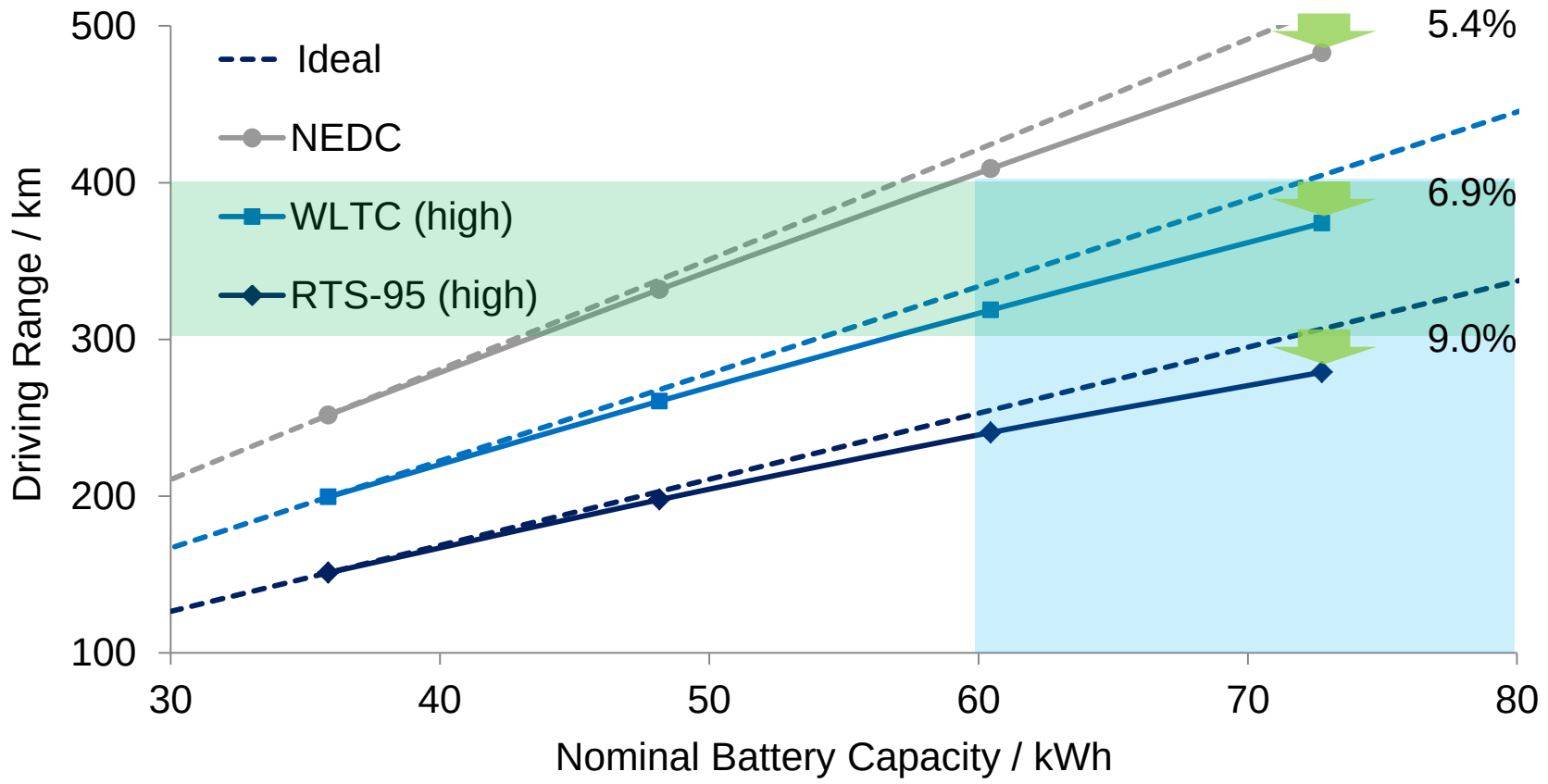

The larger the battery the larger the deviation from linearity!

Acceleration Performance vs. Battery Size

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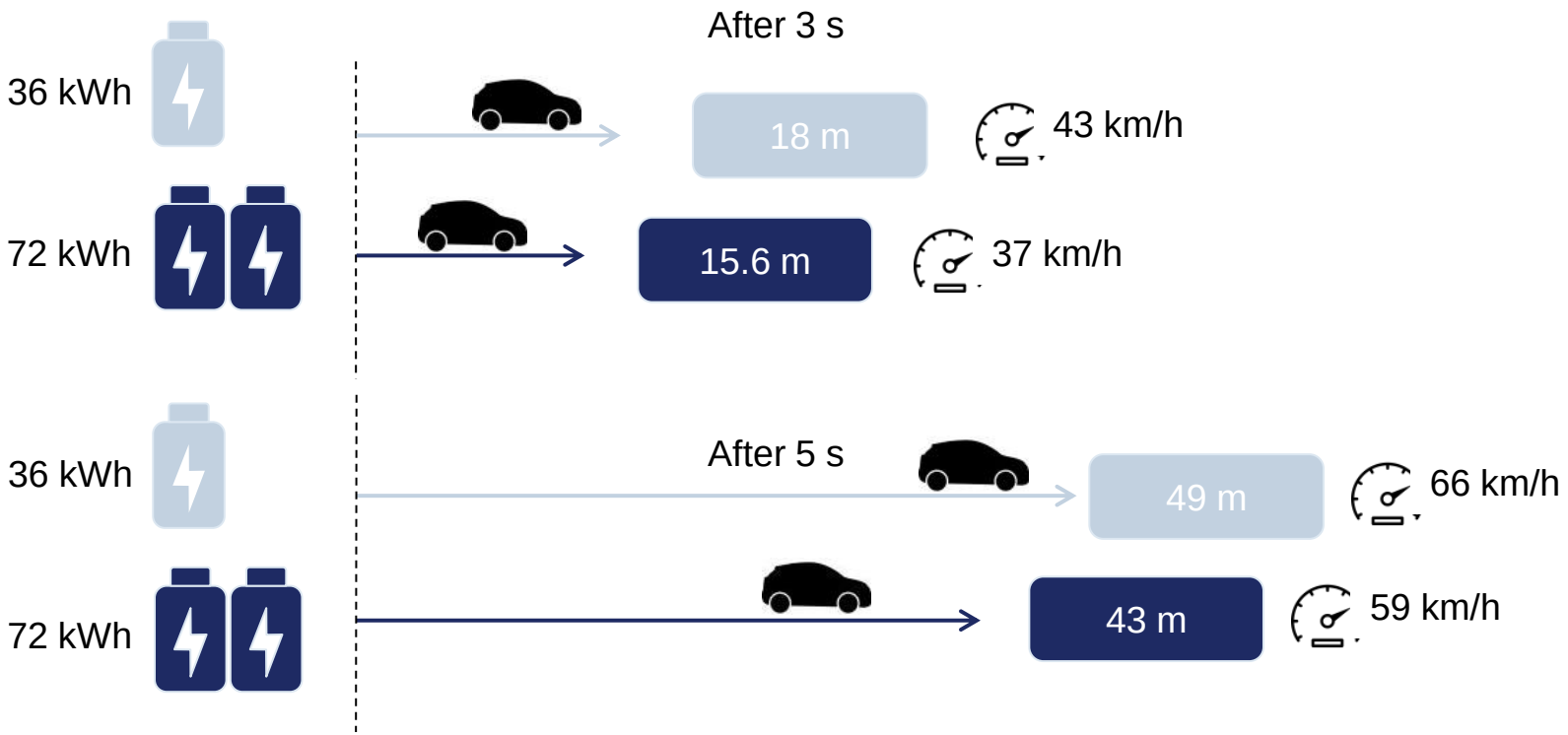

The larger the battery the lower the acceleration performance.

Life Cycle Assessment

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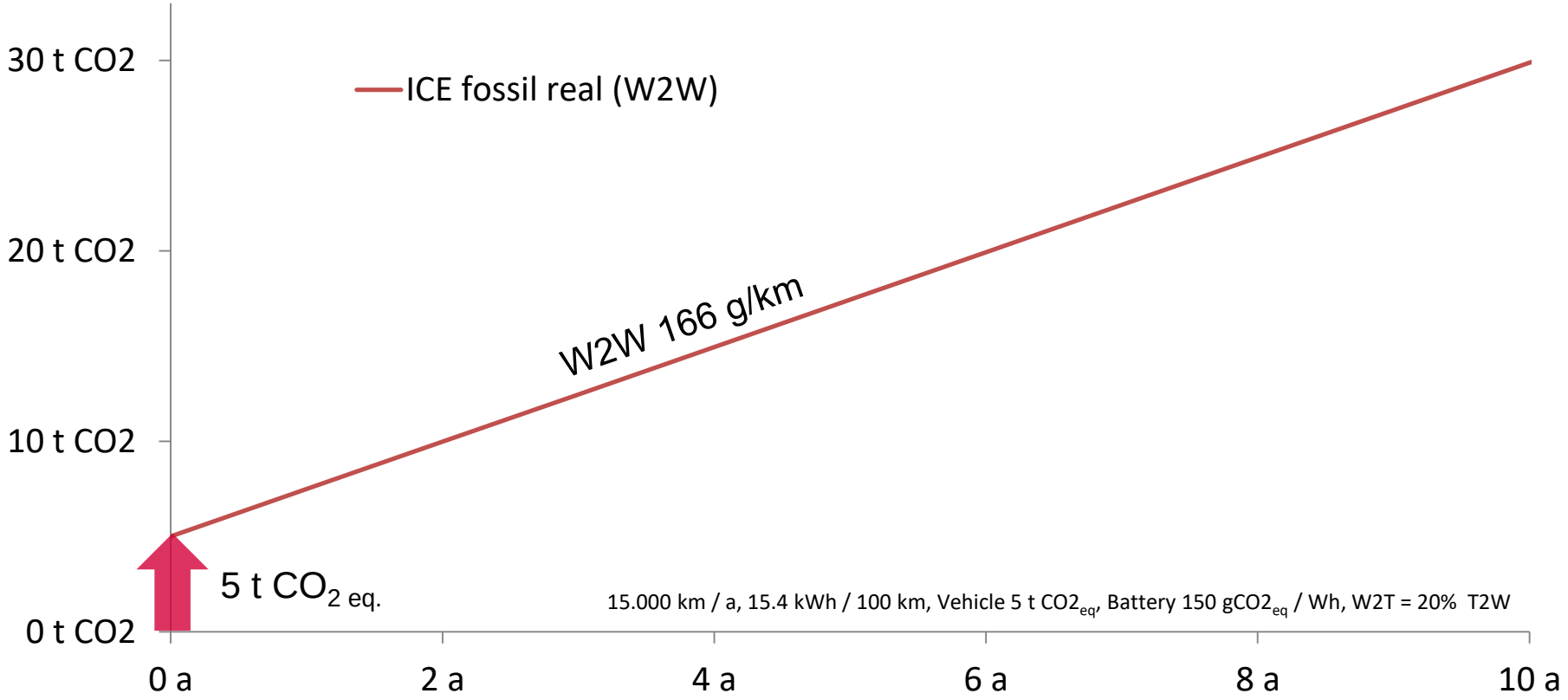

Typical ICE, vehicle production 5 $tCO_{2eq.}$, 5.9 l /100 km,

Life Cycle Assessment

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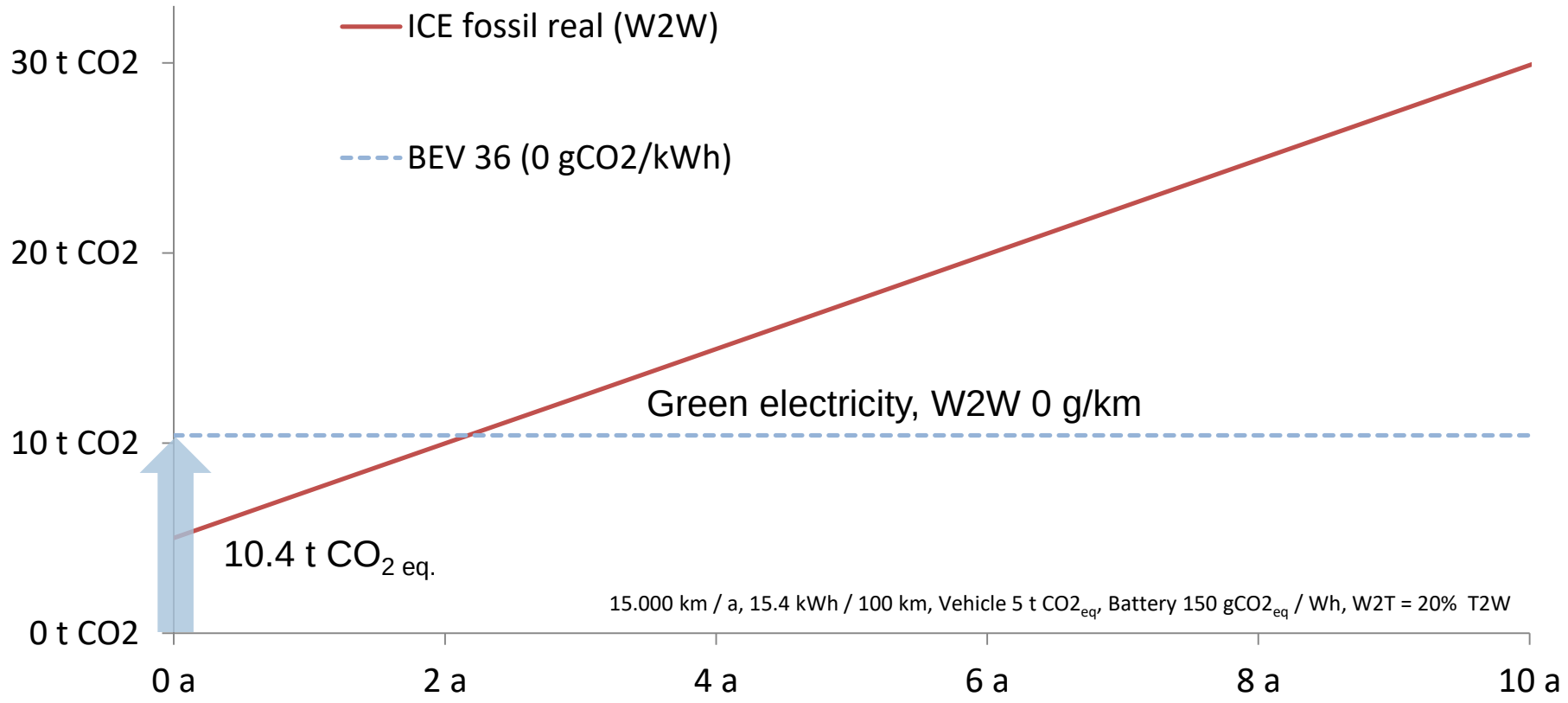

BEV vehicle production 5 $tCO_{2eq.}$+ Battery (36 kWh) 5.4 $tCO_{2eq.}$

Life Cycle Assessment

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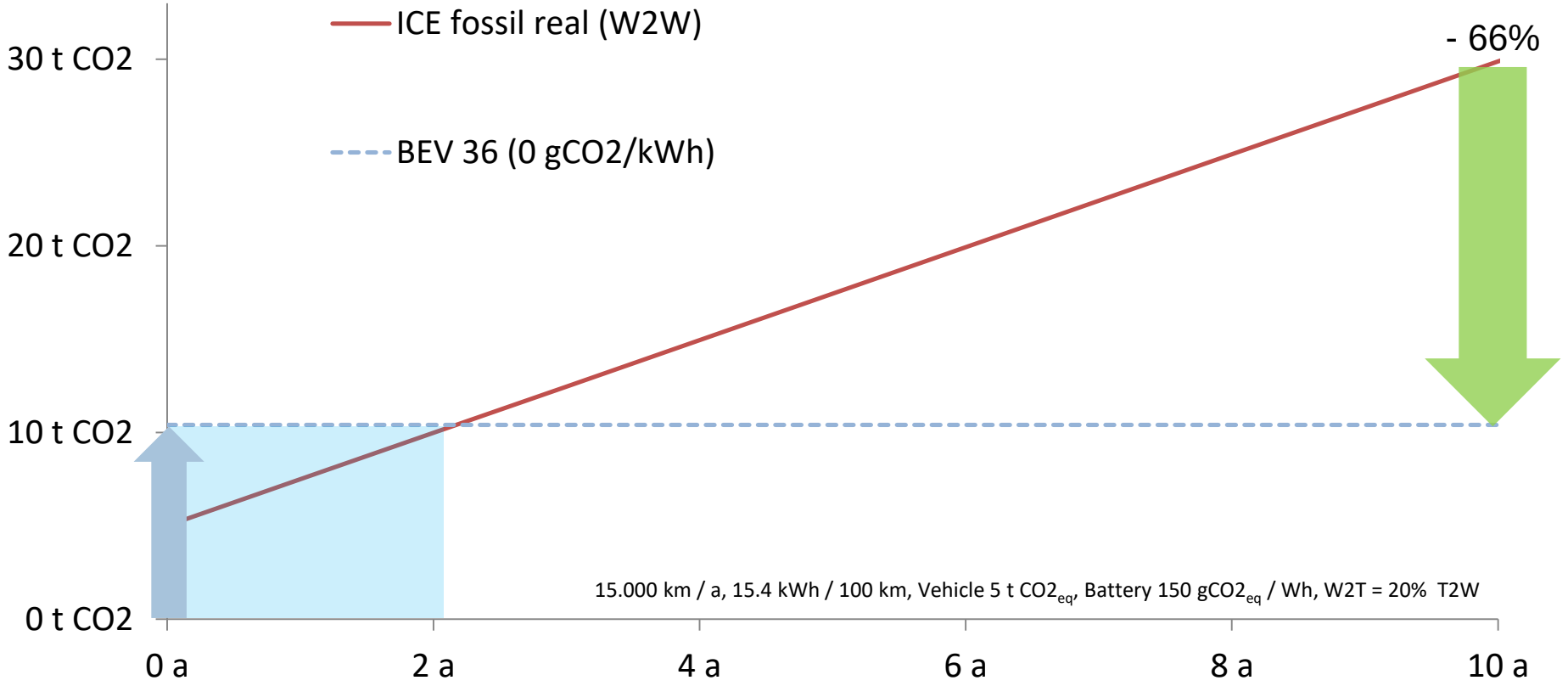

Compensation of production footprint within 2 years …

Life Cycle Assessment

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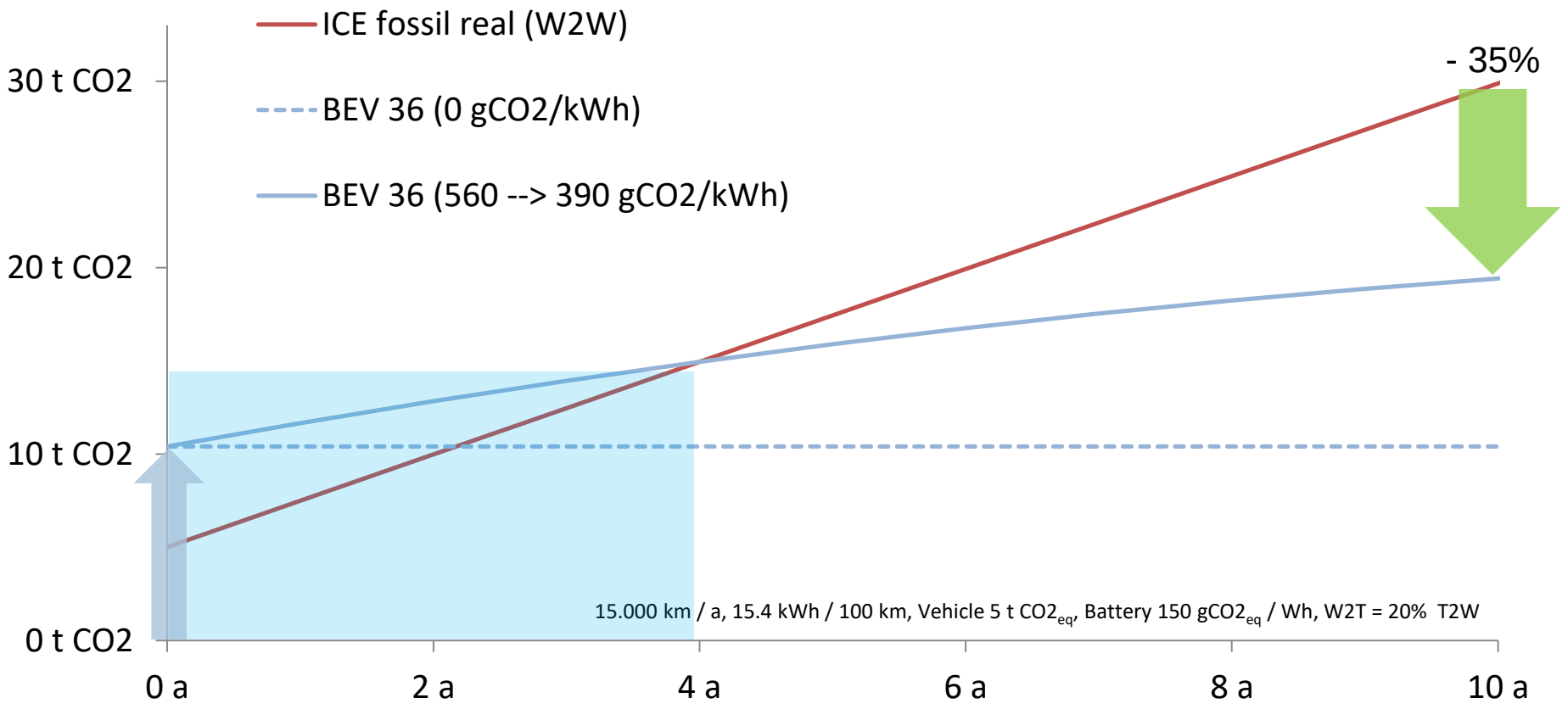

… however, it takes longer with current and future electricity mix.

Life Cycle Assessment (LCA)

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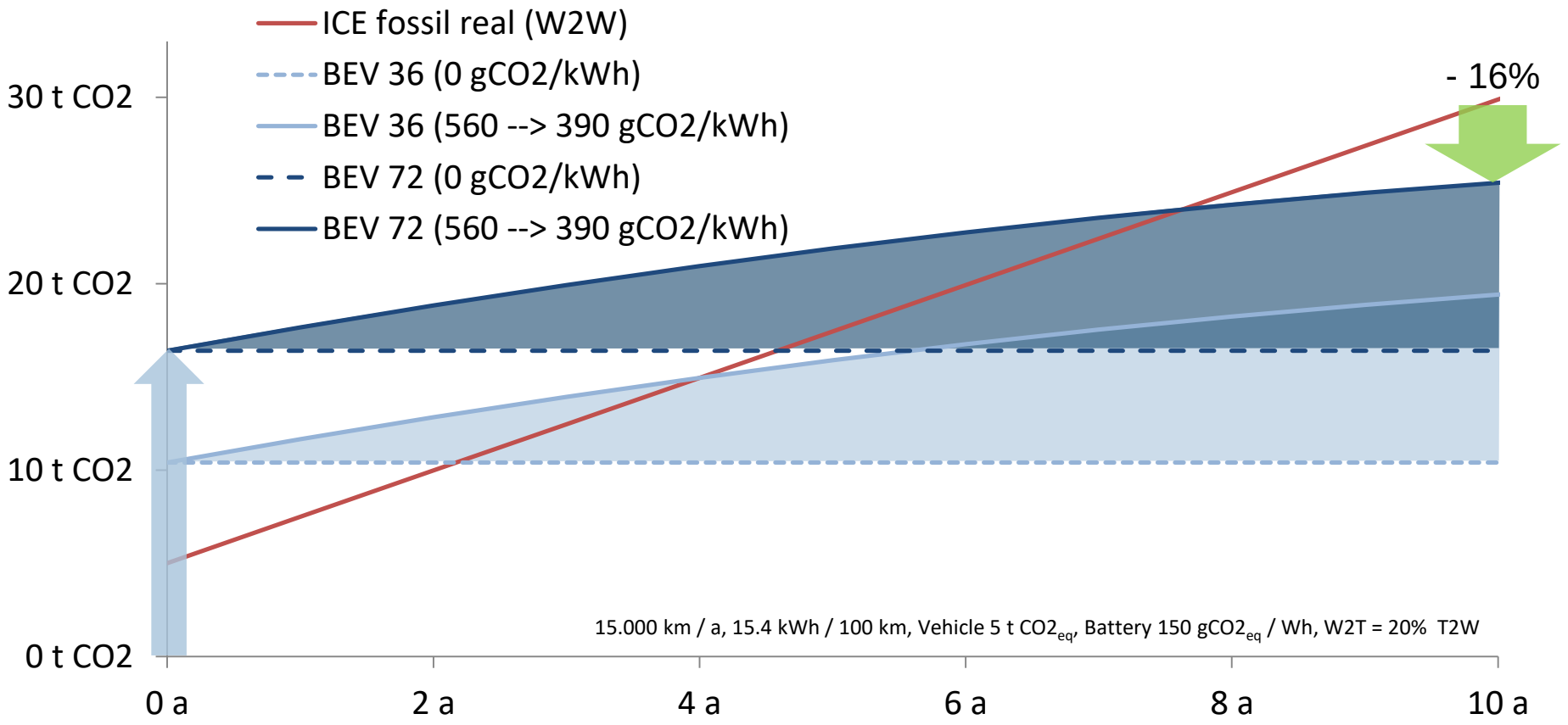

The bigger the battery the larger the LCA impact!

Quick Charging (80% SOC) and Battery Size

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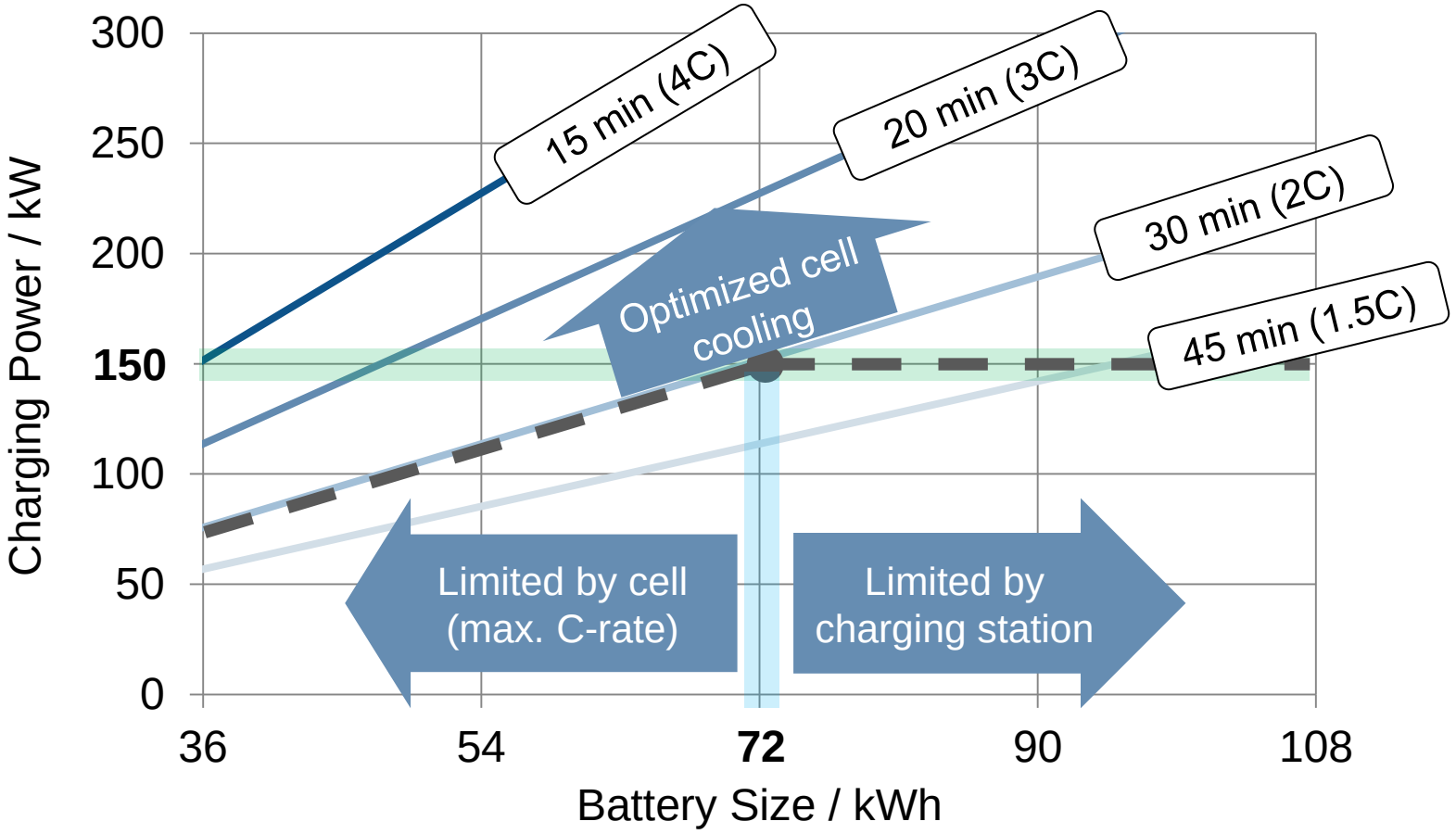

The larger the battery the higher the charging power required

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Driving performance

CO_2 production footprint

Infrastructure

Cost

Is there a smarter way?

The ’Three Enablers’

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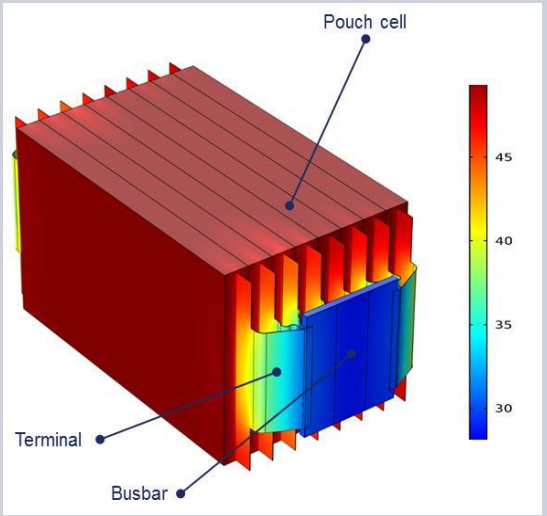
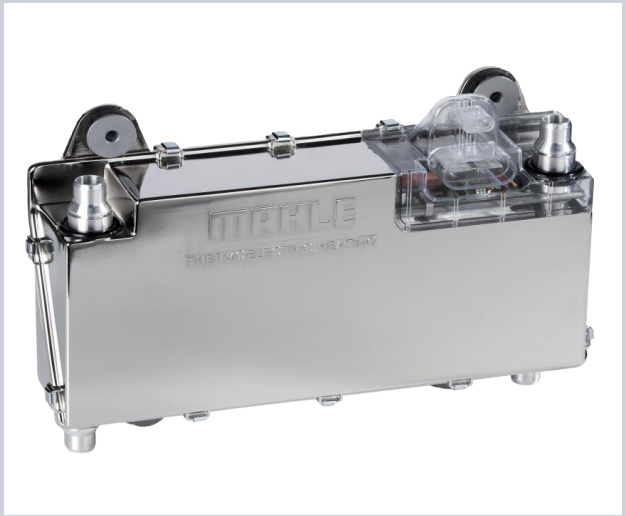
Efficient propulsion	Quick Charging	Efficient cabin comfort





Efficient Propulsion

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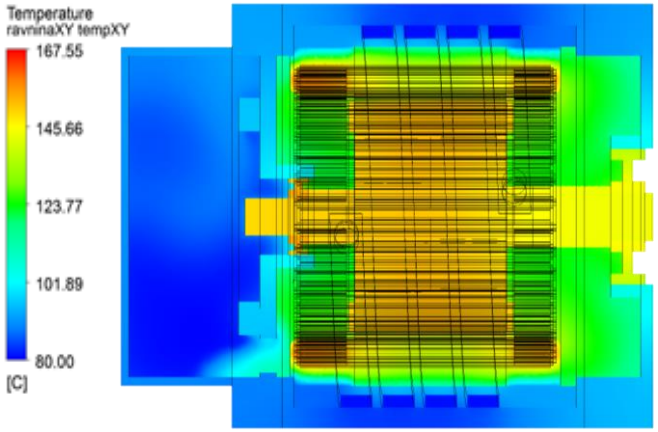
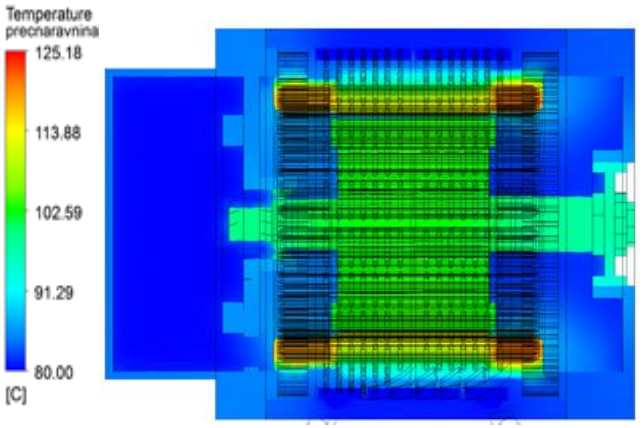
Conventional E-Motor Cooling



- New E-motor cooling concept
- Reduction of winding temperature: 40K
  - ➢ Reduction of losses
  - ➢ Higher power density
- Confirmed by simulation and testing

Advanced E-Motor Cooling



2% Efficiency Increase and Cost Reduction

Quick charging

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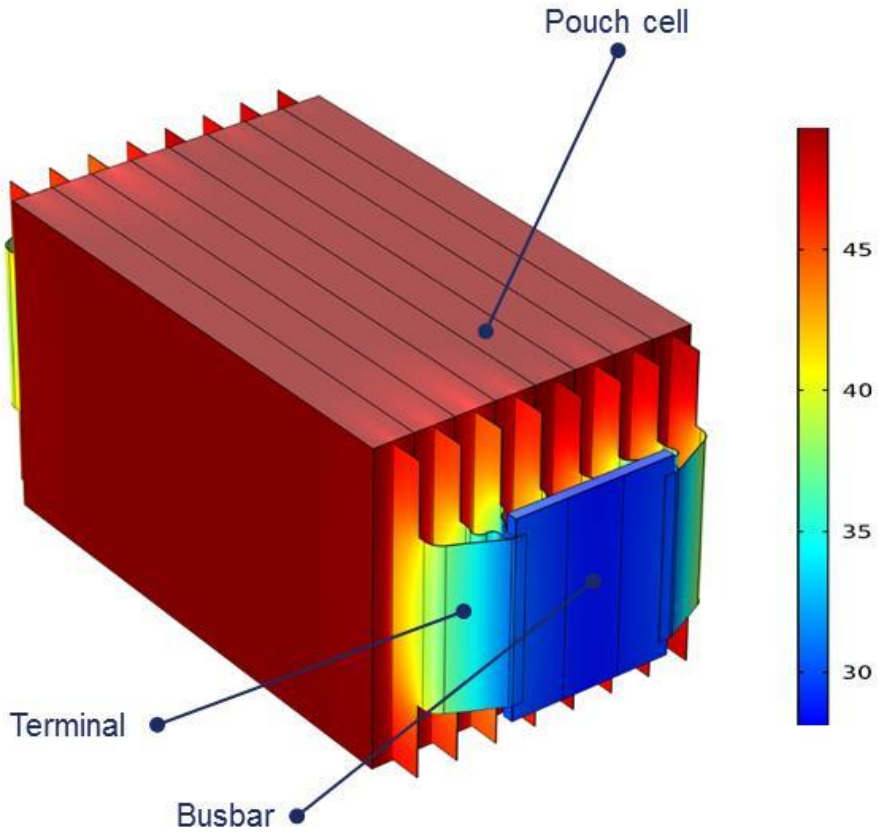

- Charging time (5 – 80% SOC): 7.5 minutes (6C)
- Coolant inlet temperature: 25°C

- Busbar temperature: 29°C
- Maximum cell temperature: **51°C**

- **Ultra-fast charging possible with terminal cooling**

Enabler for Quick Charging (up to 6C): Optimized cell cooling!

Impact of cabin heating on electric driving range

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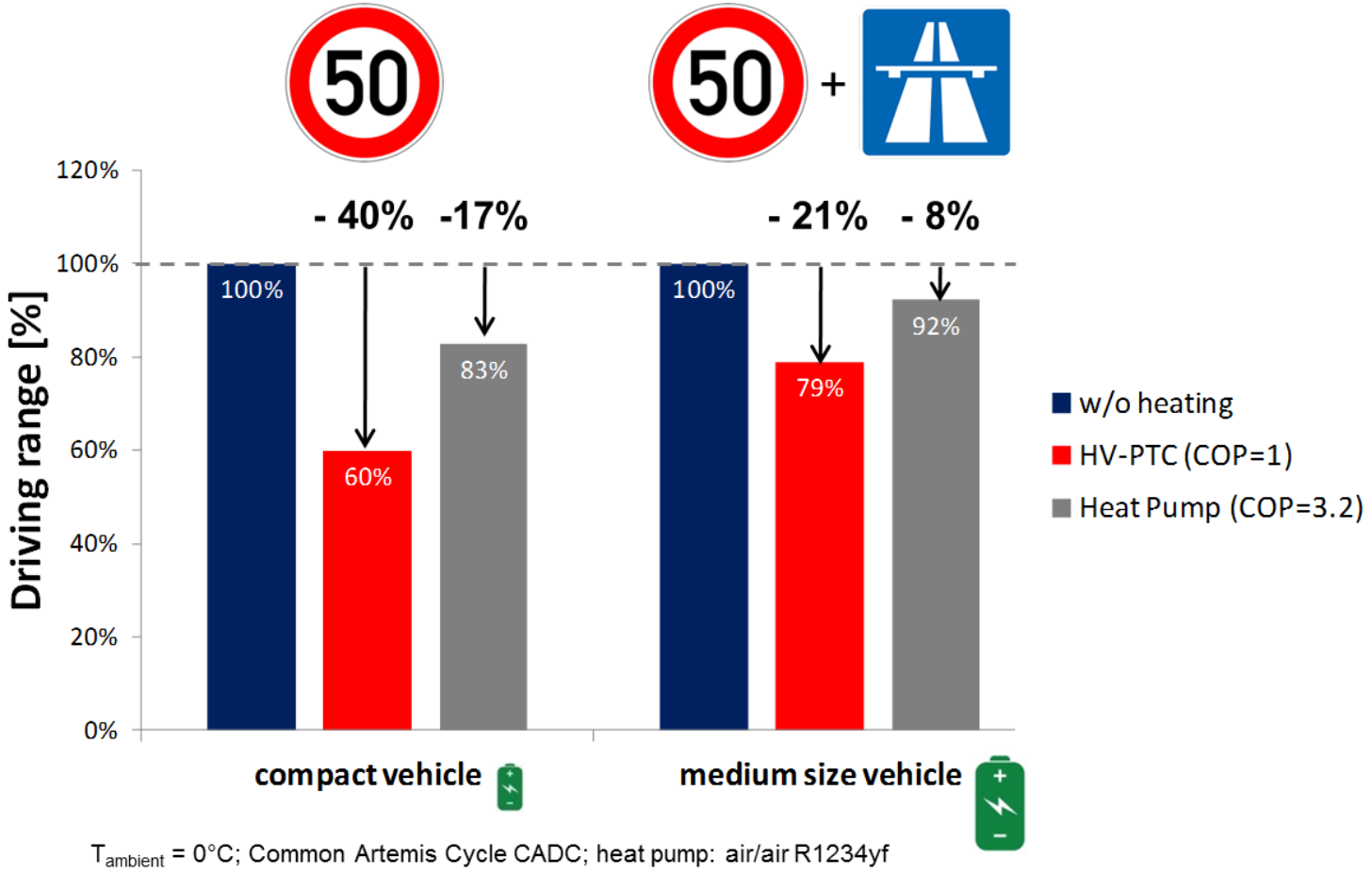

$T_{ambient}$ = 0°C; Common Artemis Cycle CADC; heat pump: air/air R1234yf

> 50% lower impact of cabin heating on driving range

Comfort and Efficiency

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Available Waste Heat	Coefficient of Performance
0 kW	1
0,75 kW	1,4
1,5 kW	2,1
2,25 kW	3,8

At 0°C ambient temperature and a requested heating power of 3kW:

Thermoelectrics: new heat pump for cabin air heating

Comfort and Efficiency

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MeeT: Individualized thermal comfort

Summary

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- Battery size has a main impact on CO2 footprint of a BEV
- To avoid high cost and weight, batteries should be designed as small as possible
- To be able to do so, three prerequisites are required
  - High efficient electric drivetrain
  - Fast charging capability
  - Efficient climatic comfort system
- Range anxiety can be avoided if high C-rates are available

Urban vehicles get along well with 20kWh battery size

MEET MAHLE Efficient Electric Transport

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