

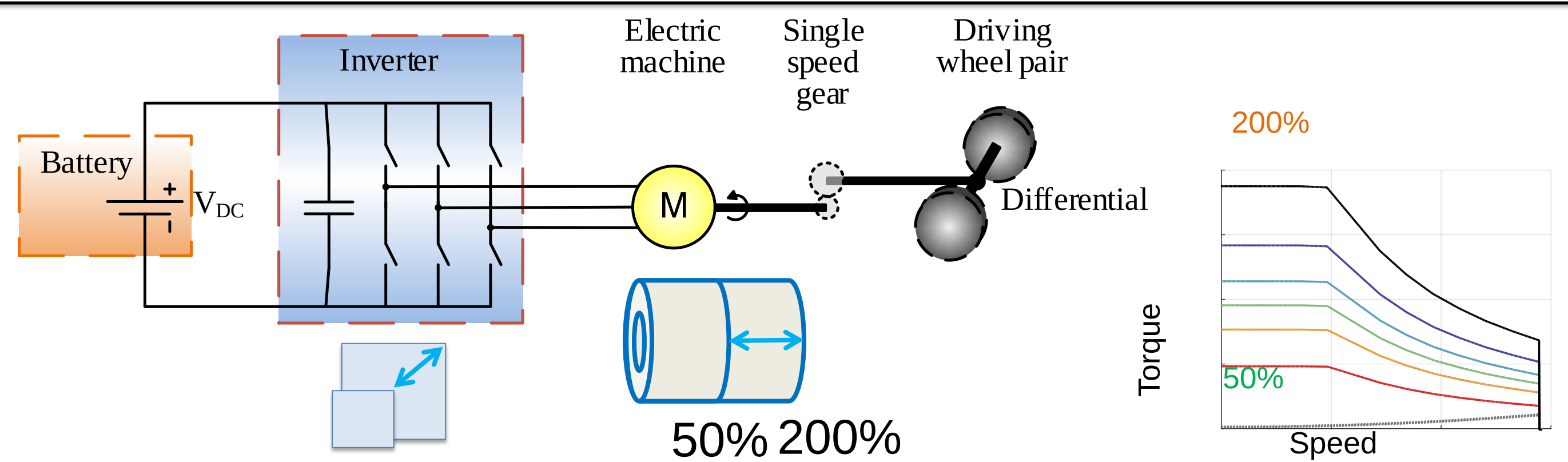
Electric Drive system Scaling - Influence on Acceleration, Energy Use and Cost

Purpose

Investigates the consequence on

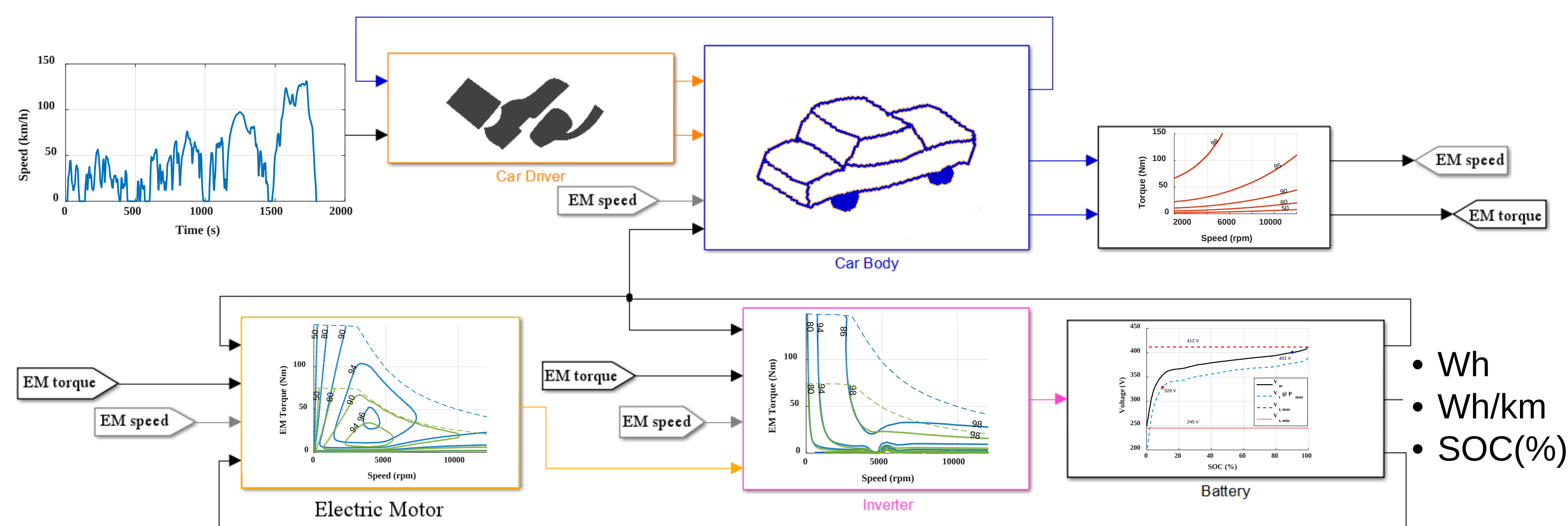
- o **Performance**
- o **energy consumption**
- o **cost**

while scaling the electric drive system 50%-200% of a Small and Large electric car.



Method & Modelling

- Axial scaling of the active length of the permanent magnet motor...
- ... and rewinding to keep base speed
- Scalable inverter module model
- Vehicle Simulink model with load dependent models



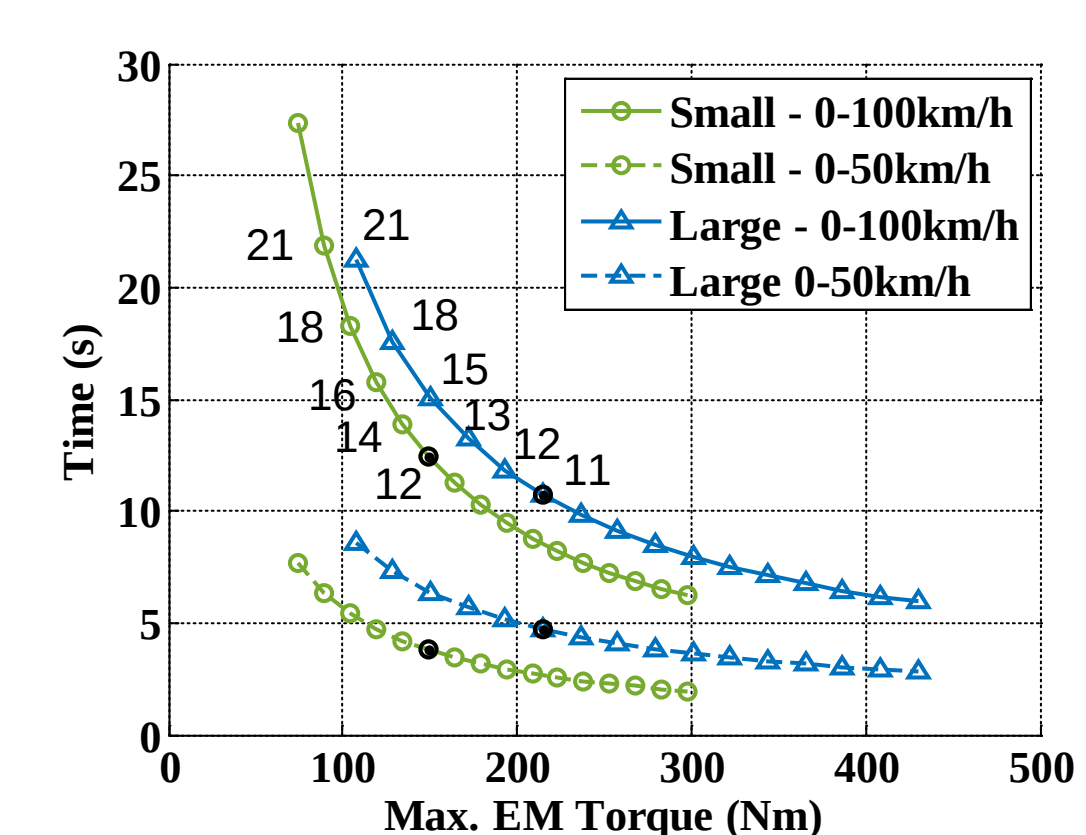
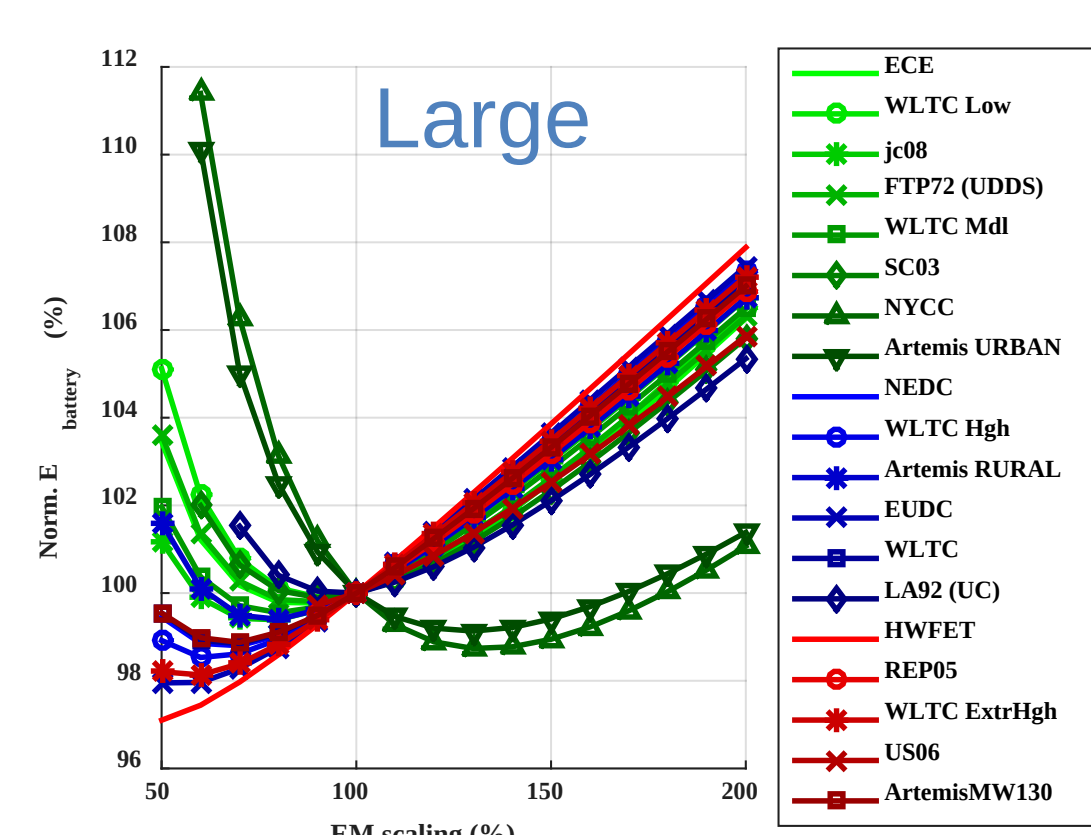
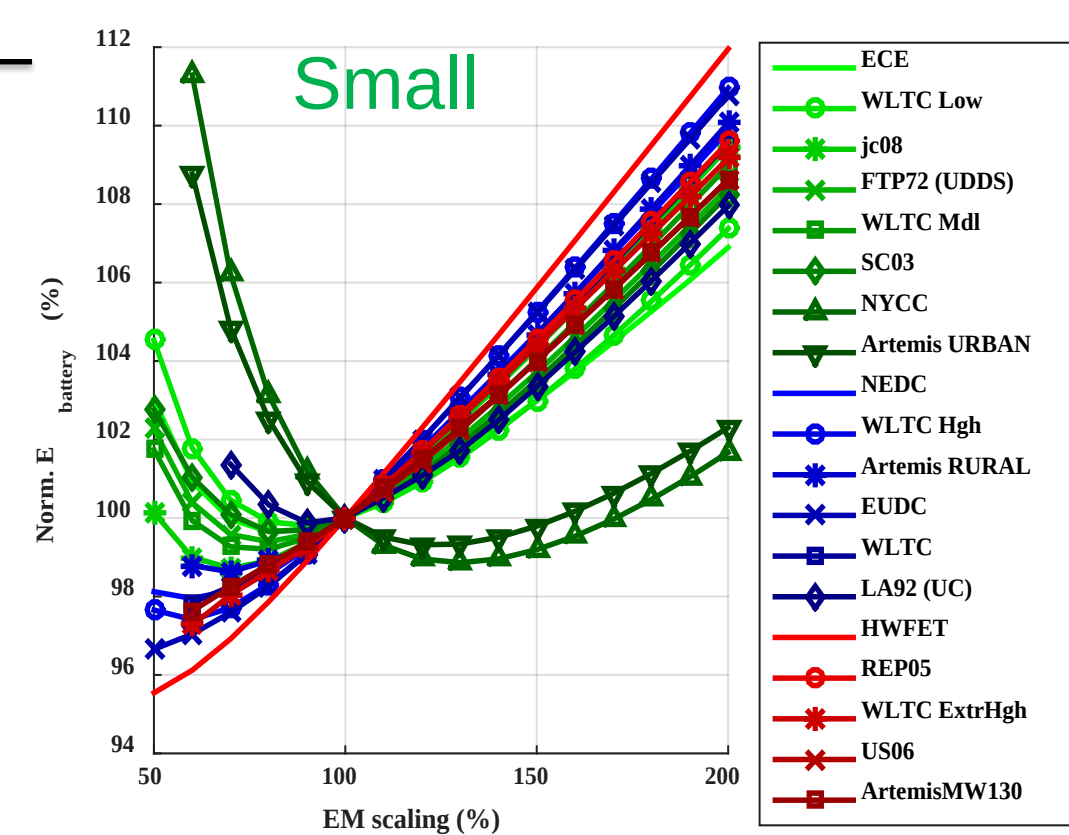
Results

- Drive cycle energy consumption per distance (Wh/km)

- o Low speed
- o Middle speed
- o High speed

- Acceleration time (s)

- o 0-50 km/h
- o 0-100 km/h



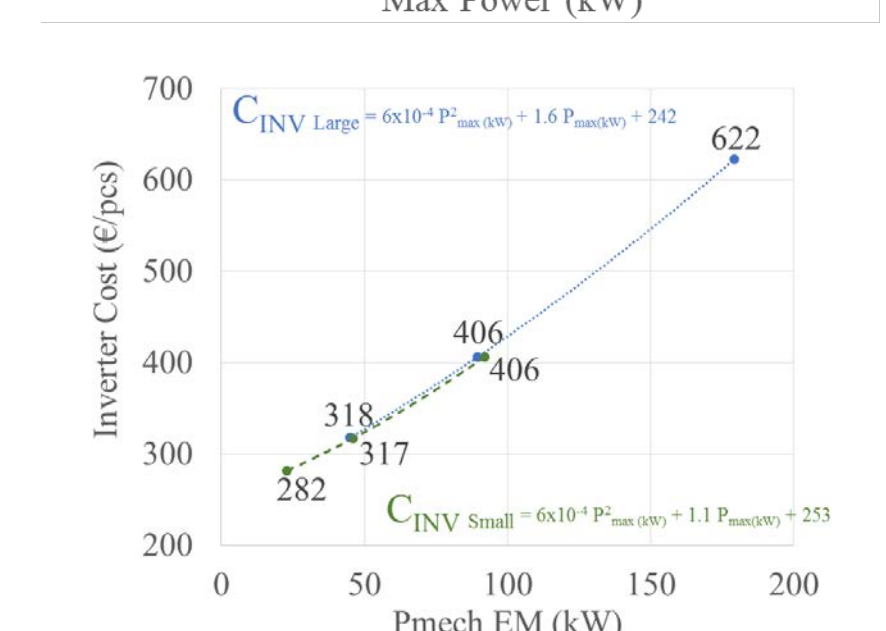
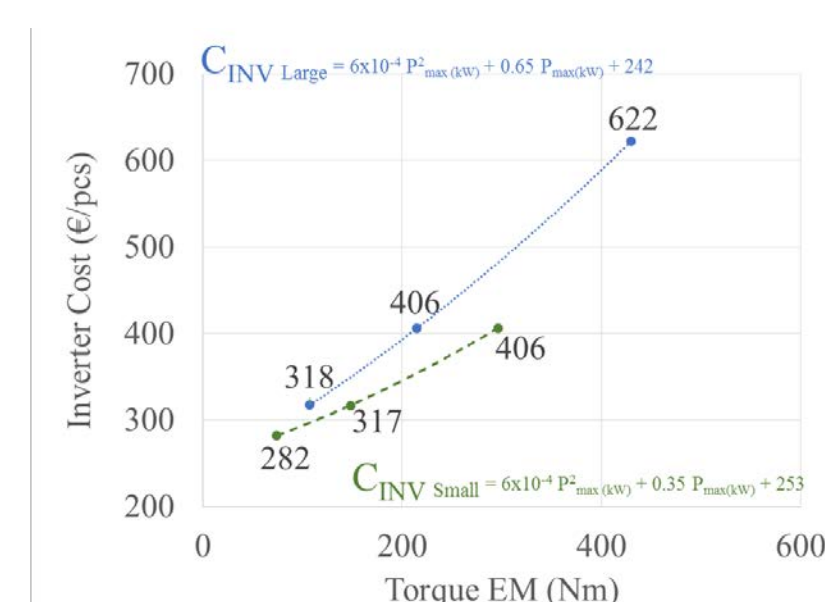
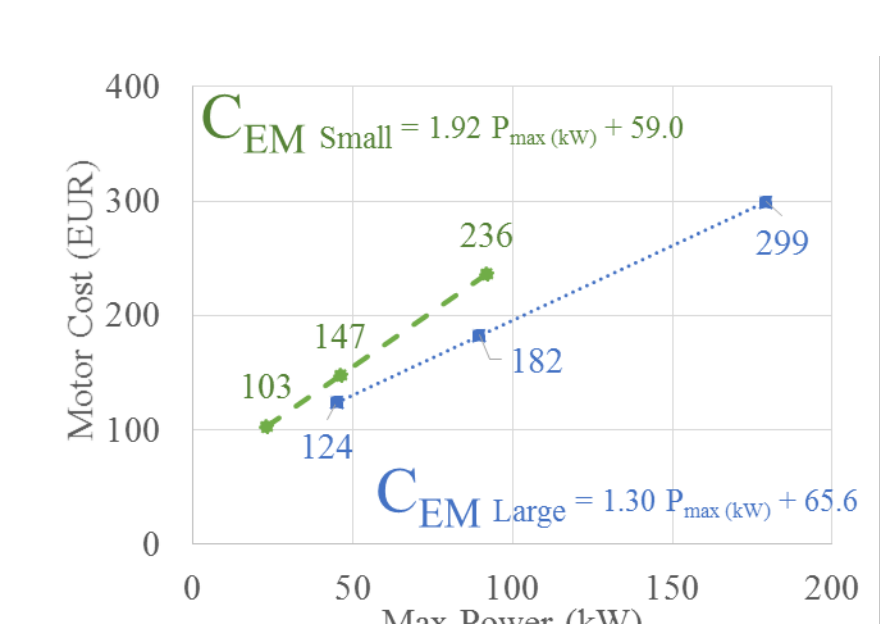
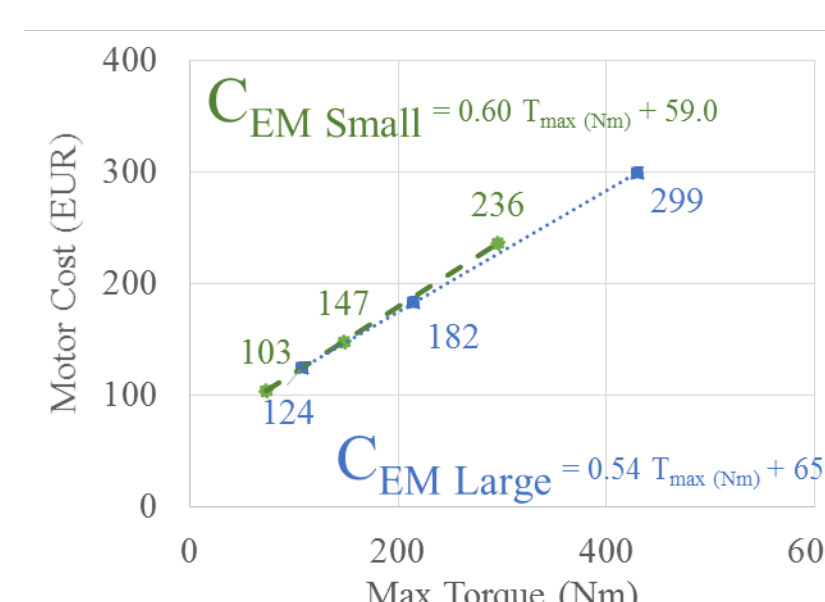
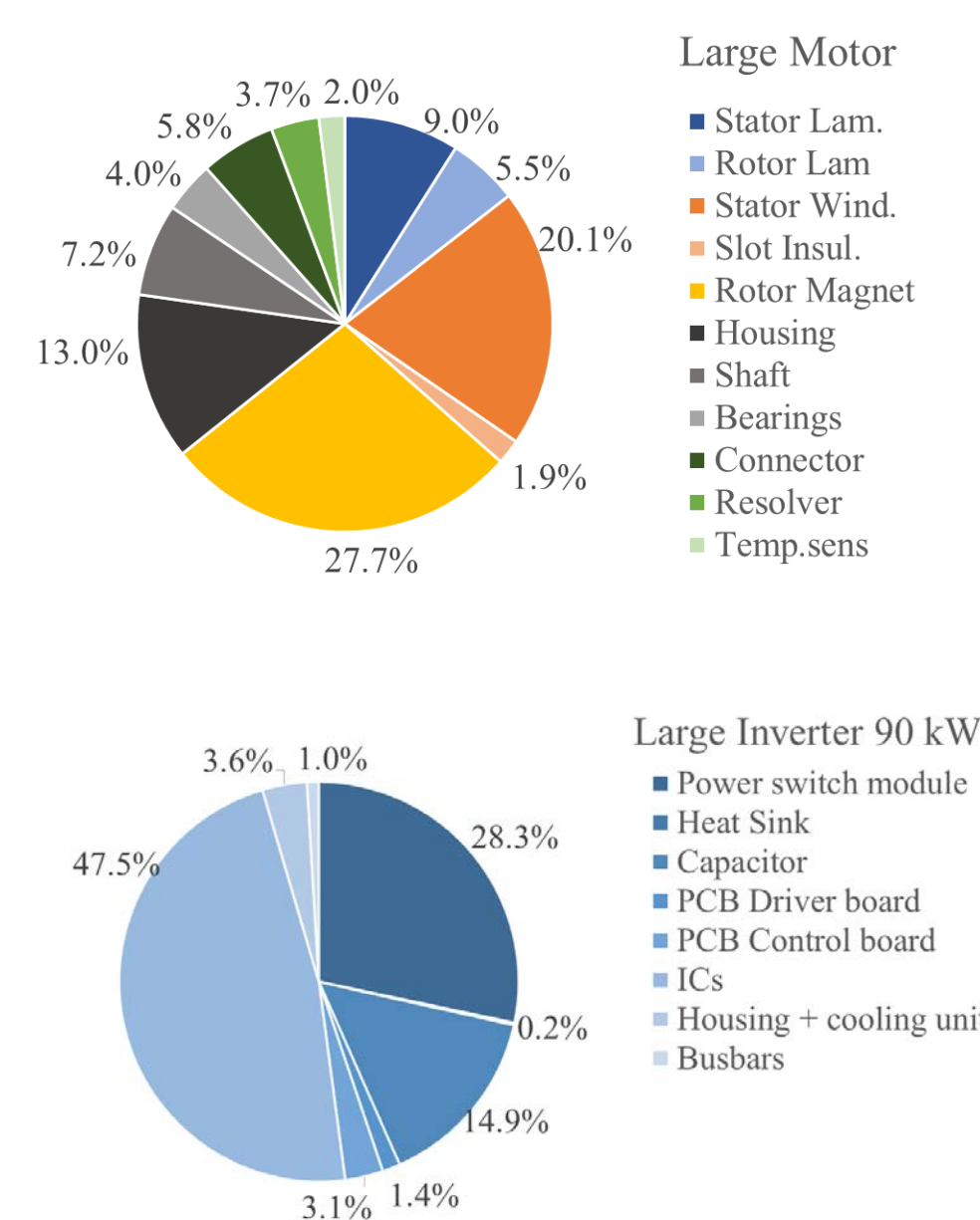
Cost estimation

- Motor subparts

- o Core lamination
- o Winding
- o Magnets (NdFeB)
- o Housing
- o Frame

- Inverter subparts

- o Power module
- o DC-Link capacitor
- o Driver and Controller cards
- o Busbars
- o Housing



Conclusions

- Lowest Wh/km: **96%** for Small car, **97%** for Large Car
- Down-scaling to **70%** is possible and still manage all drive cycles
- Then 0-100 **increase 2 s**
- The cost decrease **10%** for Small system and **15%** for Large