Cost model for future electrified powertrains: cost evaluation on a system level

ECS Simulation Conference

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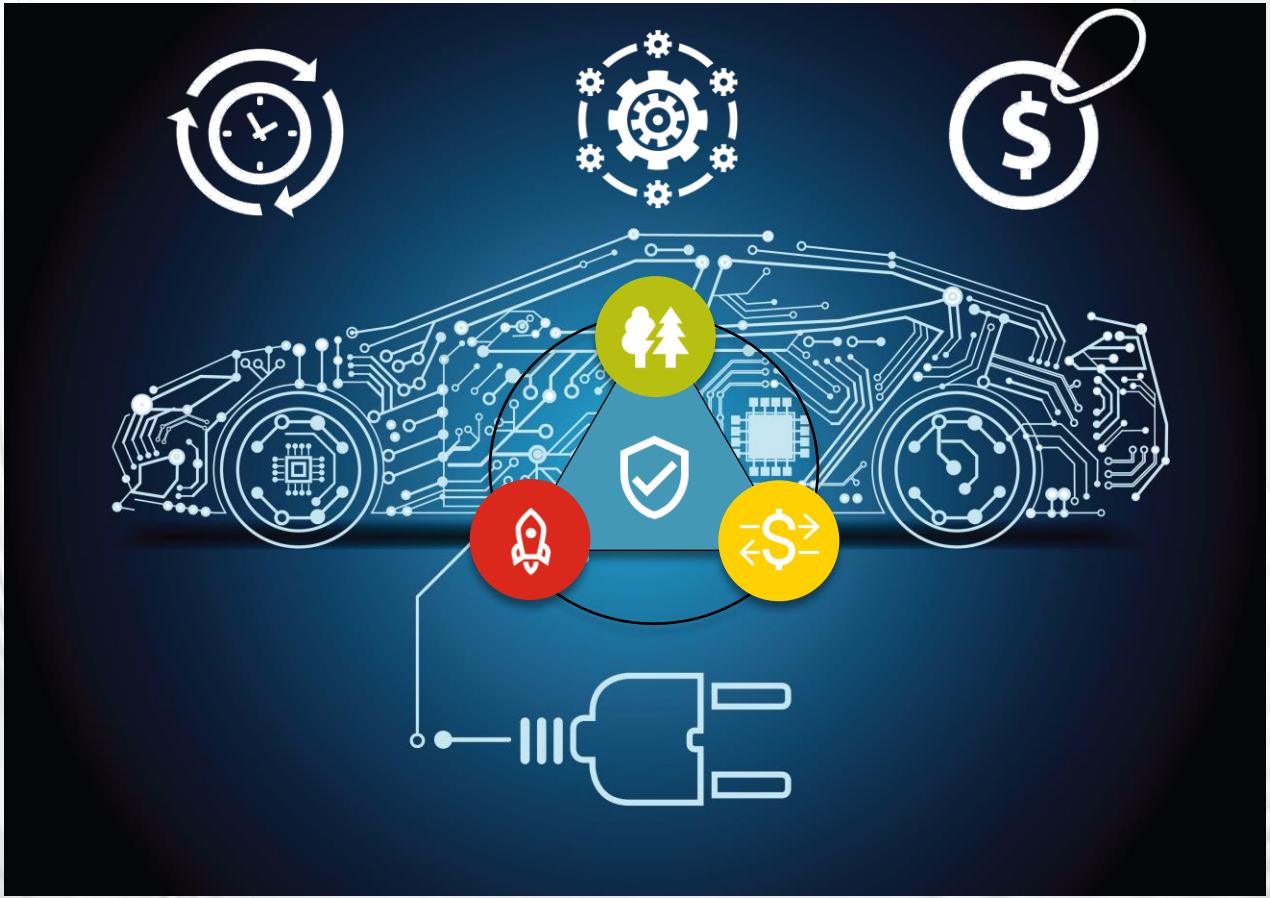
May 2021

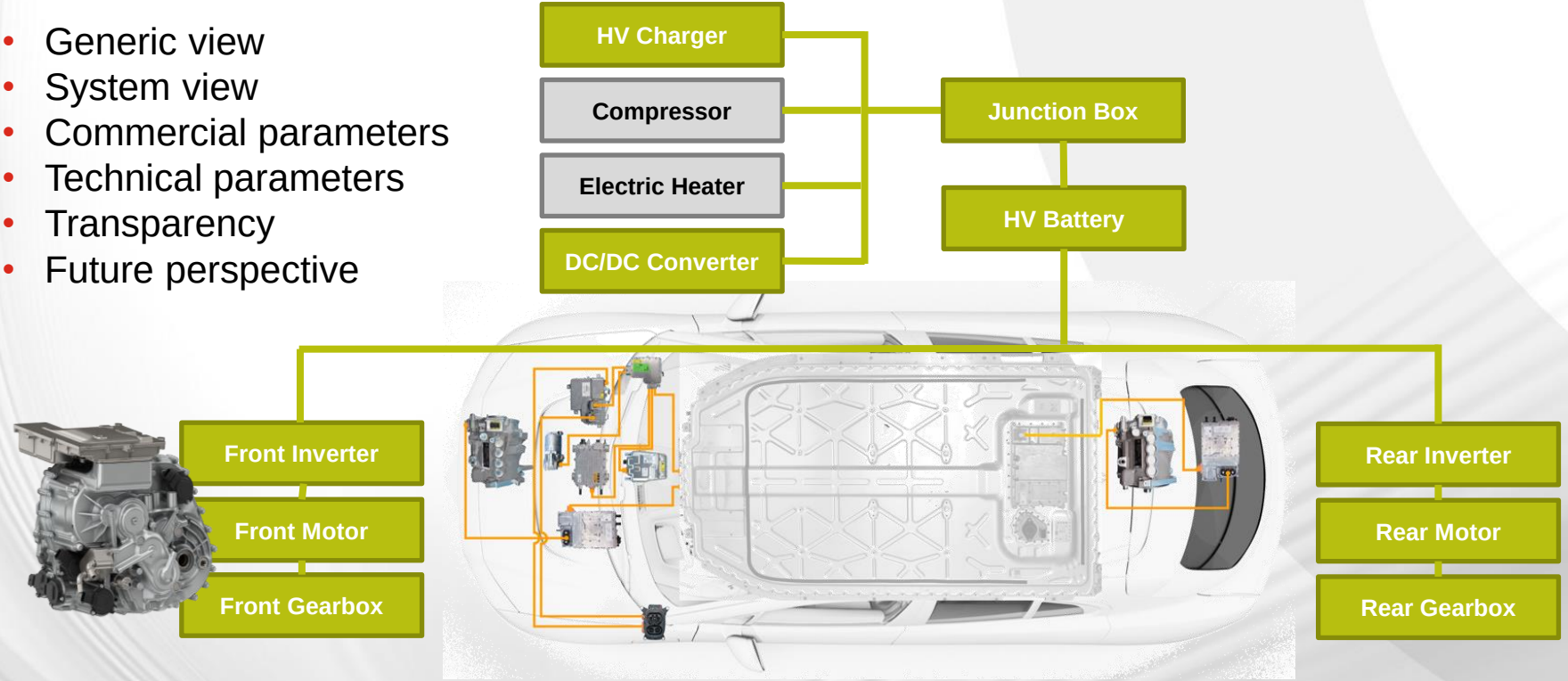
Cost model for future electrified powertrains - Motivation



Cost model for future electrified powertrains - Requirements

xEV Powertrain Cost Model

- Generic view
- System view
- Commercial parameters
- Technical parameters
- Transparency
- Future perspective

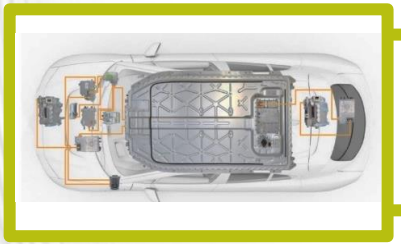


Cost model for future electrified powertrains –
General Approach

Reference costs from external database

Further references, market knowledge & target values from external database

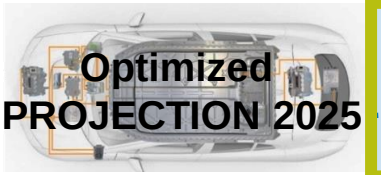
Reference design (as of today): BEV, MHEV, HEV, PHEV



Commercial projection

Technical projection

Reference design as of 2025



Commercial simulation

Technical simulation

xEV Powertrain Cost model 2025-2030

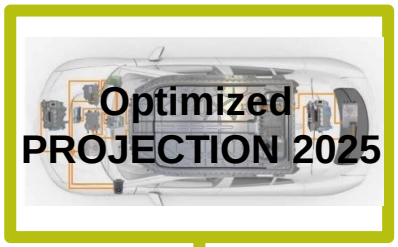
Reference designs from external database

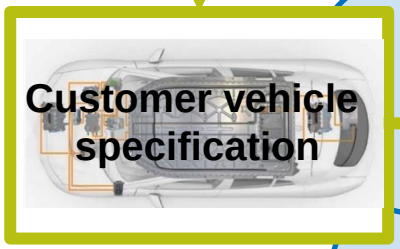
References based on Magna Powertrain Engineering

KULI software
:BY MAGNA POWERTRAIN

Cost model for future electrified powertrains

Thermal eDS capability assessment workflow

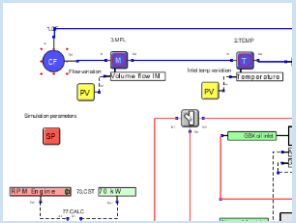




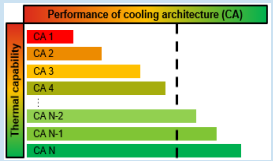
PERFORMANCE

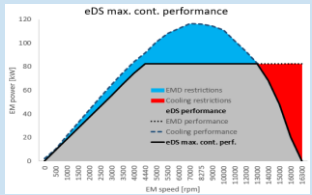
COOLING CIRCUIT

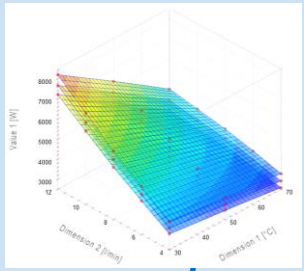
KULI software
BY MAGNA POWERTRAIN



eDS cooling
architectures impact







Resulting eDS
cooling capability

xEV Powertrain
Cost model 2025-2030

COST

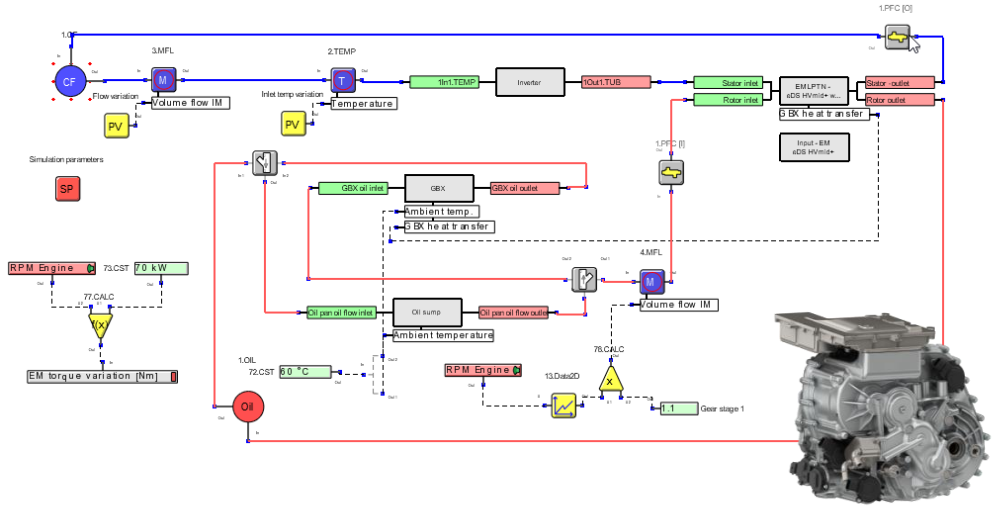
€

Fulfilling
customer eDS
performance
requirements
based on the
most cost-
effective
solution

eDS cooling layout

Cost model for future electrified powertrains

Thermal eDS model implementation



Target of thermal eDS cooling architectures assessment:

Identification of thermal limits relating to performance requirements, resulting in thermal eDS capability in addition to EMD performance to determine holistic eDS performance capability

KULI software
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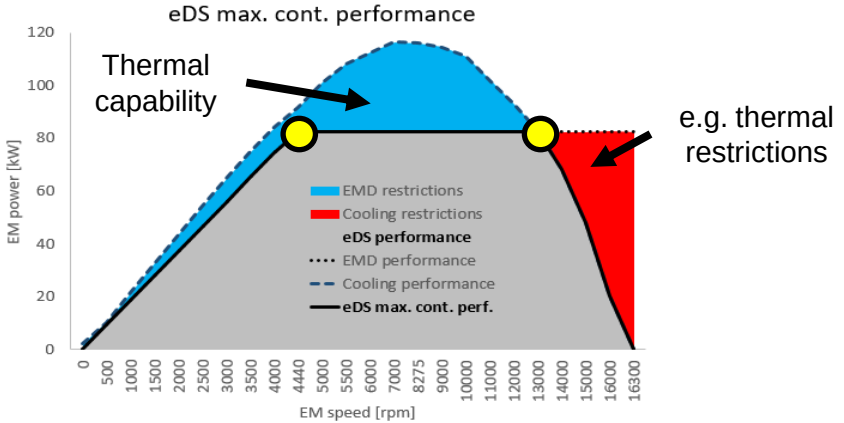
Implementation of eDS cooling architectures based on KULI 1D CFD simulation and determination of thermal eDS capability, based on possible customer requirements:

- eDS power output
- Vehicle interface
- Ambient conditions

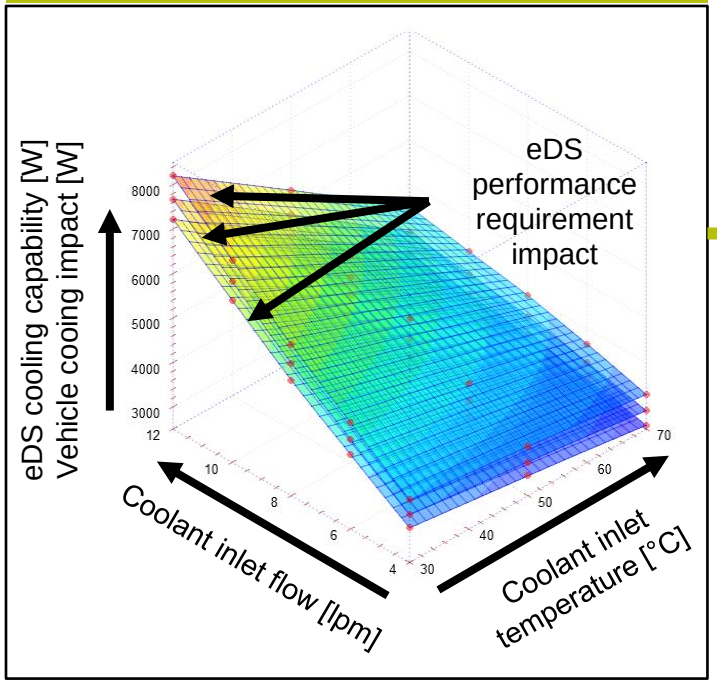


Cost model for future electrified powertrains

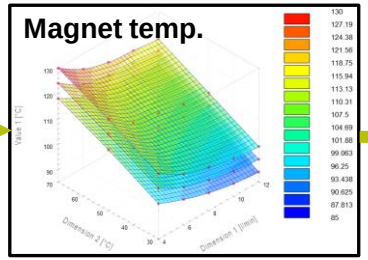
Thermal eDS performance capability based on limiting temperatures

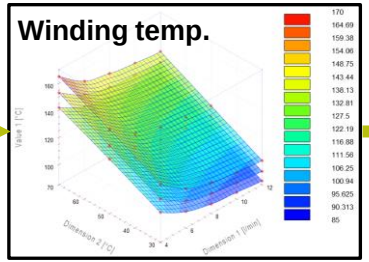
KULI software

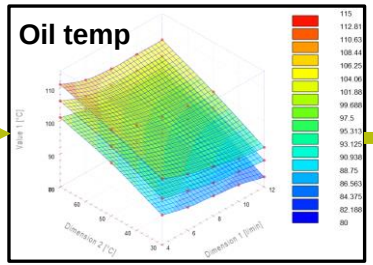
Vehicle impact based on performance requirement according to determined eDS cooling architectures via look-up tables



eDS component temperature

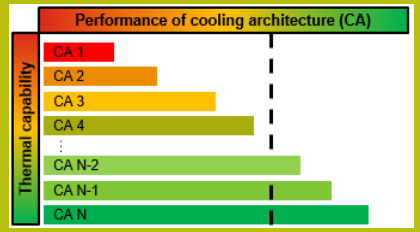






Determination of eDS component temperatures for thermal behavior assessment.

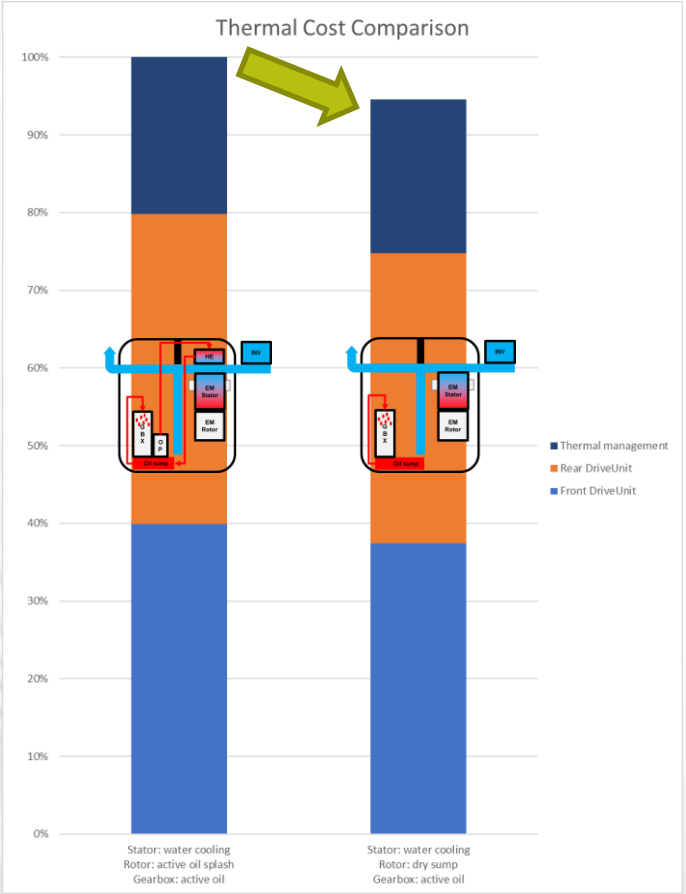
- Magnet temp.
- Winding head temp.
- Oil sump temp.

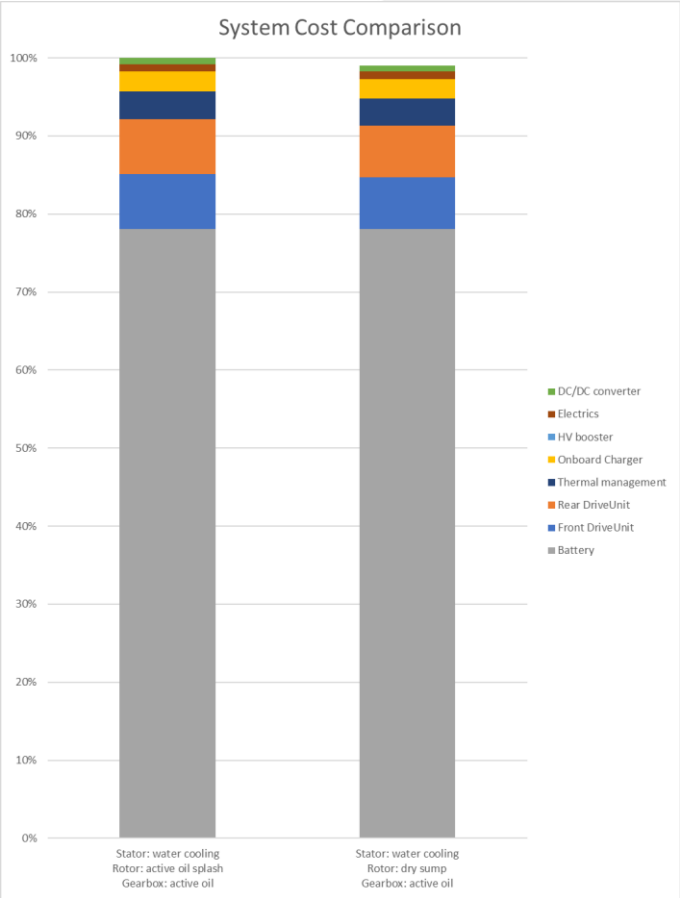


Cost impact

- EM materials
- Winding technology
- Oil cooler design / scaling
- Internal cooling layout
- Oil pump scaling

Cost model for future electrified powertrains –
xEV Powertrain Cost Model Result





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