

Innovations for competitive Electric Vehicles

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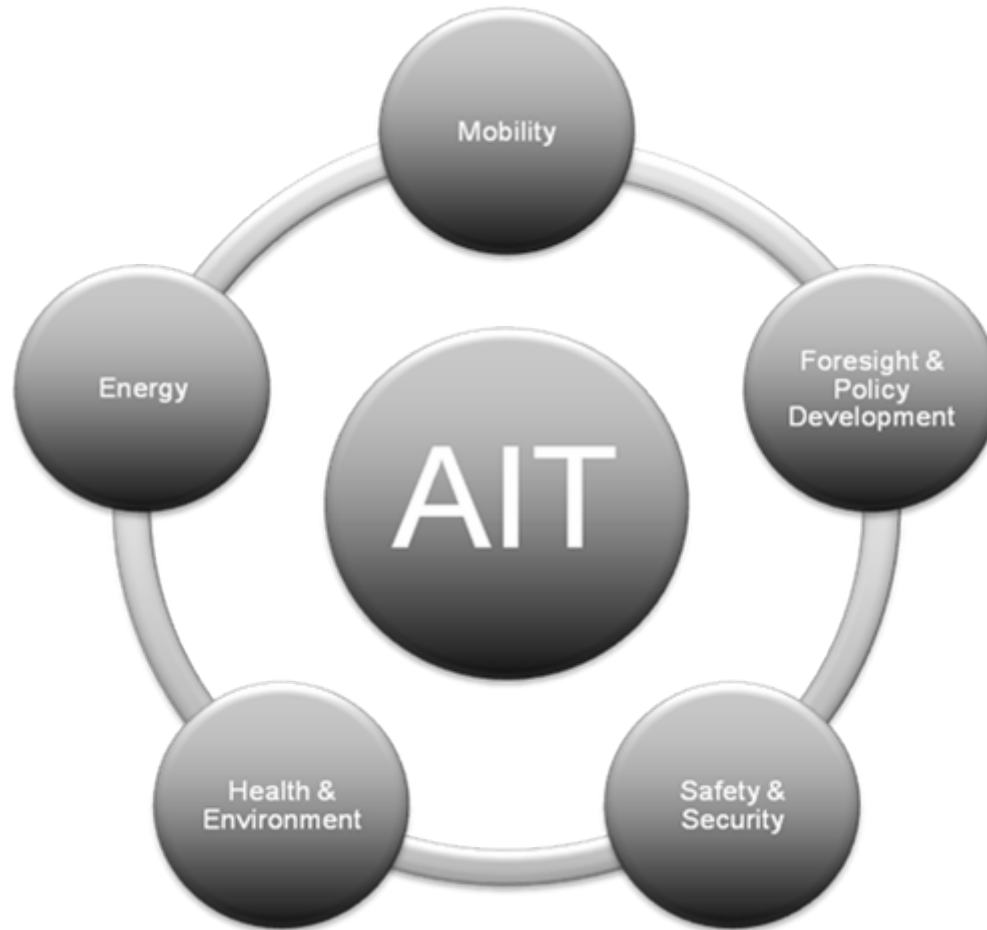
Alternative Propulsion Systems and Energy Carriers

Austrian, European and global R&D- and demonstration projects,
research institutions and funding programs

Outline

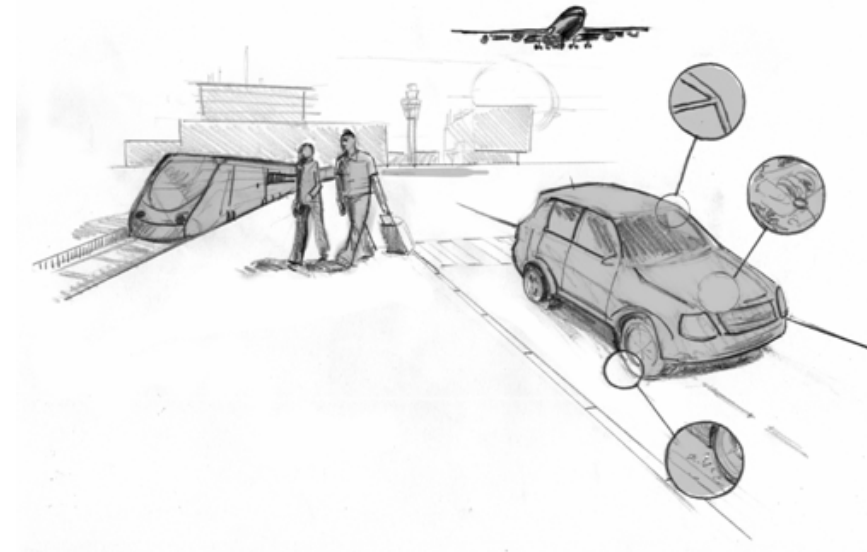
- AIT
- Mobility Department
- Potential e-mobility
- Requirements e-vehicles
- Development process
- Case Study
- Innovation potential

Austrian Institute of Technology (AIT)



General Direction of the Department Mobility

- Challenges – Motivation
 - Climate change
 - Scarce resources
 - Changing societies
- Efficient, safe and green mobility
 - Transportation infrastructures
 - Co-modal transportation systems
 - Future vehicle concepts
- Systemic / integrated approach
 - Simulation
 - Development of models and algorithms
 - Design & prototyping
 - Validation through research infrastructure

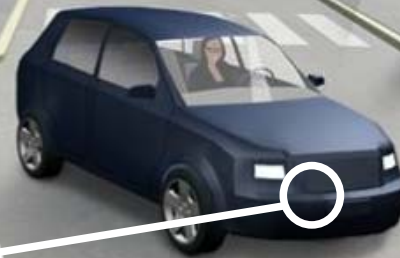
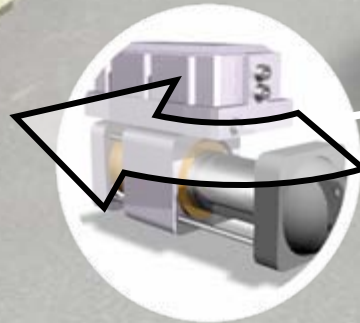


USP Department Mobility

Transportation System



Transportation Infrastructure



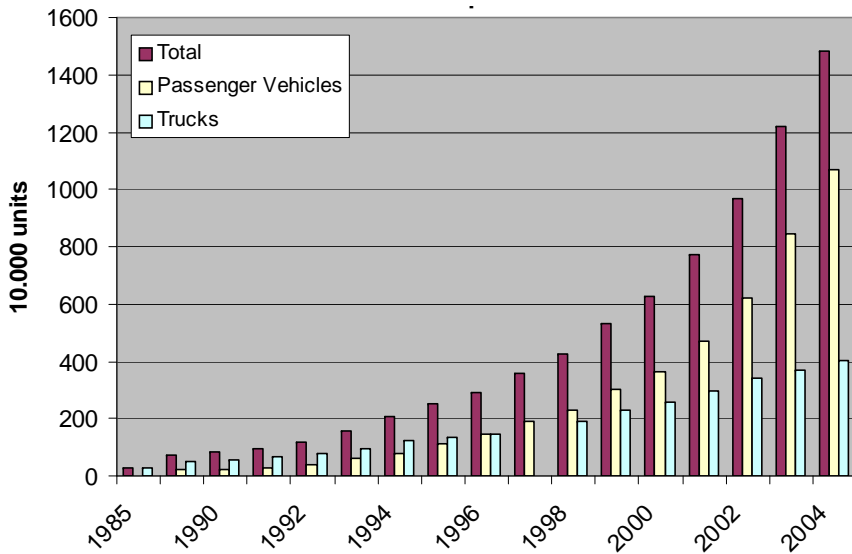
Vehicle

GEORG FLOR 2007

Potential e-mobility

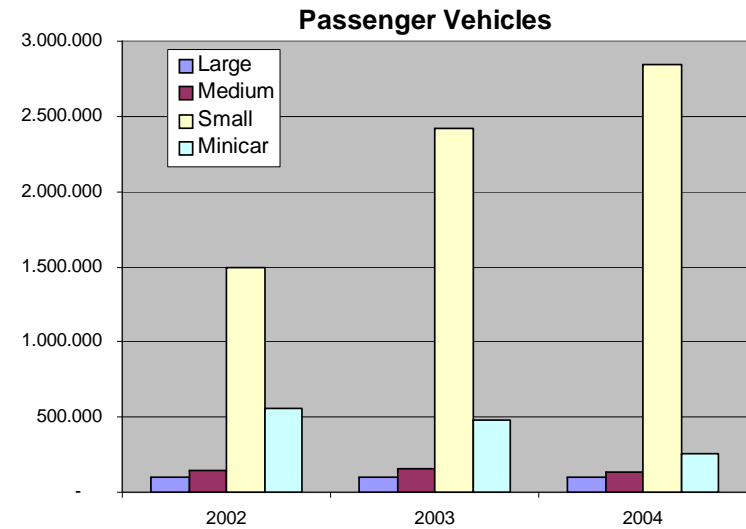
China:

Number of vehicles



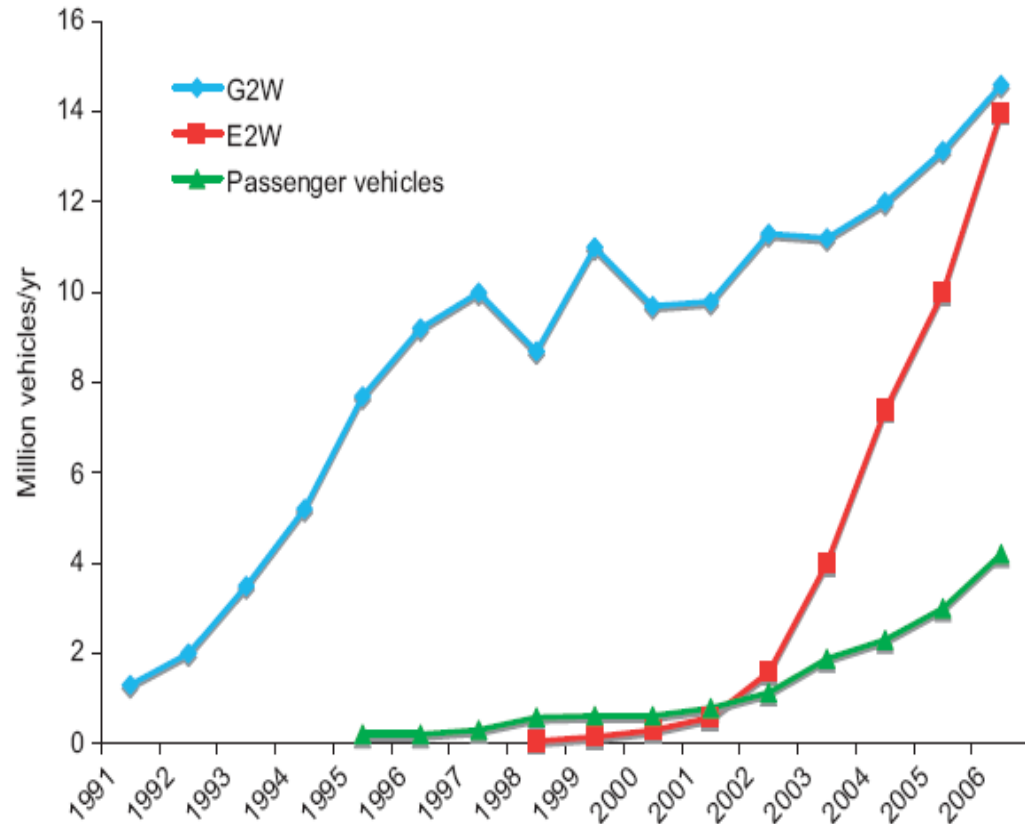
China:

Development of number of registered vehicles



Potential of electric 2-Wheelers in China

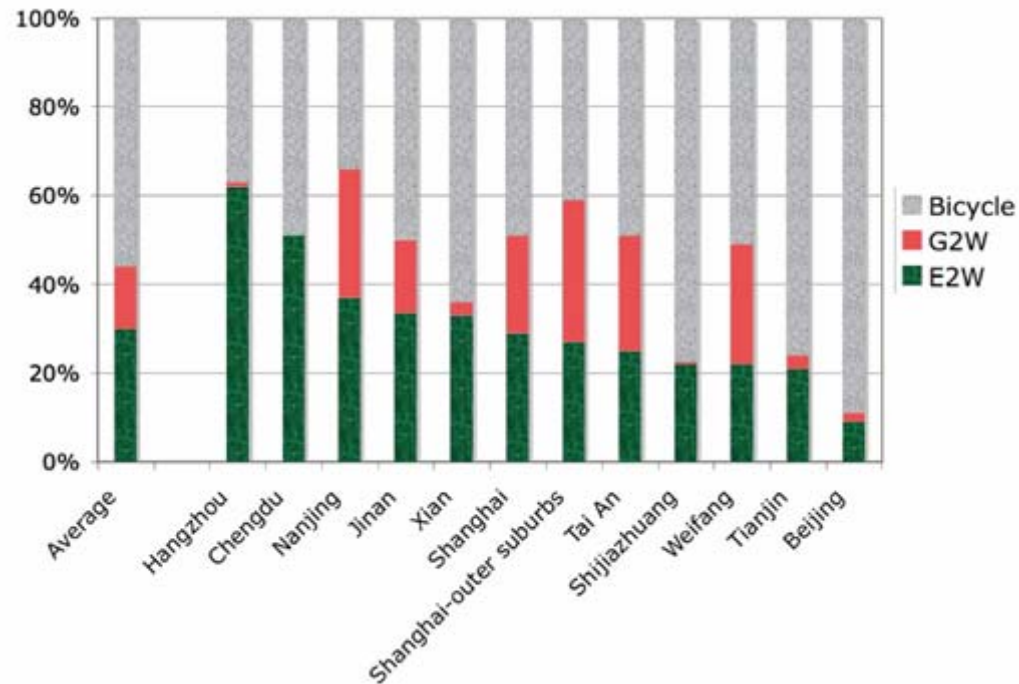
- approx. 80 million motorcycles in 2005
- Sales forecast for China: approx. 30 million E2W in 2010



source: J. Weinert: The future of electric two-wheelers and electric vehicles in China, Energy Policy, 2008, doi:10.1016/j.enpol.2008.03.008

2-Wheeler contingent in cities of China

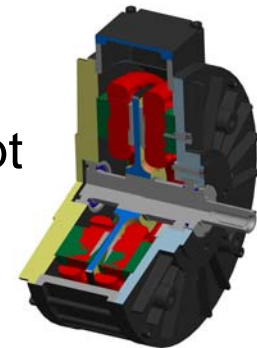
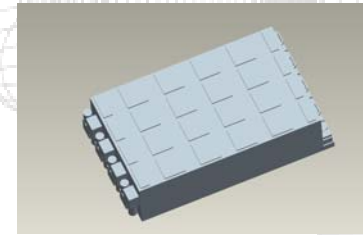
- Present 2-Wheeler traffic in cities
 - E2W approx. 28%
 - Bicycles approx. 57%
 - G2W approx. 15%
- Motorcycle ban in 148 cities in 2006



source: J. Weinert, PhD-thesis, 2007

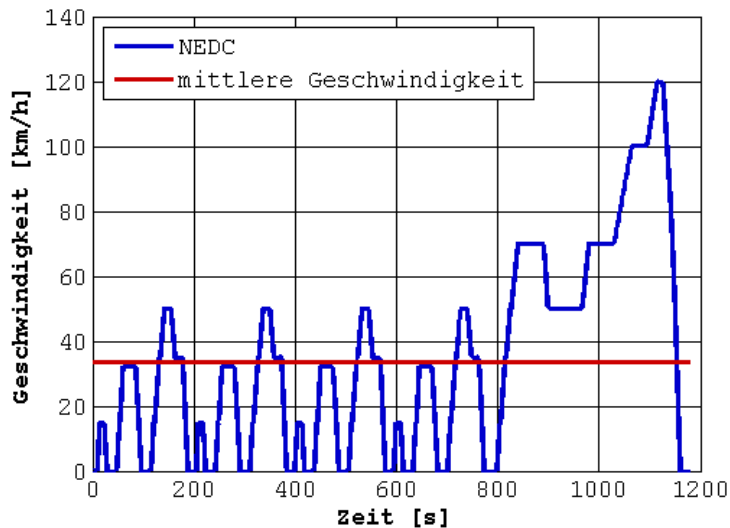
Challenges e-vehicle

- Conventional versus electric drive-train
 - Energy Storage
 - Power Electronics
 - Electric Machine
 - Control
 - Energy Management
- Specification of the vehicle - components
 - Operating Range – Energy Content
 - Performance – Power - Torque
 - Safety – High Voltage Systems – Failsafe Concept
- Consideration of the entire drive train



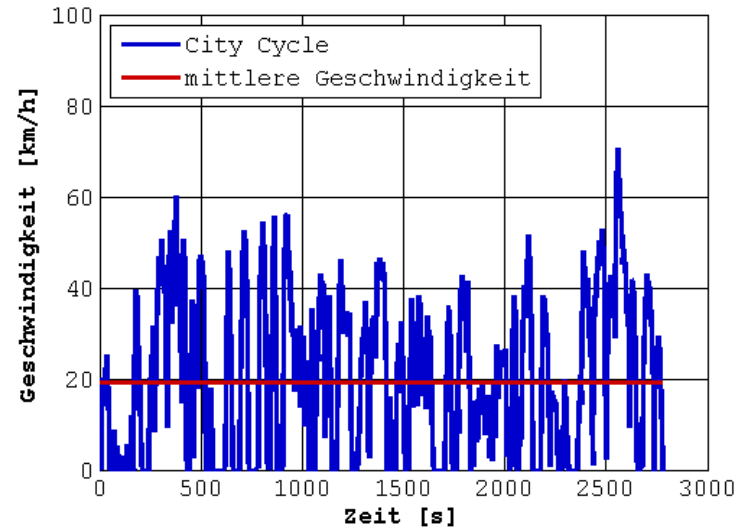
Driving Cycle dependent operating range

NEDC



- length: 11.028,4m
- duration: 1.180s
 - approx. 25% standstill (281s)
 - approx. 75% ride time (899s)
- Average speed
approx. 33,6km/h

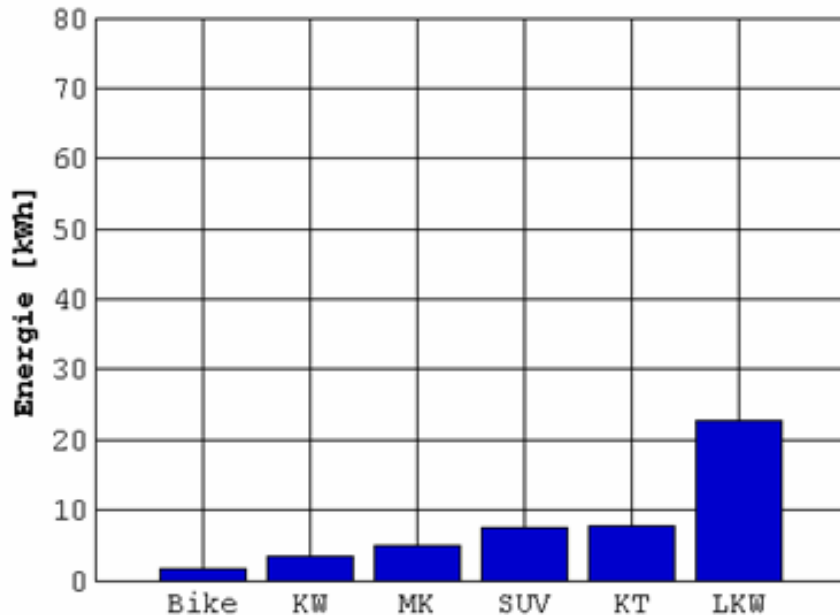
City Cycle



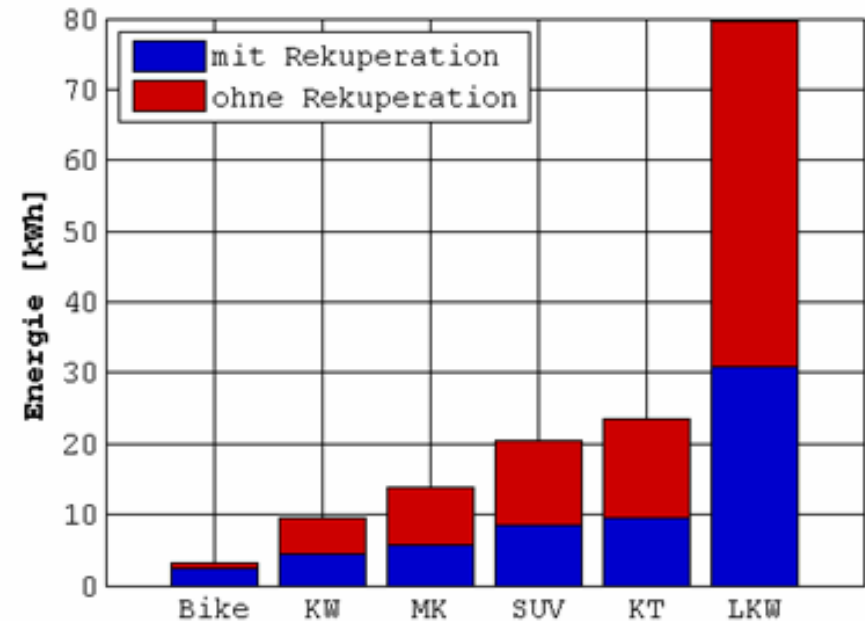
- length : 14.823,1m
- duration : 2.779s
 - approx. 25% standstill (696s)
 - approx. 75% ride time (2.083s)
- Average speed
approx. 19,3km/h

Energy Consumption City Cycle

- 100 km average speed



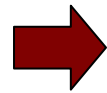
- 100 km driving cycle



Conclusions design e-vehicle

- Energy Consumption mainly depending on
 - Driving cycle
 - vehicle
- Recuperation Potential mainly depending on
 - Driving cycle
 - vehicle

Vehicle design



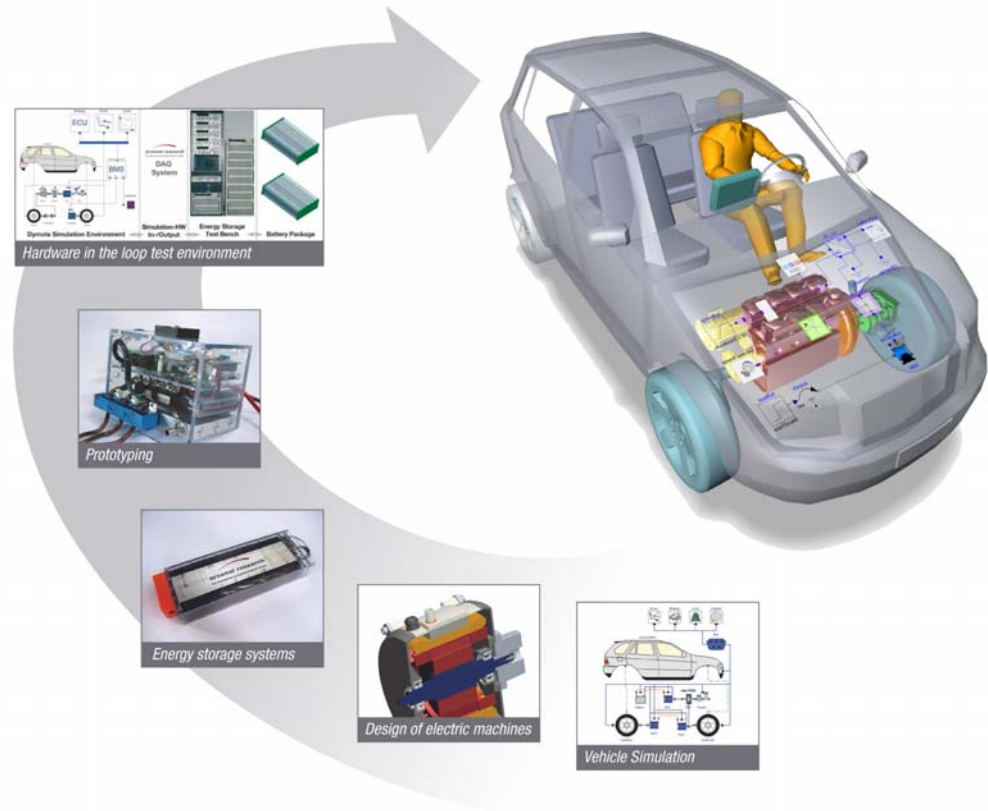
- **Customised car**
- **Customised electric drive**

Vehicle and Component development process

- Validation on components & systems level
- Hardware-in-the-loop (HIL) Simulation of
 - electric drives
 - energy storage systems

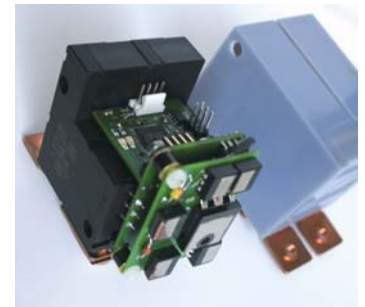
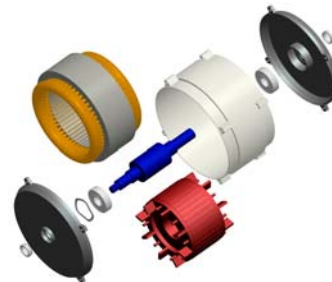
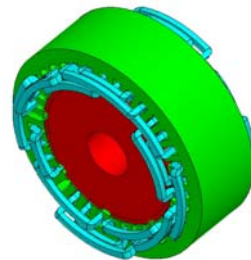
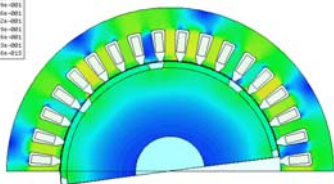
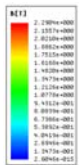
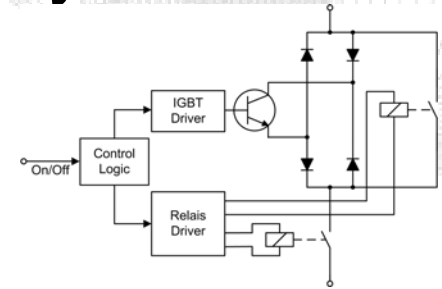
- Design and prototyping of
 - electrical machines
 - embedded control and power electronics
 - energy storage systems incl. management
- Development of diagnostics and monitoring methods

- Longitudinal vehicle simulation for
 - evaluation of vehicle concepts
 - specification of optimised components
- Detailed simulation of electric components



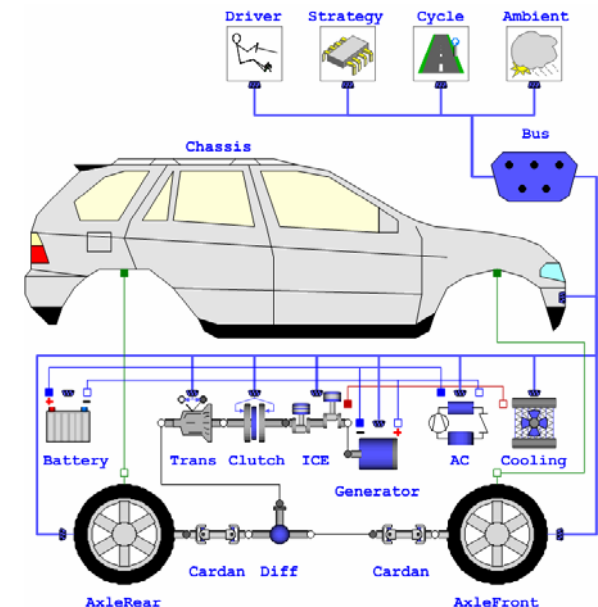
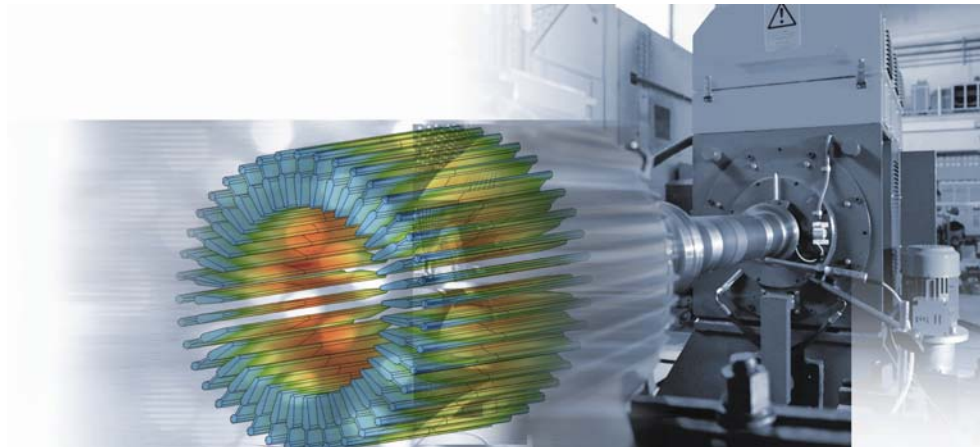
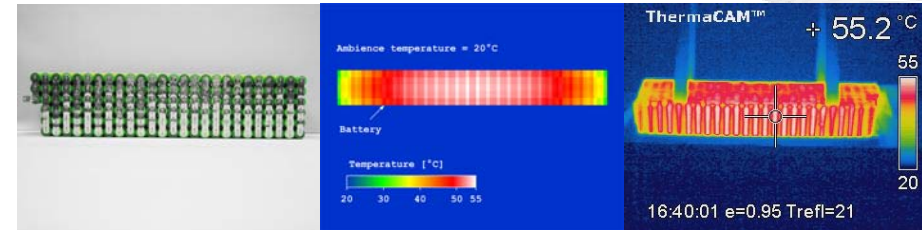
Innovation potential for the industry I

- Electronics
- Power electronics
- Switch-devices and components
- Control / Energy Management
- Electric machine
- Material development



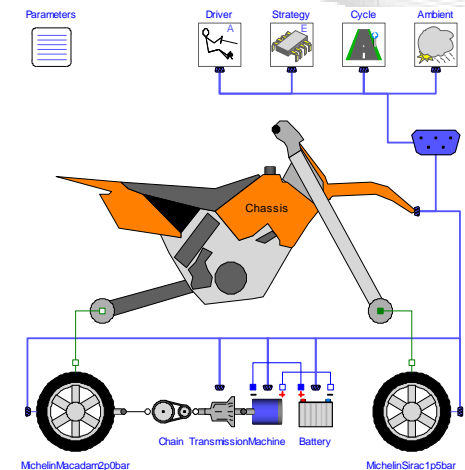
Innovation potential for the industry II

- System Integration
- Development Tools
 - System Simulation
 - HiL-Simulation
 - Rapid prototyping



Case Study: Zero Emission Sport motorcycle

- Challenge: Zero Emission Vehicle
- Objectives for „Ready to race“
 - Highest Power Density
 - Highest Performance
 - Lowest Weight
 - Operating Range / Racing Time
- Virtual Design and Development of a Sport motorcycle



Conclusion

- Novel concepts need novel approaches
- Innovation Potential
 - System Level
 - Components
 - Materials
 - Processes



Thank you for your attention !!!!!

Contact

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