Electromobility and Smart Grid

<table>
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<tr>
<th>Module code</th>
<th>Workload</th>
<th>Credits/CP</th>
<th>Semester</th>
<th>Frequency of module</th>
<th>Duration</th>
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<tr>
<td>FH28933 (PL)</td>
<td>90h</td>
<td>3</td>
<td>3rd onwards</td>
<td>each semester</td>
<td>1 semester</td>
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1. Module: Electromobility and Smart Grid
   - Teaching Language: German
   - Contact hours: 2 SWS / 22.5h
   - Self-study: 67.5h
   - Class size: 20

2. Learning outcomes
   - acquire knowledge of the economic and ecological evaluation of electric vehicles
   - understanding the storage technology for electric vehicles in its mode of operation (Energy conversion ↔ Energy storage!) and the currently possible operating behavior, rough calculations
   - understand and calculate the technical system behaviour of the drive unit (incl. memory) with the associated vehicle (driving resistance curves, power and consumption calculations, ...)
   - be able to carry out profitability calculations and estimate the environmental impact of electric and conventional vehicles, differentiated according to operating conditions, and acquire evaluation competence

Introduction: In their third hype of eMobility, electrically powered vehicles are spreading more and more, albeit below expectations (Angela Merkel's target of 1 million eMobiles in 2020 will probably only be met by about 10%) compared to thermodynamically powered vehicles. The reasons for this are on the one hand the technological progress in development (especially in storage technology) combined with falling production costs, but also the increasing importance of environmental compatibility, which is also being forced by many legislators. For example, the market penetration of e-mobility would suddenly increase if, for example, China were to close its inner cities to "burners".

At this point at the latest, which we cannot plan for, some sectors will suffer severe losses or even collapse; others integrated into eMobility will experience a boom in orders. Therefore, all companies investing in value chains in the conventional passenger car and commercial vehicle sectors that are involved in components that are no longer needed in the eVehicle are well advised to acquire a new competence in the eMobility value chain as soon as possible.

3. Individual component content

1. electric mobility - market situation and market potential, profitability calculation, integration of the battery in smart grid
2. storage tanks and their charging or refuelling Energy and power supply for a relevant electrification in D
   1. lithium battery
      Functional principle, energy and power density, temperature behaviour, charging method
      a. Charging columns (with cable or contactless transformer)
      b. ii. non-contact charging and battery changing stations
   2. fuel cell
      a. Functional principle, energy density, temperature behaviour, electrolysis
      b. PEM cell for operation with hydrogen and air
      c. PEM cell for operation with methanol (via reformer) and air
d. Tank and refuelling
3. power electronics and drive
1. modern inverters (sinus modulation, filter, control, ...)
2. asynchronous and synchronous machine (incl. experimental demonstration in MME actuator laboratory)
3. Comparison Electric Motor Combustion Engine (incl. Thermodynamics Basics)
4. comparison electric drive <=> combustion engine
1. driving resistance calculations and consumption determination of electric vehicle <=> conventional vehicle in different operating modes

4 Teaching methods
Lecture

5 Prerequisites
none

6 Methods of assessment
written exam

7 Applicability of module
Elective subject for Bachelor of Science and Master of Science

8 Person responsible for module/ lecturer
Prof. Dr.-Ing. Franz Aßbeck

9 Reading list (Core texts and recommended texts)

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<td>1.</td>
<td>Dobrinski/Krakau/Vogel:</td>
<td>„Physik für Ingenieure“</td>
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