Executive Master Program
Green Mobility Engineering
Technology + Management
The HECTOR School of Engineering & Management offers seven Executive Master Programs. The HECTOR School – named after Dr. Hans-Werner Hector, one of the co-founders of the software company SAP – is the Technology Business School of the Karlsruhe Institute of Technology (KIT).

The Master Programs are more than typical MBA programs, because they combine management with engineering topics. The primary goal is to enable professionals to take a holistic approach when managing highly interdependent processes and to be aware of the latest state of technology in the respected field of expertise.

All programs share five Management Modules, providing the participants with general leadership know how for engineers: knowledge in Finance, Accounting, Marketing, Business Strategy, International Project Management and Intellectual Property Rights. On this basis they can consider commercial implications of business decisions. Workshops and case studies allow ample opportunity to explore the direct application of the know-how, simulating the real business environment.

Essential part of the HECTOR School is the part-time philosophy of its Master Programs. Intermittend periods of lectures are scheduled to allow participants to continue with demanding careers while acquiring new skills & knowledge.
Graduates of Green Mobility Engineering (GME) are able to meet the requirements of future mobility systems regarding the conservation of natural resources and environment protection as well as social acceptance, and to drive the re-orientation regarding energy and utilization efficiency, zero emission level, neutral CO$_2$-balance, safety, comfort and affordability. Therewith they supplement and replace existing technologies.

For this purpose, they acquire an extensive and structured system-knowledge, divided into the subsystems automotive (with its components, functional elements and materials), driver, traffic, infrastructure, markets and society. They are capable to analyze complex systems by taking relevant interdependencies between subsystems and level of details into account and deriving approaches for sustainable mobility and automotive concepts. Methods and processes needed for an efficient development of technical, economical and in the market successful and innovative solutions are familiar to the graduates. Moreover they are capable to reduce complexity by means of innovative problem solution methods and further creativity approaches.

For that, they will attain knowledge, skills, capabilities and competences in the fields of energy efficient combustion machines, regenerative fuels, energy sources and storages, safe and efficient propulsion systems, efficient use of available energy in the car, lightweight design, control and regulation concepts, architectures and technologies, E-Engines, power electronics, embedded electronic systems, sensor data processing, production systems for electro mobility, drivability, models of human behavior, noise and vibration comfort, advanced driver assistance systems, car-to-car and car-to-infrastructure communication systems, automated perception of environment by cars, autonomous vehicles, mobility supply and demand, holistic CO$_2$-balance and smart supply of energy.

Join us to acquire the tools that will guide your career path in this exciting area!
As an introduction of the master program, its first module provides a review about the requirements, approaches, and challenges of sustainable future mobility systems. Those are given by social, environmental, economic, political, and user needs. They foster the creation of new solutions on different levels: traffic, energy, and data infrastructure, traffic, mobility behavior, driver vehicle interaction, vehicle, vehicle subsystems and components, functional elements and new materials. New vehicle and traffic concepts are based on that.

The module then refers to drive systems and their interaction, describes energy carrier, and energy storage starting with alternative fuels and modern internal combustion engines followed by storage systems for electrical drive systems. The lecture ‘Energy conversion’ presents conventional and new power train systems. The module also covers the transmission from the wheel to the road and is concluded by today’s advanced control systems.

Modern vehicles are becoming more and more intelligent. Sensors and cognitive control units detect and communicate with the environment, recognize other vehicles and other road users, interpret and predict their behavior and improve dramatically road safety. Based on detailed road, infrastructure and traffic data and using predictive green routing and vehicle operation management a comfortable, energy and time efficient drive is realized.

Many components of actual and future cars are coming along with properties which differ significantly from those in classical vehicles as high torque at zero speed, limited cruising range, need for additional battery charging infrastructure and cost accounting systems, high voltage safety requirements, different noise and vibration, autonomous actions etc. Consequently new vehicle concepts and operation strategies are needed which also affects the human machine interaction. In the vehicle many control units has massively increased.
units are used. The most important control system in the car is the driver. Understanding its sensation, cognition and action is very important to create attractive vehicle concepts and to get the driver’s acceptance.

This module addresses different aspects of the driver vehicle interaction. The drivability deals with the usability of a vehicle by the driver including ease of use, fulfillment of driver’s expectations concerning safe, comfortable and efficient drive, degree of complexity of the driver vehicle interface, predictability of vehicle’s action and reaction and others. Many different methods to evaluate the driver needs, benefits and acceptance exist and will be presented in this module.

**Vehicle Traffic Interaction**

This module extends the scope of green mobility to the perspective of multiple cars interacting on the road and with traffic-related infrastructure. Cars will become able to perceive their environment and react autonomously to reduce the risk of accidents, to improve driving efficiency and comfort. Autonomous driving has the potential to improve traffic flow, reduce traffic congestions and save energy. Enhanced traffic management systems will increase the ability of the driver to interact with the car and the surrounding traffic.

This module introduces technologies for vehicle perception based on lidar, radar and visual camera sensors. The interpretation of the sensor signals to obtain a consistent model of the environment is demonstrated. Latest developments of car-to-x-communication systems are presented and improvements in safety and traffic flow are discussed. Finally, models of traffic flow and traffic management are introduced. Traffic demand modeling as a core concept for modern traffic management is included in this module.

**Regulations & Economics of Networks**

Developing future “Green Mobility” products requires advanced technologies and production systems as well as an understanding of demand and supply in transportation markets. Those factors are boundary conditions for the successful implementation of future mobility systems.

This module introduces lightweight strategies and methods of manufacturing as well as production systems for e-mobility. Key aspects of electric energy distribution systems and management are addressed. Students are enabled to evaluate vehicle concepts based on total cost of ownership and well-to-wheel CO₂-emission scenarios. Transportation markets and their specific mechanisms, trends in travelling demand and economy as well as political regulations are further topics. Students are enabled to analyze market opportunities for future projects.

**Overview Engineering Modules (EM)**

**EM 1: ICE, Power Train & Energy Storage**
Courses: Introduction into requirements, solutions and challenges in green mobility • Advanced Green Combustion Engines/ Bio Fuels • Energy-Storage: Batteries, Fuel Cells, H₂ • Energy Output • Energy Conversion • Automotive Control Systems

**EM 2: Electric Power Train**
Courses: Selected topics of Electrical Engineering • Electro Engines • Power Electronics • Energy Conversion • Automotive Control Systems

**EM 3: Vehicle Driver Interaction**
Courses: Drivability • Noise, Vibration & Harshness (NVH) • Driver Assistant Systems • Technical Cognitive Systems • Human Factors Engineering

**EM 4: Vehicle Traffic Interaction**
Courses: Perception of Environment • Auto-Control Systems • Traffic Engineering & Control • Automotive Radar Technology • Car-to-X Communication Systems

**EM 5: Success Factors of Green Mobility**
Courses: Light-Weight Construction and High-Performance Fiber • Production Systems for e-Mobility • Energy Distribution • CO₂-Balances: well to wheel • Transportation Markets and Policy
The aim of the 5 Management Modules (MM) is to provide profound knowledge and understanding of the fundamental concepts which are essential for every successful manager.

International Project Management (MM1)

International Project Management is a key to the world of business. Participants will get familiar with objectives of project management and scheduling, analysing planned projects and controlling project execution. Particular attention is paid to the construction of project networks and Gantt charts, heuristic solution procedures and rescheduling. Modelling, planning and scheduling, which arise in a great variety of practical situations, are also emphasized.

Finance for Executives (MM2)

Finance for Executives provides participants with an understanding of the key financial statements and its underlying accounting principles. The course gives an overview of investment rules and financial decisions.

Business Strategy, Marketing & Controlling (MM3)

This module comprises three important challenges in companies, Business Strategy, Marketing and Controlling. Particular emphasis is placed upon the process of strategic management containing strategic analysis, formulation and evaluation based on competitive advantage, and portfolio strategy. In addition to these concepts approaches of modern marketing that show a strong reference to business strategy are presented.

Human Resource Management (MM4)

Human Resource Management addresses challenges head on, exploring the key elements of innovation, creativity and leadership as well as the steps necessary to implement and manage it successfully. This multidisciplinary module provides valuable experience in implementing the techniques needed to ensure the company’s continuing success.

Law & Contracts (MM5)

This module comprises both economics and legal sections. In the economics section, a groundwork is laid through introducing decision theory, expected utility, risk and ambiguity, bargaining and basic incentive theory. In addition, fundamental problems regarding world economics are discussed, e.g. stagnation and economic growth, unemployment and international division of labor, and harmonization of the international monetary system. The legal section is divided into lectures about the law of business organizations about international patent, trademark and copyright law.

Overview Management Modules (MM)

MM 1: International Project Management
   Courses: Project Management & Scheduling, Multi-Project Management in an International Setting, Development Management, Intercultural Management

MM 2: Finance for Executives
   Courses: Introduction, Financial Accounting, Fundamentals of Finance

MM 3: Business Strategy, Marketing and Controlling
   Courses: Business Strategy, Introduction to Management Accounting, Marketing

MM 4: Human Resource Management
   Courses: Human Resource Management, Leadership & Conflict Management, Management Training

MM 5: Law & Contracts
The academic calendar for the next program starting on October 5, 2015 consists of 10 intensive modules, each with a duration of 10 days. At the end, the Master Program concludes with a Master Thesis.

The Master Thesis is set up as a project work in the company, starting after the successful completion of at least nine modules according to the personal study plan.