EVS30 Symposium
Stuttgart, Germany, October 9 - 11, 2017

Education about energy and mobility transition from TU Berlin and business partners about German Energiewende with electric vehicles

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Executive Summary

On the 55.000 square meters EUREF-Campus area in Berlin-Schöneberg, universities and companies work together to develop and test new energy technologies for energy and mobility transition to a sustainable future. Renewable energies, storage devices, electric vehicles and a micro smart grid are managed to reach 100% renewable energies for electricity and heat on the campus.

1-2 day Workshops are developed for different branches to disseminate the knowledge acquired on this new real world laboratory.

A 3-semester master seminar has been developed under the title: “Sustainable Mobility Management”

Keywords: education, renewable energies, demonstration project, mobility, training

1. Description of EUREF-Campus

At EUREF-Campus (EUREF-European Energy Research Centre), a 55.000 square meter area in the centre of Berlin/Germany, a group of universities and economy of 35 partners as Schneider electric to small and medium enterprises and Start-Ups is developing 1-2-day seminars to educate people from different business branches about the transition to sustainable energy and mobility systems, the so called “German Energiewende”. In this place, energy and mobility transition will be developed together, especially as mobility transition not only means changing the driving system of the vehicle.

The workshops will take place on the EUREF-Areal, so the technologies already on place will be part of the education: e.g. buildings with platinum LEED-certification, electricity from renewable sources, storage batteries (lead and lithium), heat from combined heat and power with biogas, electric vehicles and scooters in car sharing, organised by a micro smart grid.

The reached sustainability level on EUREF-Campus is already today on the goal level planned by German government for the year 2050, as the heat demand of the area is covered by a CHP-biogas device.

On this area with the old gasometer (large gas storage facility), a sign for old fossil fuel economy, new, fuel efficient technologies and renewable energies rise.

With these new seminars the “Mobility2Grid-research consortium” makes available the knowledge of thousands of research hours from different topics related to renewable energies, sustainable mobility, and smart grids.

Figure 1: Old Gasometer Berlin-Schöneberg

The old gasometer today is a famous event location for several hundred guests.

Lunches and catering can be organised by one of the four restaurants: “Café im Wasserturm”, “Schmiede”, “Bamboo (Asian)” or “Werkstatt”.

Figure 2: Map of EUREF-Campus at Berlin-Schöneberg

2. Description of 1-2 day workshops

The 1 to 2 day seminars can consist of 3-6 of the following 6 modules:

Module 1 “mobility-to-grid basics” is describing the EUREF-Campus with its different elements as renewable energy systems, storage devices, electric vehicles and a micro smart grid. Part is a walk through the area and an explaining simulation at a screen table in the zeeMobase (zero emission mobility showroom).

Module 2 is about renewable energies and smart grids. The different energy technologies as solar, wind or biomass are explained. New and conventional storage methods are described. The practical part will be the measurement and documentation of the energy input of one whole day with a photovoltaic solar system.

Module 3 “batteries” describes different actual and future storage concepts with a focus on lithium batteries. As well experience with conventional battery systems and new battery-technologies will be introduced. Especially the difference between power and energy will be explained and the different storage technologies will be discussed in a “Ragone-diagram”. The practical part is the complete charge of an automotive lithium-battery-system with a battery-management-system from the 230 volt electric grid (AC).

Module 4, “electric vehicles” is explaining the components of an electric drive system as motors, motor-controllers, DC/DC-device and on board chargers. A market overview of different vehicle categories from bicycles to trucks and buses is another part of the module. The practical part is assembling the electric drive system of a 1:10 RC electric vehicle and a test ride on the EUREF-Campus.

Module 5 “energy and charging infrastructure” describes infrastructure as the energy grid, charging stations, connectors, fast charging stations as CCS, CHAdeMO or Tesla. Practical part is the feeding into the grid of electric energy from an automotive lithium battery with a solar sinus-wave inverter.

Module 6 is about “innovative business models” for electric mobility and vehicle-to-grid.

Figure 3: RC-Car for educational purpose

The 1-2 day seminars can consist of the basics “module1” and 2 to 5 other modules with duration from 1.5 (without practical part) to 4 hours (including practical part).

Groups can be up to 10 participants.

The seminars are actually only available in German language; an English version may be developed later.

In 2017 three seminars are scheduled, 2 already have taken place on EUREF-Campus area.

Up to now, 3 seminars per year will be free of charge for the participants.

3 Master “Sustainable Mobility Management”

From October 2017 a new 3 semester master degree seminar is offered at EUREF-area.

Introduction

The MBA in Sustainable Mobility Management targets transport engineers, transport and mobility experts, planners, architects, and sustainability project managers who want to gain in-depth, special knowledge in the field of sustainable mobility management.

Authorities, companies and other agencies engaged in transport and mobility need nowadays to rethink their strategies. Each urban area faces its own specific set of challenges: congestion, emissions, safety, accessibility and economic implications are only some factors that account for the mobility situation that inhabitants experience. This implies an increased need for broadly educated, skilled managers, capable of framing those issues with social shifts, new technologies and innovative business models.

The TU Berlin's master program in “Sustainable Mobility Management” closes the educational gap in this field and prepares students for leadership positions by training people who can deliver cutting-edge and sustainable mobility solutions. The master program is intended for an international and diverse audience: Learning and studying in small groups of up to 30 students means excellent and tailored learning conditions.

The academic directors are Professors Dr. Hans-Liudger Dienel and Prof. Dr. Andreas Knie. The academic coordinator is Dr. Massimo Moraglio.

Programme Content

The growing environmental impact of transport systems, as well as their energy voracity, require new approaches and new concepts. This MBA offers an integrative design across disciplines, addressing a range of different perspectives. The theory and practice-driven approach gives students both a conceptual understanding and the skills needed to tackle practical problems, covering the needs of strategy development, analysis and implementation, complex decision making and project management.

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Graduates will be able to plan and to manage complex projects in the transport and mobility fields. The program provides the knowledge and skills for assessing projects from social, sustainability and economic perspectives and for creatively, in teams or independently, finding solutions that consider the varying stakeholders’ interests. Graduates will either be able to enter the labour market (private and public sector) or continue with postgraduate studies.

Students who are the future mobility experts learn in a close cooperation with leading enterprises and institutions located on the EUREF-Campus to become acquainted also with practical projects in the field of energy, infrastructure and mobility.

The lecturers are experts from universities, European and national authorities, and international and national transport companies.

Modules

The master program is taught over a period of three semesters. The first two semesters include lectures, tutorials, seminars and excursions. The program will be completed in the 3rd semester by writing and defending a master thesis.

The first semester is dedicated to the fundamentals of mobility and sustainability, considering these issues from different perspectives such as economic factors, social and managerial elements, and naturally including technological drivers.

In the second semester, trends and the future of transport as well as the transition toward sustainable mobility will be the main focuses, which encompasses also the issue of governance and management of complex structures. A lecture series will provide world-based case studies.

The third semester is devoted to the Master Thesis.

Elective courses for specialization are offered.

Project Management (in Mobility) (9 ECTS)

At the end of this module, students will recognise the basics of strategic management and management methods concerning today's challenges in transport and mobility. Students will be able to develop managerial solutions, tackle issues related to a transition toward sustainable mobility and to implement appropriate solutions.

Mobility Actors and Practices (9 ECTS)

At the end of this module, students will comprehend the fundamentals of mobility concepts and approaches, transport systems, and theories in sustainable mobility. The focus is to recognise mobility as a socio-technical system.

Students will deal with and manage the social/economic/technological tensions and critical points emerging in the implementation of the transition toward sustainable mobility.

Technological Foundations in Transport (9 ECTS)

At the end of this module, students will diagnose several elements relevant to transport engineering and operations, including but not limited to analysis of the energy source, propulsion, efficiency, as well as multiple, sometime opposing, motivations of transport managements. They will also have an understanding of road design, including main and urban access roads. Students will utilize such knowledge to implement and plan according to technical potentials and limitations, as well as evaluate its relevance in addressing sustainability.

Macro-Economics and Business Models of Sustainable Mobility (9 ECTS)

At the end of this module, students will understand and classify the fundamentals of financial tools and business practice to achieve sustainable mobility. Students will develop and plan current and innovative economic and financial issues surrounding transport investment and evaluate traditional and innovative business models.

Mobility Trends and Futures (9 ECTS)

Students will understand mobility trends, in order to ultimately tackle the future complexities of open and interconnected transport. Students will be able to assess societal and technological shifts and changes, gaining knowledge of the forecasting basics in order to develop scenarios and plan long-term concepts in mobility transition.

Managing Transition: Governance and Skills (9 ECTS)

At the end of this module, students will be able to frame the transition to sustainable mobility according to different policy options, thus achieving tools for its management. Students will assess, implement and run solutions towards the sustainable transition. They will be able to manage and develop available governance tools as well as to engage not-political actors.

Lecture Series (9 ECTS)

At the end of this module, students will have an overview of state-of-the-art sustainable mobility trends. National and international experts from industry, academia and research centres involved in the transition toward sustainable mobility will present different opinions, case-studies and perspectives.

Managing Smart and Green Mobility (9 ECTS)

At the end of this module, students will compare the key concepts emerging from sustainability debates and literature, assessing and managing the tensions and synergies between environmental, social and economic objectives. Students will thus design, plan and deploy sustainable transport regimes, developing the transition towards novel models.

Compulsory elective: Innovation and Technology Management (9 ECTS)

Innovation management, technology management, IP management, project management, team building; this knowledge will be applied to a real project by developing a prototype in interdisciplinary teams based on a given problem.

Compulsory elective: Managing ICT and Mobility (9 ECTS)

At the end of this module, students will frame and assess the current and future practices of (highly) digitalized transport industry and service. Students will be able to cope and manage the disruptive consequences of ICT in the mobility field with a focus on future scenarios.

Compulsory elective: Mobility and Development (9 ECTS)

At the end of this module, students will recognise the aspects that distinguish transport sector issues in developing countries versus those from emerging economies of the industrialised world. This will allow participants to plan and implement different analytical techniques in varying institutional and economic contexts, and to generate effective instruments.

Master thesis (18 ECTS)

<table>
<tr><th>1. Semester</th><th>2. Semester</th><th>3. Semester</th></tr>
<tr><td>Project Management (in Mobility)
9 ECTS</td><td>Mobility Trends and Futures
9 ECTS</td><td rowspan="2">Managing Smart and Green Mobility
6 ECTS</td></tr>
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6 ECTS</td><td rowspan="2">Thesis
18 ECTS</td></tr>
<tr><td rowspan="4">Macro-Economics and Business Models of Sustainable Mobility
6 ECTS</td><td colspan="2">Compulsory electives</td></tr>
<tr><td colspan="2">Innovation and Technology Management 12 ECTS</td></tr>
<tr><td colspan="2">Managing ICT and Mobility 6 ECTS</td></tr>
<tr><td colspan="2">Mobility and Development 6 ECTS</td></tr>
<tr><td>30 ECTS</td><td>30 ECTS</td><td>30 ECTS</td></tr>
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Fig. 4: Module Course Plan SMM-Master

Advantages & Opportunities

The program's interdisciplinary content, which covers the social, economic, technical and governance aspects of tomorrow's sustainable mobility, gives students and future employees a distinctive profile and qualifies them for a leading position in the mobility sector.

The students completing the MBA will have possibilities for careers within transport suppliers and equipment industries, national or international organizations, as well as with national, regional or municipal public authorities.

Potential positions of employment encompass, but are not limited to, vehicle and sustainable transport service design engineer; infrastructure or transport service, operator/administrator; transport network planner, developer, marketer or regulator; auditor or manager of sustainable development policy in a company or public and private institutions.

Tuition Fees

The tuition fees for the master program amount to 15,000 Euro (5,000 Euro per semester) including the regular administration (enrolment/registration) fees of currently 306.99 Euro per semester.

The administration fees include the so-called semester ticket for freely using the public transportation service in the city of Berlin.

Application for Master SMM

The application deadline is May 31st of each year for a start in October of the same year.

The number of students is limited to 30 per year. An admission committee will make selection decisions in accordance with the valid admission regulations, which may be viewed in the document linked above.

Acknowledgments

The 1-2 day workshops are developed by the partners of “Themenfeld 5” of the EUREF-project funded by the German ministry for education and research (BMBF).

Authors

Andreas Manthey studied vehicle engineering at Technical University of Berlin, was awarded with the European Solar Prize 1994 of the European Commission and is working on the topics of electric vehicles and renewable energies since 1985. Since 1992 he was responsible for the German part of the charging station network “Park&Charge”, see another paper in EVS30.

Today he teaches electric energy and develops the technical part of the described education workshops especially efficient electric (lightweight) vehicles, renewable energies and charging infrastructure.

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