i-RESEV

ICT-aided integration of Electric Vehicles into the Energy Systems with a high share of Renewable Energy Sources

International SDEWES 2013 Summer School on

Integration of Electric Vehicles into Energy Systems with a high share of Renewable Energy Sources

September 17-27, 2013
Dubrovnik, Croatia

Chair : Prof. Joško Deur
Co-chairs: Prof. Ingo Stadler, Dr. Goran Krajačić

International SDEWES 2013 Summer School on

Integration of Electric Vehicles into Energy Systems with a high share of Renewable Energy Sources

September 17-27, 2013
Dubrovnik, Croatia

Side event of Dubrovnik 2013 SDEWES Conference
http://www.dubrovnik2013.sdewes.org/

Organized by University of Zagreb in cooperation with
Cologne University of Applied Sciences and Aalborg University

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Scope

Due to the intermittent nature of renewable energy sources (RES), the related energy systems need to include significant backup in terms of traditional energy sources or a significant electric storage capacity. This increases the cost of electrical energy and the overall energy system and hinders the RES proliferation. The growing presence of electric vehicles (EV) including plug-in hybrid electric vehicles (PHEV) brings a substantial amount of distributed and fast-response battery storage capacity that is connected to the grid during long vehicle-parking intervals, thereby opening new opportunities for the RES integration. This relates to appropriate time-distributing EV-battery charging (so-called smart charging) aimed at the grid load leveling including absorption of excess production from the RES, as well as to the vehicle-to-grid (V2G) technologies associated with bidirectional charging for grid regulation and spinning reserve purposes. However, the overall transport and energy system (TES) becomes more complex and it can be optimally managed only by way of a widespread involvement of information and communication technologies (ICT) in (i) TES modeling, simulation and optimization processes; (ii) EV fleet modeling based on realistic EV energy management control strategies and naturalistic driving cycles; (iii) energy system strategic planning; and (iv) supporting services such as those related to smart charging.

Main objective

The summer school is targeted to early stage researchers and professionals who are interested in gaining the knowledge and competence in different types of electric vehicles and their integration into modern energy systems. The main objective is to provide an educational platform and a forum for disseminating and discussing recent R&D efforts in the propulsive area of integration of electrified transport into future greener energy systems.

Structure

The summer school will be organized in two parts: the course itself and participation at the SDEWES conference including a Special Session of Integration of electric vehicles into grid systems. The course will include lectures and practical examples of computer-aided modeling, design, and optimization of electric vehicles and related smart grid systems. The students who complete the whole program are anticipated to be awarded by ECTS credits.

Program

17/09/2013	**Electric and Hybrid-electric Vehicles: Configurations, Modeling, Optimization, and Control** Prof. Francis Assadian, Cranfield University, UK Prof. Joško Deur, University of Zagreb, Croatia
18/09/2013	**Synthesis of Naturalistic Driving Cycles and Modeling of Electric Vehicle Fleets** Dr. Tae-Kyung Lee, Ford Motor Company, USA Rashid A. Waraich, ETH Zurich, Switzerland
19/09/2013	**Integration of Electric Vehicles into Grid Systems and Smart Charging** Dr. Filipe J. Soares, Prof. Joao A. Peças Lopes, Porto University, Portugal Rashid A. Waraich, ETH Zurich, Switzerland
20/09/2013	**Energy System Planning including Vehicle-to-Grid Aspects** Prof. David Connolly, Aalborg University, Denmark Prof. Neven Duić and Dr. Goran Krajačić, University of Zagreb, Croatia
21/09/2013	**Energy Storage Systems** Prof. Ingo Stadler, Cologne University of Applied Science, Germany Dr. David Dallinger, Fraunhofer Institute, Germany
22/09/2013	**Round Table** **Student presentations** **City Tour**
23-27/09/2013	**SDEWES Conference** including **Special Session** on Integration of Electric Vehicles into Grid Systems

Tuesday, September 17, 2013

Electric and Hybrid-Electric Vehicles: Configurations, Modeling, Optimization, and Control

Abstract: The seminar starts with an overview of various configurations of electric vehicles (EV), including Hybrid Electric Vehicles (HEV), Plug-in Hybrid Electric Vehicles (PHEV), Extended Range Electric Vehicles (EREV), and Battery Electric Vehicles (BEV). Optimization of main EV component sizing parameters and related analyses are discussed next. Mathematical models of EV power trains are presented as a prerequisite for EV control system design and verification studies. The bond graph modeling method is used to graphically analyze the power flow in common EV configurations such as power-split HEV and EREV configurations. The dynamic programming method is used for off-line optimization of EREV control variables for various certified driving cycles, where the main aim is to gain the insight into optimal vehicle behavior for the purpose of controller design and provide an "idealized" benchmark for controller verification. On-line (feedback) controller design methods are illustrated on PHEV and EREV examples, where the emphasis is on the design of energy management strategy (as a supervisory control loop). The controllers will be verified against the optimization benchmark to illustrate that the causal control strategies can approach the global optimum behavior under realistic operating conditions and constraints. In the afternoon session, the modeling, optimization, controller implementation, and simulation verification methods will be illustrated to the participants through a computer demo course.

Moderator: J. Deur

Schedule:

8:00-8:45	Registration and Welcome reception
8:45-9:00	Summer School Introduction
9:00-10:00	Overview and optimization of EV configurations, F. Assadian
10:00-10:45	Modeling of EV power trains, F. Assadian
10:45-11:30	EV power flow analysis, J. Deur
11:30-12:00	Coffee break
12:00:13:00	Optimization of EV control variables, J. Deur
13:00-13:45	EV control – PHEV case, F. Assadian
13:45-14:30	EV control – EREV case, J. Deur
14:30-15:30	Lunch break
15:30-17:30	Computer course: EREV modeling, optimization, and control, M. Cipek and B. Škugor

Wednesday, September 18, 2013

Synthesis of Naturalistic Driving Cycles and Modeling of Electric Vehicle Fleets

Abstract: Driving cycles play an important role in analysis and design of EV propulsion systems and smart charging strategies. Their role is magnified in the case of plug-in EVs, because driving patterns have a strong impact on specific energy consumption, ability of the vehicle to provide pure electric operation, range of charge depleting operation, and finally assessments of the state-of-charge (SOC) at the beginning of charging. Certification schedules are commonly used for various vehicle studies, but there is a significant discrepancy between the certification schedules and real-world driving. Hence, characterizing the naturalistic driving patterns and generating representative real-world schedules is essential for EV design and control work, studies of technology adoption by real consumers, and assessments of the impact on the grid. This seminar introduces a procedure for synthesizing and validating real-world driving cycles to reproduce naturalistic driving patterns for arbitrary driving distances. The procedure is illustrated in the afternoon's computer course through a case study of a delivery vehicle fleet characterization. The following examples of applications of synthetic cycles are also demonstrated: (i) analysis of PHEV daily missions, their impact on the electric grid, and possible charging opportunities using representative synthetic cycles with the consideration of daily driving schedules; and (ii) assessment of the impact of electrified vehicles on the grid combining representative real-world driving cycles in Midwestern US and vehicle simulations. Finally, an agent-based approach for modeling electricity demand by electric vehicles is presented. The *Transportation Energy Simulation Framework* is presented, which has been implemented recently by extending an existing travel demand simulation. This open-source framework provides various features and interfaces for creating new models, which allows to simulate a wide range of electric mobility scenario, as will be exemplified through some of the Thursday's lectures.

Moderator: J. Deur

Schedule:

9:00-10:00	Overview of real-world driving cycle analysis, T.-K. Lee
10:00-11:00	Synthesis and validation of naturalistic driving cycles, T.-K. Lee
11:00-11:30	Coffee break
11:30-12:30	Use of naturalistic driving cycles for estimating PHEV energy consumption and charging opportunities, T.-K. Lee
12:30:14:00	Adding electric vehicle modeling capability to an agent-based transport simulation, R. A. Waraich
14:00-15:00	Lunch break
15:00-16:00	A modeling approach for the assessment of PHEV impact on grid, T.-K. Lee
16:00-17:30	Computer course: Naturalistic driving cycles: data collection, analysis, and synthesis, B. Škugor

Thursday, September 19, 2013

Integration of Electric Vehicles into Grid Systems and Smart Charging

Abstract: This seminar addresses the impacts and benefits of EV and EV active management on the power systems, both in steady-state and dynamic operation modes. The emphasis is on: (i) an EV integration framework capable of dealing with the technical aspects of electricity grids operation and market operation, and considering different EV charging strategies; (ii) approaches to evaluate the grid impacts due to EV integration, based on a stochastic model to simulate the EV movement and a Monte Carlo simulation method; (iii) participation of properly charged EVs in primary and secondary frequency controls; and (iv) experimental/testing work performed at the Microgrid/EV laboratory facilities of INESC Porto. Furthermore, modeling of different charging schemes, including smart charging, will be presented by using the *Transportation Energy Simulation Framework* (TESF) tool presenting on the Wednesday's seminar. The approach will be illustrated through a real-world scenario for the city of Zurich (controlled vs. uncontrolled charging). In the afternoon's computer course, the participants can learn how to get started using the open-source TESF tool, and create their own models quickly and perform simulations using this framework.

Moderator: J. Deur

Schedule:

9:00-10:00	The electric mobility paradigm need, F. J. Soares
10:00-11:00	Framework for EV integration into grid system including smart charging management, F. J. Soares
11:00-11:30	Coffee break
11:30-12:30	Steady-state and dynamic behavior impact studies due to a large EV presence, F. J. Soares
12:30-14:00	Smart charging schemes and their modeling using a framework for electric vehicle simulation, R. A. Waraich
14:00-15:00	Lunch break
15:00-16:00	Microgrid/EV laboratory, and policy needs and work to do, F. J. Soares
16:00-17:30	Computer Course: Introduction to the Transportation Energy Simulation Framework, R. A. Waraich

Friday, September 20, 2013

Energy System Planning including Vehicle-to-Grid Aspects

Abstract: A critical aspect of sustainable development of modern societies includes planning and development of modern energy systems. These systems should provide security of energy supply, they should be competitive and cause minimal impact to the environment. In a long term, only renewable energy sources (RES) supported by energy storage technologies (including those provided by EVs) could fulfil these requirements. Energy system planning, simulation, and analysis models will be presented to the summer school participants. Emphasis is given at the methodologies and models that can account for the interconnection of intermittent RES, electrical grid, EVs and other system components. The models are aimed at energy system component optimisation under different constraints, such as installed power of electricity producing units, aggregated vehicle storage capacity, CO2 emission costs, fuel-electricity cost ratio, RES potential, and EV charging strategy. Participants will be introduced with various energy planning software tools such as H2RES, MAED, EDT, LEAP and EnergyPLAN. The focus is on EnergyPLAN as a deterministic tool incorporating general inputs are demands, renewable energy sources, energy station capacities, costs, and a number of different regulation strategies for import/export and excess electricity production. EnergyPLAN optimises the operation of a given system as opposed to tools which optimise investments in the system. In the afternoon's computer course, the participants will be able to model some basic components within the energy system such as the electricity demand, power plants, intermittent renewable energy, heat demands, and transport. The course will be completed with a comparison between using conventional and electric vehicles within a country-level energy planning scenario.

Moderators: D. Conolly and N. Duić

Schedule:

8:30-10:00	Introduction to energy system planning, N. Duić
10:00-10:30	Coffee break
10:30-12:00	Planning of energy systems with a high share of renewable energy sources and EV presence, N. Duić and G. Krajačić
12:00-13:00	EnergyPLAN: An Advanced Energy System Planning Tool, D. Connolly
13:00-14:00	Lunch break
14:00-16:00	Computer course: EnergyPLAN, D. Conolly
16:00-16:30	Coffee break
16:30-18:00	Computer course: Energy System Planning - Demand and Supply, G. Krajačić

Saturday, September 21, 2013

Energy Storage Systems

Abstract: The seminar starts with a thorough overview of energy storage technologies. This is not only restricted to electricity storage, but also to primary energy storages, heat and cold storages, and measures for load shifting. The main focus of this introductory lecture is on how those storages will be able to contribute to a 100 % supply by renewable power systems. The second lecture gives a deep insight on those technologies that could be applied in electric vehicles (EV), and these are mainly electro-chemical energy storages. Comparing these technologies with all other alternatives discussed in the introductory lecture, students and lecturers will discuss and elaborate possibilities but also challenges and hurdles of EV-to-grid operation. Where are chances for electric vehicles and where their restrictions are will be discussed. The second part of the seminar discusses the necessary battery sizes and configurations of plug-in electric vehicles (PHEVs) with respect to the resulting vehicle-to-grid (V2G) storage capabilities. Methods to calculate V2G discharging costs caused by the battery degradation and efficiency related losses are presented and compared with commonly used storage technologies. Also, aspects of battery's secondary use and possible applications within the electricity system will be discussed. Finally, a system analysis comparing the capability of PHEVs' demand response and V2G to balance fluctuation of electricity generation from wind and photovoltaic sources will be presented, including an analysis of possible revenues compared to conventional charging.

Moderators: I. Stadler and G. Krajačić

Schedule:

9:00-11:00	Overview of energy storage technologies and their contribution towards the goal of 100% supply by renewable power systems, I. Stadler
11:00-11:30	Coffee break
11:30-14:00	EV en-ergy storages including EV-to-grid application, I. Stadler
14:00-15:00	Lunch break
15:00-16:30	Plug-in electric vehicle battery storage and vehicle-to-grid discharging costs, D. Dallinger
16:30-17:30	Contribution of plug-in electric vehicles to integrate fluctuating renewable electricity generation, D. Dallinger

Sunday, September 22, 2013

Round table and Student presentations

Aim: Lecturers will be answering participants' questions and debating on prospects for proliferation of electric vehicles, their integration into energy systems, and viable charging technologies.

Afterwards, the students will present their work in the field through selected lectures and a poster session, which will further facilitate broad discussions on emerging Ev-grid technologies.

Moderator: N. Duić

Schedule:

9:00-10:30	Round table
10:30-11:00	Coffee break
10:30-13:30	Student presentations (selected lectures and poster presentations)

Social program

17:00-19:00	City tour

	Tuesday, Sept. 17	Wednesday, Sept. 18	Thursday, Sept. 19	Friday, Sept. 20	Saturday, Sept. 21	Sunday, Sept. 22
8:00	Registration and Welcome reception					
8:15						
8:30				Introduction to energy system planning, N. Duić		
8:45	Summer School Introduction					
9:00	Overview and optimization of EV configurations, F. Assadian	Overview of real-world driving cycle analysis, T.-K. Lee	The electric mobility paradigm need, F. J. Soares		Overview of energy storage technologies and their contribution towards the goal of 100% supply by renewable power systems, I. Stadler	Round table
9:15						
9:30						
9:45						
10:00	Modeling of EV power trains, F. Assadian	Synthesis and validation of naturalistic driving cycles, T.-K. Lee	Framework for EV integration into grid system including smart charging management, F. J. Soares	Coffee break		
10:15						
10:30				Planning of energy systems with a high share of renewable energy sources and EV presence, N. Duić and G. Krajačić		Coffee break
10:45	EV power flow analysis, J. Deur					
11:00		Coffee break	Coffee break		Coffee break	10:30 - 13:30 Student presentations (selected lectures and poster presentations)
11:15						
11:30	Coffee break	Use of naturalistic driving cycles for estimating PHEV energy consumption and charging opportunities, T.-K. Lee	Steady-state and dynamic behavior impact studies due to a large EV presence, F. J. Soares		EV energy storages including EV-to-grid application, I. Stadler	
11:45						
12:00	Optimization of EV control variables, J. Deur			EnergyPLAN: An Advanced Energy System Planning Tool, D. Connolly		
12:15						
12:30		Adding electric vehicle modeling capability to an agent-based transport simulation, R. A. Waraich	Smart charging schemes and their modeling using a framework for electric vehicle simulation, R. A. Waraich			
12:45						
13:00	EV control – PHEV case, F. Assadian			Lunch break		
13:15						
13:30						
13:45	EV control – EREV case, J. Deur					
14:00		Lunch break	Lunch break	Computer course: EnergyPLAN, D. Conolly	Lunch break	
14:15						
14:30	Lunch break					
14:45						
15:00		A modeling approach for the assessment of PHEV impact on grid, T.-K. Lee	Microgrid/EV laboratory, and policy needs and work to do, F. J. Soares		Plug-in electric vehicle battery storage and vehicle-to-grid discharging costs, D. Dallinger	
15:15						
15:30	Computer course: EREV modeling, optimization, and control, M. Cipek and B. Škugor					
15:45						
16:00		Computer course: Naturalistic driving cycles: data collection, analysis, and synthesis, B. Škugor	Computer Course: Introduction to the Transportation Energy Simulation Framework, R. A. Waraich	Coffee break		
16:15						
16:30				Computer course: Energy System Planning - Demand and Supply, G. Krajačić	Contribution of plug-in electric vehicles to integrate fluctuating renewable electricity generation, D. Dallinger	
16:45						
17:00						17:00-19:00 City tour
17:15						
17:30						
17:45						

Lecturers' Biographies

Prof. Francis Assadian (www.cranfield.ac.uk/soe/profiles/f_assadian.html) is a Professor of Automotive Engineering at Cranfield University. He earned his B.Sc. in Mechanical Engineering from the Oklahoma State University in 1982; M.Sc. in Electrical Engineering from the California State University, Sacramento in 1992, and Ph.D. in Mechanical Engineering with emphasis in System Modeling and Control System Design from the University of California Davis in 1997. He has 30 years of industrial experience of which 15 years are in the automotive domain. He has worked for companies such as Peugeot Citroen, Ford of Europe and Jaguar Land Rover. He joined the Department of Automotive Engineering at Cranfield University in September of 2009. He has established and directing the Automotive Mechatronics Centre (www.cranfield.ac.uk/soe/departments/automotive/automechatronics) towards innovative research to assist in speeding up the introduction of current and future automotive sustainable energy technologies. He is currently the Head of Department of Automotive Engineering. In 2008, he was nominated for the Ford Technical Achievement Award in 'Yaw Stability and Traction Control Using an Electronically Controlled Limited Slip Rear Axle Differential". Prof. Assadian has over 80 journal, conference and technical papers and serves as an Associate Editor of a number of journals such as IFAC Journal of Control Engineering Practice and IEEE Journal of Vehicular Technology. He is a Fellow of Institute of Mechanical Engineers.

Mr. Mihael Cipek received his Dipl. Ing. Degree in Mechanical Engineering at the Faculty of Mechanical Engineering and Naval Architecture of the University of Zagreb in 2009. He is currently a Research Assistant at the same University. His recent research interest includes modelling and control of electric and hybrid-electric vehicles. For his paper in this field he received the Third Best Paper award at the 10th ICBGM meeting held in Genoa in 2012.

Prof. David Connolly (http://www.dconnolly.net/) received his Ph.D. Degree from the University of Limerick, Ireland, which focused on the role of pumped hydroelectric energy storage (PHES) in aiding the integration of intermittent wind power. As part of his Ph.D. work, he developed a unique software tool which identifies suitable sites for the construction of PHES. He is currently an Assistant Professor in Energy Planning at Aalborg University, Denmark. At present his main area of interest is energy systems analysis, particularly in relation to the integration of wind power, district heating, and alternative transport fuels. He develops energy systems models at a national level to evaluate the technical, environmental, and financial consequences of energy systems, with specific emphasis on 100% renewable energy systems. Most recently, his worked has focused on the role of district heating in the future EU27 energy system and the potential for synthetic fuels in the transport sector. To date, Prof. Connoly has published approximately 15 international journal papers in the area of energy planning and energy systems analysis.

Dr.-Ing. David Dallinger received his B. Eng. (Business and Engineering) from the Jena University of Applied Sciences in 2006 and his M. Sc. (Mechanical Engineering) and Ph.D. (Electrical Engineering) from University of Kassel in 2008 and 2012, respectively. He was subsequently employed at ABB High Voltage in Switzerland and China. Dr.-Ing. David Dallinger has been working at the Fraunhofer Institute for Systems and Innovation Research ISI in Karlsruhe since April 2008. He has been visiting scientist at the Energy Analysis Department of the Lawrence Berkeley National Laboratory in California and serves as member of the International Energy Agency Task Forces: Plug-in Hybrid Electric Vehicles. His research interests include the grid integration of electricity from fluctuating renewable energy generation and electric vehicles.

Prof. Joško Deur (www.fsb.hr/acg/jdeur) received his Ph.D. Degree in Electrical Engineering from the University of Zagreb in 1999. In 2000, he spent a year with the Ford Research Laboratory in Dearborn as a postdoctoral scholar, where he was working on different aspects of automotive powertrain modelling and control. Subsequently, he has led numerous research projects supported by Ford Motor Company and Jaguar Cars, and a number of domestic R&D projects, including the project "ICT-aided integration of Electric Vehicles into the Energy Systems with a high share of Renewable

Energy Sources" (http://powerlab.fsb.hr/iresev/). He is coordinating research activities on a couple of work packages within the EU FP7 FET cooperation project "High Altitude Wind Energy", and is a member of the Management Committee of the COST Action TU1105 entitled "NVH Analysis Techniques for Design and Optimization of Hybrid and Electric Vehicles". Prof. Deur was recognised domestically by the Annual National Science Award for Exceptional Scientific Achievements in 2006, and he received the Best paper awards at the XIX IAVSD Symposium held in Milan in 2005 and the 10th ICBGM meeting held in Genoa in 2012. His research interests include: modelling and control of vehicle mechatronic systems, hybrid electrical vehicles, optimal control, electrical energy storage systems, and servosystems. His research efforts in these fields have resulted in one research book and more than 25 journal papers and 80 conference papers.

Prof. Neven Duić (http://powerlab.fsb.hr/neven/) is with the Department of Energy, Power Engineering and Environment of the Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb. He has been a member of International Scientific Committee of Dubrovnik Conference on Energy, Water and Environment Systems since 2003. He is a member of regional editorial board of Thermal Science Journal and an Associated Editor of Energy journal. Since 1994 Prof. Duić has been a guest researcher at the Research Group on Sustainable Energy Development, Instituto Superior Técnico (IST), Portugal. He has taken part in various fields of Sustainable Energy Development including energy management, energy planning, climate change and integration of renewable energy in islands, as well as the CFD (Computational Fluid Dynamics) projects mainly in field of combustion and energy transfer. During his research work at IST on energy planning in islands (Azores, Madeira, Cape Verde), he worked on several projects which aim was integration of renewable energy sources into island energy supply. From 1999 to 2001 he was involved in the UN Convention on Climate Change process in the field of technology transfer. He received his PhD degree in 1998, and has devoted his expertise in energy studies and developing new tools for energy planning and policy, in particular for developing countries and the economies in transition, including capacity building.

Dr. Goran Krajačić is researcher at Department of Energy, Power Engineering and Environment at the Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb. He defended his Ph.D. thesis "The role of energy storage in planning of 100% renewable energy systems" at the University of Zagreb in 2012. Since 2002 he has been a member of Local organising committee of Dubrovnik Conference on Sustainable Development of Energy, Water and Environment Systems (SDEWES), and since 2004 he has been working on numerous EU projects: ADEG, WEB-ENV, WEB-MOB, STORIES, GERONIMO, SMART, BIOSIRE, DISKNET, JoRIEW, i-RESEV as well as on the national project Smart Energy Storage for Sustainable Development of Energy Systems.

Dr. Tae-Kyung Lee is currently with Ford Motor Company, USA, at the department of Vehicle and Battery Controls. Before joining Ford, Dr. Lee served as a Research Faculty in Department of Mechanical Engineering, University of Michigan, USA. He had worked as a senior research engineer on powertrain computer aided engineering (CAE) in NVH and dynamics at Hyundai Motor Company (HMC), R. O. Korea, from 1998 to 2005. Dr. Lee received his Ph.D. in Mechanical Engineering from the University of Michigan in 2009 and earned B. Sc. and M. Sc. degrees in Mechanical Engineering from Seoul National University, R. O. Korea in 1996 and 1998, respectively. His main research interests include alternative and hybrid powertrain systems, electrochemical battery modelling for controls, advanced internal combustion engine modelling and controls, driving cycle analysis, and the control of automotive and powertrain systems. His research activities include 16 internationally renowned journal papers and 15 conference papers. Dr. Lee is the recipient of the IMechE Donald Julius Groen Award (2011) by the Institution of Mechanical Engineers' (IMechE) Mechatronics, Informatics and Control Group, and Springer Award (2012) by the International Journal of Automotive Technology.

Dr. Filipe J. Soares received the Physics degree (five-year course) from the Faculty of Sciences and an Electrical Engineering (Renewable Energies) Postgrad from Porto University, in 2004 and 2007,

respectively. In 2012 he received the Ph.D. degree in Sustainable Energy Systems, within the MIT|Portugal Program, from Porto University. His Ph.D. thesis was entitled "Impact of the Deployment of Electric Vehicles in Grid Operation and Expansion". Currently he is a researcher in the Power Systems Unit of INESC Porto and his research activity is directed towards the integration of renewable energy sources and electric vehicles in electric distribution grids, as well as to the development of advanced functionalities for the management of electric vehicles' charging and their participation in the electricity markets. In these areas, he has actively participated in the European project MERGE and in the Portuguese project REIVE. He is author or co-author of more than 40 papers and two books: "Electric Vehicle Integration into Modern Power Networks" edited by Springer and "Integration of Electric Vehicles in Distribution Networks: Methodologies to Evaluate Impacts and Manage Electric Vehicles' Charging" edited by Lambert Academic Publishing.

Mr. Branimir Škugor received his Masters Degree in Electrical Engineering from the University of Zagreb in 2011. He has been working as a Research Assistant at the University of Zagreb since November 2011, where he is engaged in the project entitled "ICT-aided integration of Electric Vehicles into the Energy Systems with a high share of Renewable Energy Sources". His research interests include hybrid electric vehicles control strategies, optimisation algorithms, vehicle fleet probability analyses, and smart charging.

Prof. Ingo Stadler (http://www.f07.fh-koeln.de/fakultaet/personen/professoren/ingo.stadler**)** is with the Institute for Electrical Power Engineering of Cologne University of Applied Sciences. Within the institute he covers the areas of renewable energies and energy economics. He has been working for many years with the topic of electricity supply systems with high fractions of renewable energies. Among others he investigates demand response activities and non-electric energy storage devices in order to decouple electricity generation and consumption. Within the second grid study of the German energy agency (dena II) it has been investigated on how high fractions of renewable energies can be integrated into the electricity supplies by energy storage and demand side activities. Within that project Prof. Stadler takes care about transition to a flexible demand side and integration of thermal stores in order to improve flexible electricity generation. He has also been a German's expert for "Stand-alone and Island Applications" in the Photovoltaics Power System Program of the International Energy Agency (IEA) for a period of ten years. Here he dealt with electricity supply of communities that are not connected to the public grid.

Mr. Rashid A. Waraich (http://www.ivt.ethz.ch/people/rwaraich/index_EN) studied computer science at ETH Zurich, Switzerland, with an exchange year at KTH Stockholm. He wrote his Master's thesis in the area of distributed systems and information security, during his final Masters semester at University of California, Berkeley. He received the M.Sc. degree in computer science from ETH Zurich in 2007. In 2008, he joined the Institute for Transport Planning and Systems at ETH Zurich, where he is working towards the Ph.D. degree. The main topic of his dissertation is related to microscopic electric vehicle demand modelling. Based on an agent-based traffic simulation, he has developed an open source framework for electric vehicle modelling, which has been utilized in several projects, such as ARTEMIS, where the possible impact of electric vehicle charging on the electricity grid of the city of Zurich is assessed. Furthermore, he is also involved in the THELMA project (http://www.thelma-emobility.net) where a Switzerland wide assessment of electric mobility is performed. In 2012, he was invited for a research visit to the Future Cities Laboratory (FCL), in Singapore, where he furthered his previous research related to electric vehicles and created models for inductive charging and has also contributed by a parking model for Singapore. His research interests include large-scale parallel micro-simulations, simulation of electric vehicles and parking policies.

CITY OF DUBROVNIK, CROATIA

"Those who seek paradise on Earth should come to Dubrovnik and see Dubrovnik."
George Bernard Shaw

AREA: 143 sq km.
GEOGRAPHIC LOCATION: 42°38'26" N - 18°06'35" E
POPULATION: 42,641 (2011 census)
Dubrovnik is a medieval city on the Croatian side of the Adriatic coastline and a treasure-trove of cultural/historical monuments that were created throughout its thousand-year existence (www.tzdubrovnik.hr/eng/).

In the past, it was a City-Republic, and alongside Venice one of the most famous cultural-economic centres on the Mediterranean. In more recent times, it has become the centre of modern cultural and tourist events: a city of summer festivals - an international parade of top musical and theatrical achievements, a city of museums and galleries. These values have turned Dubrovnik into a place that offers a rich selection of various experiences and excitement, but also a complete holiday in a quiet and calming, mild Mediterranean ambience and wonderful seaside landscapes.

The walls of Dubrovnik girdle a perfectly preserved complex of public and private, sacral and secular buildings representing all periods of the City's history, beginning with its founding in the 7th century. Since 1979 Dubrovnik is in the register of UNESCO as a protected World heritage. Particular mention should be made of the city's main street in the old historical centre - Stradun, Rector's Palace, St. Blaise's Church, Cathedral, three large monasteries, Custom's Office and the City Hall.

The geographical position of this region is typically Mediterranean with mild and wet winters, and hot and humid summers (2,600 hours of sunshine on average). The average annual precipitation is 1,250 mm, air temperature is 17° C, and summer sea temperature is 21° C. There are many sunny days during the winter months. The average summer air temperature is 25° C, made pleasant by the mild 'maestral' wind – a messenger of good weather, while the 'bora' and the 'jugo' generally blow during the colder months.

The coastline is beautiful, dotted with bays, beaches, steep cliffs and many forested islands. There is a great variety of flora, predominantly cypress, pine and olive trees, as well as vineyards, lemon and orange plantations – together with aromatic herbs and flowers, including exotic plants such as palm trees, agave and cactus, which create a special atmosphere. Nature lovers will find a true Mediterranean landscape here, while those fond of sailing will discover a wonderful sea and marinas.

Dubrovnik is not only a fascinating place to explore in its own right but it makes a great base for day trips throughout southern Dalmatia. The Dubrovnik countryside is replete with small villages that retain their folklore traditions. Further down the coast is the resort of Cavtat. Lying at the tip of Croatia, Dubrovnik is close to Mostar in Bosnia-Hercegovina and

Montenegro, which make great day tours. And offshore, lie some of the most beautiful islands in the Adriatic: Mljet, Lokrum and Elaphiti Islands.

Elaphiti Islands are true jewels of Dubrovnik archipelago. Chain of islands between the Pelješac peninsula and the Lapad peninsula used to be a favourite place for summer residences of the Dubrovnik aristocrats. Sailing trip is the ideal way to experience Elaphiti Islands; enjoy the sun and the clear blue sea that surrounds the islands.

UNIVERSITY OF DUBROVNIK

The history of higher education and scientific research in Dubrovnik started in the distant past. This is especially related to maritime, social and natural sciences. In 1624.Jesuites have founded "Collegium Rhagusinum". The Dubrovnik Republic Senate proclaimed it a public high education institution in year 1654. That institution provided education for RuđerBošković, one of the most eminent Croatian scientist and the founder of the Dynamic atomic theory, who continued his doctorate studies in Rome. The Dubrovnik Republic Senate allowed young aristocrats to study navigation and commerce and apply their professional knowledge when sailing out of the Adriatic Sea. The „Collegium Ragusinum" is the real predecessor of the modern higher education in Dubrovnik functioning successfully from the middle of the last century.

The Summer School lectures will be held in the University chambers equipped with state of the art technology.

University of Dubrovnik's address: ĆireCarića 4, HR-20000 Dubrovnik, Croatia

1cm ≈ 200 m

Suggested Accommodation:

Accommodation booking is possible directly using variousweb sites such as:

http://booking.com/ or http://dubrovnik-area.com/.

It should be noted that the month of September falls in the main tourist season in Dubrovnik, and that many hotels are fully booked at that period. Thus, we appeal to the registered authors to make their room reservations as soon as possible. For the same reason, please book your flight on time.

Certain number of rooms is ensured at the hotel Vis in the bay of Lapad, 10 min walking distance from the University of Dubrovnik. To reserve a room with the special rates please send an e-mail with your dates and hotel preference to: accommodation.dubrovnik2013@sdewes.org

Some of the recommended hotels are listed in the following table:

Hotel	Stars	Typical Price	Web
GRAND HOTEL PARK DUBROVNIK	****	1/1 - € 155	Grand Hotel Park
VIS	***	1/1 - € 90; 1/2 - € 55	Vis
KOMODOR	***	1/1 - € 90;	Komodor
VALAMAR LACROMA	****	1/1 - € 120;	ValamarLacroma
VALAMAR TIRENA	***	1/1 - € 90;	ValamarTirena
ADRIATIC	**	1/1 - € 70;	Adriatic
Student Hostel	***	1/1- € 30;	Hostel
Privat apartments	n/a	from 30 €	Private

From the Dubrovnik Airport (DBV/LDDU),which is located 15 km from the city, the following airport connections are available:
Athens, Barcelona, Belfast, Belgrade, Bergen, Berlin-Schönefeld, Berlin-Tegel, Bilbao, Birmingham, Bordeaux, Brussels, Bucharest, Bydgoszcz, Cologne/Bonn, Copenhagen, Cork, Dublin, Düsseldorf, Edinburgh, Frankfurt, Gdańsk, Geneva, Gothenburg-Landvetter, Hamburg, Hannover, Harstad/Narvik, Helsinki, Istanbul-Atatürk, Kiev-Boryspil, Knock, Kraków, Kristiansand, Leeds/Bradford, Leipzig/Halle, Lille, Lisbon, London-Gatwick, London-Stansted, Luxembourg, Lyon, Ljubljana, Madrid, Malmö, Malta, Manchester, Marseille, Milan-Malpensa, Moscow-Domodedovo, Moscow-Sheremetyevo, Munich, Nantes, Newcastle upon Tyne, Nottingham/East Midlands, Odessa, Osijek, Oslo-Gardermoen, Paris-Charles de Gaulle, Paris-Orly, Poznań, Prague, Rome-Fiumicino, Shannon, Skelleftea, Split, Stavanger, Stockholm-Arlanda, Stuttgart, Tel Aviv-Ben Gurion, Toulouse, Trondheim, Venice-Marco Polo, Vienna, Warsaw-Chopin, Wroclaw, Zagreb, Zürich.

From the Split Airport (SPU/LDSP) the following additional airport connections are available with a bus connection to Dubrovnik (the coastal road trip would take approximately 4 hour):
Aalesund, Amsterdam, Baku, Bari, Basel/Mulhouse, Bern, Bratislava, Bristol, Catania, Dortmund, Dresden, Erfurt, Haugesund, Jönköping, Kassel-Calden, Kiev-Zhulhany, Kristiansund, London-Heathrow, London-Luton, Lulea, Norrköping, Nuremberg, Örnsköldsvik, Ostrava, Palermo, Rotterdam, SandjefordTorp, St. Petersburg, Växjö, Visby.

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FSB

Summer School on

Integration of Electric Vehicles into

Energy Systems with a high share of Renewable Energy Sources

September 17-22, 2013, Dubrovnik, Croatia

Side event of 8th SDEWES 2013 Dubrovnik Conference

Registration Form

(Please fill this FORM and send it toiresev@fsb.hr**)**

Contact Person:

Dr. sc. Goran. Krajačić,E-mail: iresev@fsb.hr

Faculty of Mechanical Engineering and Naval Architecture (FSB)

IvanaLučića 5, HR-10002 Zagreb, CroatiaTelephone: +385 1 6168 433

Participant:

Title, Name, Last Name _____

Address _____

Institution _____

Telephone/Fax _____

E-mail _____

Participation fees (Please check applicable amount):

10% discount is awarded to all participants that will settle their fee by 28th June.

- ☐ **1000 EUR/person full price**
- ☐ **750 EUR/person for students and University employees**
- ☐ **450 EUR/person reduced fee for students from certain developing countries and countries in transition (GDP per capita <6000 USD, max 10 participants)**
  http://en.wikipedia.org/wiki/List_of_countries_by_GDP_(nominal)_per_capita
  Upon registration approval, summer school organizers will inform eligible students for reduced fee.

Price includes: Course materials, lunch Tuesday-Saturday andcoffee breaks.

Course Venue: University of Dubrovnik, ĆireCarića 4, HR-20000 Dubrovnik, Croatia.

Billing Information

Please indicate to whom the invoice will be addressed to:

Title, Name, Last Name _____

Address _____

Institution _____

Telephone/Fax _____

E-mail _____

In cooperation with: Aalborg University, Denmark, www.en.aau.dk

Cologne University of Applied Sciences, www.fh-koeln.de