



**EES – UETP**

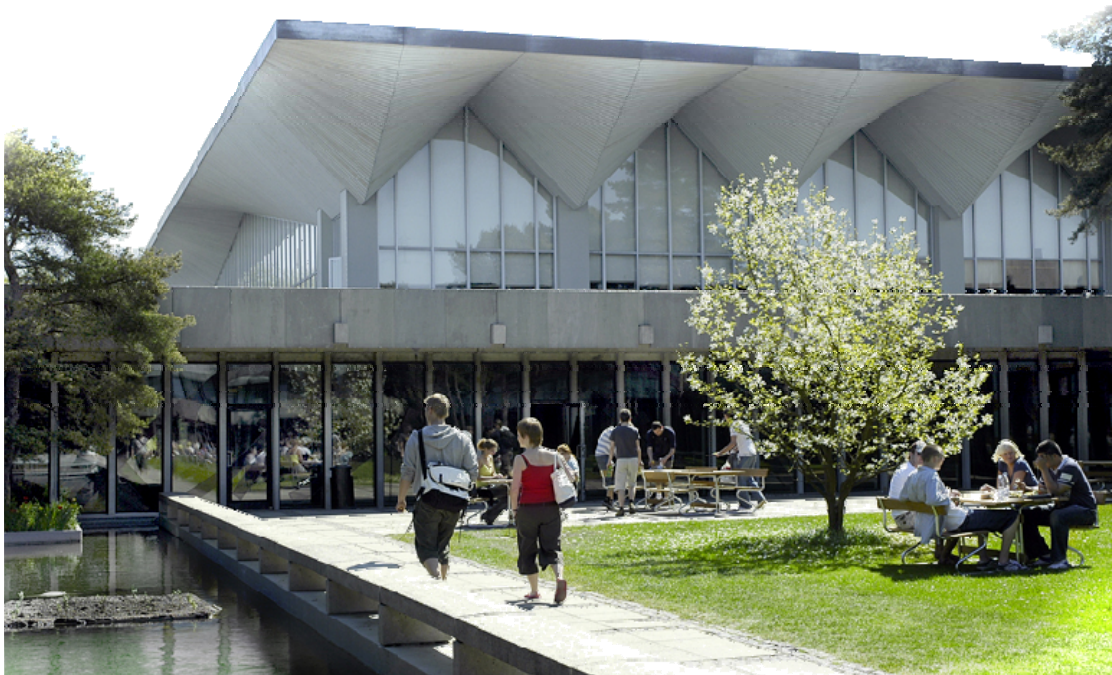
**Electric Energy Systems – University Enterprise Training Partnership**

**Course on:**

**ELECTRIC VEHICLE INTEGRATION INTO  
MODERN POWER NETWORKS**

**Centre for Electric Technology  
Technical University of Denmark**

**September 22-24, 2010**



Centre for Electric Technology  
Department of Electrical Engineering





# **EES – UETP**

**Electric Energy Systems – University Enterprise Training Partnership**

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## **1. Scope and Aims**

The energy-related targets set by EU policy require carefully examining potential solutions for the integration of renewable energy sources for electricity production into the grid. On the other side, the growing energy demand from the introduction of electric-powered cars needs an efficient concept to utilise the variable power supply. The application of dynamic techniques for prediction of electricity supply and demand, including electricity prices in the market, is expected to support the optimisation of the grid balance. The wind markets predict an installed capacity that would provide 14% of the electricity consumption in 2020. Today in Denmark the wind power accounts for more than 20% of the power production. Wind radiation production forecasts have a relatively large margin of error. However, the variable character of this renewable power supply and the 2020 significant quantities of wind capacity, impose special requirements on the whole system, including distribution and storage. It is very likely that imbalances of production and demand will occur if no efficient way of energy storage is available. Several recent research projects and studies indicate that battery capacity of electric cars could contribute to obtain an efficient way of dealing with the variable power supply from wind plants. The relative static grid system will have to become intelligent in order to deal with the future electricity supply and demand. Utilities will have to adopt large-scale renewable power technologies as core parts of their long term generation strategies. In parallel electric cars may ease the integration of renewable energies in the electricity networks and markets. This course aims to establish a state-of-the-art on the feasibility of using dynamic software tools to support the integration of large-scale renewable electricity generation plants and electricity consuming cars in our society.

The course will address the following topics:

- State of the art on introduction of electric cars
- Optimisation of power production and charging of electric cars
- Electrical vehicles activities around the world
- Charging and discharging technologies for EV technologies

## 2. Intended Audience

This course is intended for professionals of electric power utilities, regional transmission operators, power system consultants, researchers and post-graduate students.

## 3. Coordinators



**Assist. Prof. Rodrigo Garcia** ([rgv@lektro.dtu.dk](mailto:rgv@lektro.dtu.dk))

Rodrigo Garcia was born in Mexico. He received the electrical engineering degree from the National Polytechnic Institute of Mexico, in 2001, the M.Sc. degree from CINVESTAV, Mexico, in 2003 and obtained his Ph.D. degree from the University of Glasgow, U.K., in 2007. In 2008, he was granted with the Hans Christened Ørsted Award at the Centre for Electric Technology(CET) by the Technical University of Denmark to carry out postdoctoral research activities. Since 2009 he holds the position as Assistant Professor. His research interests are dynamics, stability and control of electric power systems; renewable energy integration; and modelling and simulation of FACTS and custom power controllers. He is an IEEE, IET and CIGRE member.



**Prof. João A. Peças Lopes** ([jpl@fe.up.pt](mailto:jpl@fe.up.pt))

João Peças Lopes was born in Portugal. He obtained a degree in Electrical Engineering at the Faculty of Engineering - University of Porto in July 1981. From 1981 to 1982 he worked as Engineer in the department of studies of an electrical equipment manufacturer - EFACEC. In November 1981 he joined the staff of the Department of Electrical Engineering at the University of Porto as teaching and research assistant. In 1988 he completed his Ph.D. at the University of Porto, having reached the highest grade. In November 1996 he obtained his Aggregation degree also from University of Porto. He is presently Full Professor at the Department of Electrical and Computer Engineering of FEUP – Faculdade de Engenharia da Universidade do Porto, being also Director of the Sustainable Energy Systems PhD program. Dr. Peças Lopes is presently Director of INESC Porto.

#### 4. List of instructors

<b>Jacob Østergaard</b>	Centre of Electric Technology - DTU Denmark
<b>Gerd Schauer</b>	Verbund Austria
<b>Esben Larsen</b>	Centre of Electric Technology - DTU Denmark
<b>Björn Mollstedt</b>	E.ON AB Sweden
<b>Rodrigo Garcia</b>	Centre of Electric Technology - DTU Denmark
<b>João A. Peças Lopes</b>	INESC Porto Portugal
<b>Joel Soares</b>	INESC Porto Portugal
<b>John Eli Nielsen</b>	Centre of Electric Technology - DTU Denmark
<b>Dieter Gantenbein</b>	IBM Zurich Switzerland
<b>Maya Felicia Bendtsen</b>	Østkraft Denmark
<b>Claus Amtrup Andersen</b>	EURISCO R&D Denmark
<b>Willett M. Kempton</b>	University of Delaware USA
<b>Kai Strunz</b>	TU Berlin Germany

#### 5. Course duration and location

##### ***Duration***

Three days – Wednesday 22<sup>nd</sup>, Thursday 23<sup>rd</sup> and Friday 24<sup>th</sup> September 2010, Lyngby (Copenhagen) Denmark. The gala dinner will take place Thursday 23<sup>rd</sup>, September, 19:00hrs, at a restaurant in Copenhagen.

### **Location**

The venue for the meeting is the Technical University of Denmark in Lyngby. The meeting will take place in the new meeting facilities in the main building of DTU, Building 101A.

You will be able to see the number of the meeting room for the EV Integration Course EES-UETP on a screen when entering the building.

### **How to get to DTU**

On the web-site [www.dtu.dk](http://www.dtu.dk) you can find instruction on how to get to DTU. This includes maps of the campus in Lyngby etc. [www.dtu.dk](http://www.dtu.dk) → About DTU → How to get to DTU

### **Links**

[www.dtu.dk/centre/cet.aspx](http://www.dtu.dk/centre/cet.aspx)

[www.elektro.dtu.dk](http://www.elektro.dtu.dk)

[www.dtu.dk](http://www.dtu.dk)

## **6. Course contents**

### **Wednesday, September 22<sup>nd</sup>**

08:00-08:30 Registration

08:30-09:00 Opening Session

#### ***ELECTRICAL VEHICLE ARCHITECTURES, THE STATE-OF-THE-ART***

09:00-10:30 **Grid connected vehicles – Capabilities and characteristics** (To be announced)

10:30-12:00 **Austrian activities concerning EVs** (Gerd Schauer)

12:00-13:00 Lunch

13:00-14:30 **EVs and Renewables, The USA approach** (Willet M. Kempton)

14:30-15:00 Coffee Break

15:00-16:00 **Introduction of EVs from a Swedish perspective** (Björn Mollstedt)

### **Thursday, September 23<sup>rd</sup>**

#### ***INTEGRATION TECHNOLOGY***

09:00-10:00 **Network impact of EVs on distribution and transmission levels** (John Eli Nielsen)

10:00-11:00 **Real life testing of developed technologies – the Bornholm Island** (Maya Felicia Bendtsen)

11:00-11:30 Coffee Break

11:30-12:30 **Intelligent system integration of distributed EV** (Dieter Gantenbein)

12:30-13:30 Lunch

13:30-14:30 **Smart EV grid interfaces responding to voltage and frequency variations to maximize renewable energy integration** (J. Peças Lopes)

14:30-15:30 **Efficient integration of EVs with wind power production** (Esben Larsen)

15:30-16:00 Coffee Break

16:00-17:00 **Communication interface between EV and the electric power network** (Claus Amtrup Andersen)

19:00-23:00 **Gala Dinner**

## **Friday, September 24<sup>th</sup>**

09:00-10:30	<b>Modeling and transients simulation of distribution networks with integrated electric vehicles</b> (Kai Strunz)
10:30-11:00	Coffee Break
11:00-12:30	<b>Smart charging strategies for efficient management of the grid and generation systems</b> (Joel Soares)
12:30-13.30	Lunch
13:30-14:30	<b>The EDISON project</b> (Rodrigo Garcia & Jacob Østergaard)
14:30-15:30	<b>The MERGE project control concept - Microgrids and EVs - development of management solutions for integrating EV in microgrids for normal and islanding operating conditions</b> ( J. Peças Lopes)

### **7. Course fees**

The course fees include lectures, documentation, coffee breaks, lunches and course dinner.

Member of EES-UETP	<b>367,5</b>	<b>EUR</b>
Non-Member of EES-UETP: University	<b>900</b>	<b>EUR</b>
Non-Member of EES-UETP: Industry	<b>1500</b>	<b>EUR</b>

The Course Secretariat will send an invoice to each registered participants after the reception of the filled Registration Form. Payment is requested before the beginning of the course.

### **8. Registration form**

Course: Electric Vehicle Integration into Modern Power Networks  
Monday 22<sup>nd</sup> – Wednesday 24<sup>th</sup>, September 2010.

Fill in this form and email a copy to:

**Assistant Professor Rodrigo Garcia**  
Centre for Electric Technology  
Department of Electrical Engineering  
DTU - Technical University of Denmark  
Elektrovej, Building 325, Room 010  
DK-2800 Kgs. Lyngby  
Denmark  
Email: [rgv@elektro.dtu.dk](mailto:rgv@elektro.dtu.dk)

- EES-UETP Member
- EES-UETP Non Member - University
- EES-UETP Non Member - Industry

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Name

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Company

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Position

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Phone

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Email

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Fax

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Date

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Signature

## 9. Accommodation

### Hotels in the vicinity of DTU:

**Hotel Postgaarden, Gammel Jernbanevej 18, DK-2800 Kgs. Lyngby**  
Phone: (+45) 4588 1022 Fax: (+45) 4588 3577, Website: [www.post-pub.dk](http://www.post-pub.dk) ,  
(Lyngby centrum, Bus 190 or 300S to DTU)

**Raadvad Vandrehjem (Youth hostel), Raadvad 1, DK-2800 Kgs. Lyngby**  
Phone: (+45) 4580 3074 Fax: (+45) 4580 3032,  
(1,5 km from DTU)

**Hotel Fortunen, Ved Fortunen 33, DK-2800 Kgs. Lyngby**  
Tel: (+45) 4587 0073, Fax: (+45) 4587 1222, [www.fortunen.dk](http://www.fortunen.dk)  
(1,5 km from DTU)

**Gentofte Hotel, Gentoftegade 29, DK-2820 Gentofte**  
Phone: (+45) 3968 0911 Fax: (+45) 3968 0611 [www.gentoftehotel.dk](http://www.gentoftehotel.dk)  
(0,5 km from Gentofte Station, 4 minutes with train to Lyngby; Bus no. 190 or 300 S to DTU)

**Scandic Hotel Eremitage, Lyngby Storcenter 62, DK-2800 Kgs. Lyngby,**  
Phone: (+45) 4588 7700, Fax: (+45) 4588 1782, [www.scandic-hotels.com](http://www.scandic-hotels.com)  
(Lyngby centrum, Bus no. 190 or 300S to DTU)

### Hotels in Copenhagen:

**Cabinn Hotel City, Mitchellsgade 14, 1568 Copenhagen**  
Phone: (+45) 3346 1616, Fax: (+45) 3346 1717, [www.cabinn.com](http://www.cabinn.com),

(Close to the Central railway station)

**Cabinn Hotel Scandinavia, Vodroffsvej 55, 1900 Copenhagen F,**

Phone: (+45) 3536 1111, Fax: (+45) 3536 1114, [www.cabinn.com](http://www.cabinn.com),

(Close to the Metro)

**DGI-byens Hotel, Tietgensgade 65, 1704 Copenhagen V**

Phone: (+45) 3329 8050, [www.dgi-byen.dk](http://www.dgi-byen.dk)

(Close to the Central railway Station)

**Danhostel, H. C. Andersens Boulevard 50, 1780 København V**

Phone: (+45) 3318 8332, [www.danhostel.dk](http://www.danhostel.dk)

(Close to the Central railway Station)

## 10. Contact information

**Rodrigo Garcia-Valle**

Assistant professor

Centre for Electric Technology

Department of Electrical Engineering

DTU - Technical University of Denmark

Elektrovej, Building 325, Room 010

DK-2800 Kgs. Lyngby (Copenhagen)

Denmark

Email: [rgv@elektro.dtu.dk](mailto:rgv@elektro.dtu.dk)

Phone: +45 4525 3534

Fax: +45 4588 6111

*Links*

[www.dtu.dk/centre/cet.aspx](http://www.dtu.dk/centre/cet.aspx)

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