

Residential Training

Regulation and integration of renewable energy

**11-13 October 2023**

Cappella - Villa Schifanoia, Via Boccaccio 121 - Florence

Course Directors:

Lena Kitzing | Technical University of Denmark DTU**Mario Ragwitz** | Fraunhofer Institute for Energy Infrastructures and Geothermal Systems IEG

Training Coordinator:

Marina Cascella | Florence School of Regulation, RSCAS, EUI

Logistic Coordinator:

Elena Iorio | Florence School of Regulation, RSCAS, EUI

Introduction

The FSR's training course on Renewable Energy Sources: integration and regulatory issues in market based electricity systems provides a comprehensive introduction to the topic with the newest updates from the field.

The general objective of this training course is to carefully examine the role and potential of renewable energy sources as a fundamental element to a sustainable, competitive and secure power industry as well as the regulatory mechanisms needed to achieve their integration into a liberalised electricity system.

Based on praxis-driven lectures and through interactive discussion with renowned specialists and active group work, the course seeks to contrast current and future regulatory actions needed for the steady development and integration of renewable energy and their implications for the electricity markets and networks, underlying the importance of stronger coordination and cooperation between the various actors involved with the final aim of maximising the benefits of renewable energy deployment.

This training course presents the recent developments in the EU but its focus is not limited to the Old Continent: case studies from America, Africa and Asia will be presented too.



Draft Programme

11 October **Day 1**

9:00 - 9:30 Course presentation and personal introductions

- Course objectives
- Renewable energy investments: key enablers of the energy transition
- Basic concepts: LCOE and system costs
- Main new challenges of electricity systems and markets
- Future pathways in an uncertain environment

Lena Kitzing | Technical University of Denmark DTU

Mario Ragwitz | Fraunhofer Institute for Energy Infrastructures and Geothermal Systems IEG

9:30 - 11:00 Introduction to the governance of renewable energy

- Development of renewable energy policies in Europe, from the first steps to current ambitions
- The Renewable Directive and the Energy Governance Regulation
- State Aid definitions and State Aid Guidelines
- Ongoing changes in EU renewable energy governance

Dörte Fouquet | Becker Büttner Held

11:00 - 11:30 *Coffee break*

11:30 - 12:15 Introduction to the economics of renewable energy sources

- Renewables in the electricity mix
- Technical-economic features of renewables
- LCOE trends
- Challenges posed by the integration of RES in liberalised electricity markets
- Flexibility needs, barriers and promotion of further technological development

Asami Miketa | IRENA

12:15 - 13:00 Market integration of renewable energy – general concepts

- Renewable energy investments, economics and risk factors
- Cost elements related to renewable energy (LCOE, Balancing, Grid, System)
- The challenge of market integration of renewable energies
- Market value of renewable energies and sector coupling

Mario Ragwitz | Fraunhofer Institute for Energy Infrastructures and Geothermal Systems IEG

13:00 - 14:00 *Lunch break*

14:00 - 15:30 Supporting RES uptake – market-based investment in generation capacity

- The evolution of support scheme designs: from FIT to CfD
- Auctions for renewable energy support
- Experience with competitive bidding schemes and auctions in Europe and globally
- Options and best practices in auctions design
- The future of RES procurement through auctions

Lena Kitzing | Technical University of Denmark DTU

15:30 - 16:00	<i>Coffee break</i>
16:00 - 17:30	<p>Group work on optimal auction design</p> <p>Lena Kitzing Technical University of Denmark DTU Mario Ragwitz Fraunhofer Institute for Energy Infrastructures and Geothermal Systems IEG</p>
17:30 - 17:45	<p>Wrap-up session</p> <p>Lena Kitzing Technical University of Denmark DTU Mario Ragwitz Fraunhofer Institute for Energy Infrastructures and Geothermal Systems IEG</p>
17:45 - 18:45	<i>Welcome cocktail</i>
12 October	Day 2
09:00 - 10:30	<p>Integration of RES in liberalised wholesale electricity markets – market-based dispatch of generation</p> <ul style="list-style-type: none"> • Introduction to electricity markets and market design • Electricity market target model and market coupling • Impact of RES on electricity markets • The flexibility challenge & its solutions • Rethinking European electricity markets (Short term markets vs. long term markets) <p>Tim Schittekatte Florence School of Regulation/RSCAS/EUI; MIT</p>
10:30 - 11:00	<i>Coffee break</i>
11:00 - 12:30	<p>Integration of RES in liberalised wholesale electricity markets – market-based dispatch of generation</p> <ul style="list-style-type: none"> • Market value and price impacts of RES • Impact of different support mechanisms on revenues, risks and market behaviour • Long-term contracting for RES for financing and bankability • Power Purchase Agreements • Non-distortive design of state-backed contracts-for-differences • Direct marketing of RES-based electricity (PPAs and contracts for difference) <p>Lena Kitzing Technical University of Denmark DTU</p>
12:30 - 13:00	<p>Group activity on PPAs and CfDs / optimal market premium design</p> <p>Tim Schittekatte Florence School of Regulation/RSCAS/EUI; MIT Lena Kitzing Technical University of Denmark DTU</p>
13:00 - 14:00	<i>Lunch break</i>
14:00 - 15:30	<p>Integration of RES in electricity systems and impacts on grid planning</p> <ul style="list-style-type: none"> • Introduction to electricity grids, their operation and planning (transmission and distribution) • Challenges posed by RES deployment to grids planning and access • Regulatory challenges in a more decentralised electricity system • Priority access and curtailment costs (regulated vs. market-based redispatch) • Designing future-proofed network charges and levies (coordination mechanisms between investments in generation and grid assets) <p>Tim Schittekatte Florence School of Regulation/RSCAS/EUI; MIT</p>

- 15:30 - 16:15 Sector-coupling as a main tool for market integration of renewables
- General effects of sector coupling on the market value of RES
 - Techno-economic characteristics of Power-to-X technologies
 - Regulatory aspects of sector coupling

Mario Ragwitz | Fraunhofer Institute for Systems and Innovation Research ISI

16:15 - 16:45 *Coffee break*

- 16:45 - 17:30 Case study on integration of RES in electricity system operation and grid planning
- The point of view of a European TSO
 - The Italian electricity market development
 - Grid services from distributed resources
 - Storage

Fabio Genoese | Terna

17:30 - 17:45 Wrap-up session

Lena Kitzing | Technical University of Denmark DTU

Mario Ragwitz | Fraunhofer Institute for Systems and Innovation Research ISI

19:30 *Dinner in town*

13 October **Day 3**

- 9:00 - 10:30 Trends in global renewable energy markets & Case studies of regulation and market integration in liberalised electricity systems
- India
 - Brazil
 - South Africa

Wikus Kruger | University of Capetown

10:30 - 11:00 *Coffee break*

- 11:00 - 12:30 Group work: Strategic RES investment and market incentivisation game
- Company strategies and portfolio development of renewable energy businesses
 - Multi-criteria decision making in policy and regulation for RES incentivisation

Lena Kitzing | Technical University of Denmark DTU

Wikus Kruger | University of Capetown

12:30 - 13:30 *Lunch break*

- 13:30 - 14:30 Group work: Strategic RES investment and market incentivisation game
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Lena Kitzing | Technical University of Denmark DTU

Wikus Kruger | University of Capetown

14:30 - 16:00 Beyond electricity: Renewables integration across sectors

- Sector coupling and power-to-X
- Integrating different energy vectors to provide more flexibility
- Renewable gases – a fair taxonomy?
- Renewable e-fuels
- Current policy debate, expected contributions

Amalia Pizarro | Energy Innovation Officer, Hydrogen and Alternative Fuels Unit, International Energy Agency (IEA)

16:00 - 16:30 *Coffee break*

16:30 - 17:15 Open discussion about course topics

Lena Kitzing | Technical University of Denmark DTU

Mario Ragwitz | Fraunhofer Institute for Systems and Innovation Research ISI

17:15 - 17:30 Wrap-up session

Lena Kitzing | Technical University of Denmark DTU

Mario Ragwitz | Fraunhofer Institute for Systems and Innovation Research ISI