Intelligent Energy Europe

# Promoting grid-related incentives for large scale RES-E integration into the different European electricity systems

## Economic incentives for grid operators for integrating RES-E generation into electricity grids

## GreenNet – Incentives

**www.greennet-europe.org**

**Regulation of monopolistic grid operators**

Operation of electricity grids constitutes a natural monopoly. In order to prevent
a) monopolistic price determination, which would lead to welfare losses, and
b) potential discriminating behaviour,
this segment of the electricity value chain is subject to regulation.
Hence (national) regulatory authorities develop mechanisms to derive a tariff structure for the provision of services as grid access, metering, electricity transmission and distribution, which sets a limit to grid operators' profits.

Core elements of according regulatory mechanisms are the provisions concerning the accountability of (new) investments (for cost-based approaches as well as for incentive-schemes in terms of a "starting point"): Regulatory authorities try to identify a necessary stock of assets as basis for the calculation of a respective return on equity. Infrastructure investments may alter this acknowledged stock corresponding to predefined rules; they may or may not be "passed through" into higher tariffs.

Therefore, regulatory mechanisms in general and especially the treatment of investment costs strongly impact the deployment of RES-E and the success of respective national support schemes, as respective grid and system integration is generally connected with upfront costs for the grid operator in terms of expenses for grid connection and grid reinforcement.

Only if grid operators are incentivised by predefined mechanisms for the integration of RES-E generation, they are enabled to actively support the national and international energy policies for the deployment of renewable energy sources by providing the necessary upgrades of the electricity grid infrastructure.

**Cost drivers of RES-E generation (DG/large scale):**

While on the one hand, through the integration of distributed (RES-E) generation cost savings in the operation of electricity grids may be realized (provision of ancillary services, reduced transmission losses, substitute for reinforcements), on the other hand, following additional cost drivers can be identified:

- New design criteria and operational concepts due to bidirectional load flows in case of significant amounts of DG/RES-E generation
- Higher technical standards and new concepts for ancillary service provision like voltage and frequency regulation, accounting and billing devices and procedures
- Installation of new information and communication technologies (ICT) for the management of active distribution grids.
- Higher transaction costs due to an increasing number of market actors.

Large scale RES-E generation utilising (offshore) wind energy and potentially solar and ocean energy, in most cases is located in remote areas and therefore necessitates transmission grid reinforcements and extensions to link this resources to load centres. Also, the provision of balancing mechanisms becomes more challenging.

**Incentive regulation versus incentives for RES-E integration**

Incentive regulation schemes have been introduced by many national regulatory authorities in recent years. One common characteristic of these schemes is the determination of a path for maximum prices or revenues, which is independent from actual (operational and capital) costs over a defined period, but foresees the closure of a potential gap between own and best observed efficiency.
If grid operators are expected to make investments into the grid infrastructure in order that it can accommodate increasing shares of (partly volatile or remote) RES-E generation, the corresponding regulatory mechanisms need to be amended.

Exemplarily, the formulation of an incentive regulation scheme, which foresees a continued reduction of prices according to productivity improvements, is cited below:

$$P_t = P_{t-1} * (1 + RPI - X)$$

| | |
|---|---|
| $P_t$ | *authorized price-cap in year t* |
| $P_{t-1}$ | *authorized price-cap in year (t-1)* |
| *RPI* | *annual inflation index (Retail Price Index)* |
| *X* | *productivity offset* |

Again exemplarily, a possible extension of the traditional incentive regulation formula – remunerating grid operators for the integration of renewable generation – can be indicated as follows:

$$P_t = P_{t-1} * (1 + RPI - X) + \Delta C_{RES\,i,\,j} * \Delta kW_{RES\,i,\,j} * (1 + RPI - LR_{\Delta C_{RES\,i,\,j}})$$

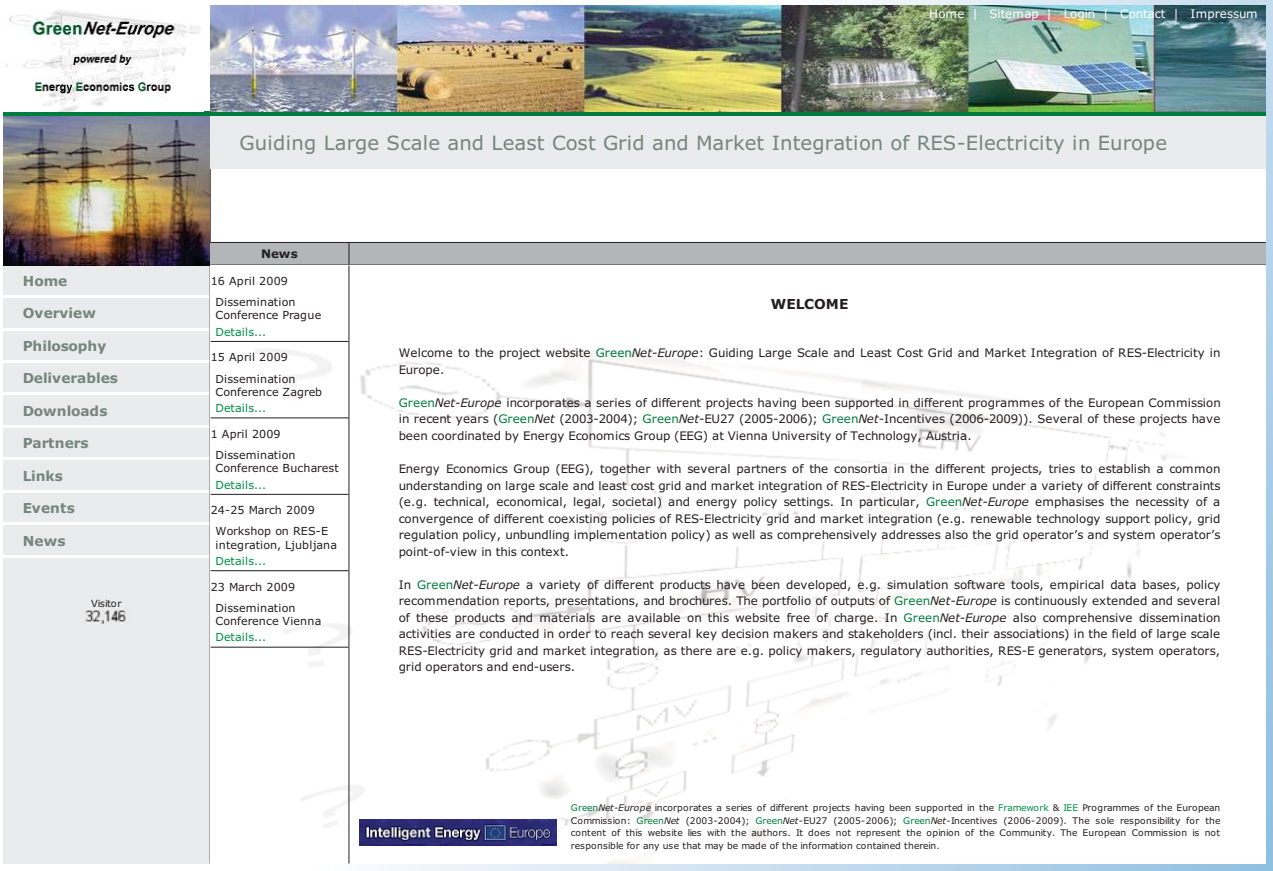
| | |
|---|---|
| $\Delta C_{RES\,i,\,j}$ | *specific cost for a distribution grid operator caused by the integration of a RES-E generation technology i into an existing grid topology j* |
| $\Delta kW_{RES\,i,\,j}$ | *installed capacity of RES-E generation technology i integrated into an existing grid topology j* |
| $LR_{\Delta C_{RES\,i,\,j}}$ | *expected dynamic learning rate and/or economies of scale of specific grid integration cost caused by the integration of a RES-E generation technology i into an existing grid topology j* |

Additional measures, as a clear separation of (financial) responsibilities between generators and grid operators or the possibility for grid operators to claim additional (initial) costs for innovative technical solutions for the integration of RES-E generation, have to accompany the overall regulatory mechanism.

A report on the topic of providing financial incentives for grid operators to support RES-E integration via endogenous mechanisms in the grid regulation process as well as a report on 10 case studies of currently implemented regulatory mechanisms with this respect are available online in the download section of the **Green*Net*-Incentives** project website:
**www.greennet-europe.org**

The full report on the topic of this brochure, summary presentations and the documentation of a broad range of events dedicated to large scale RES-E grid and system integration as well as a report on energy policy recommendations and action plans towards "green" electricity grid policies can be downloaded from the project website:

## www.greennet-europe.org




### *Project Coordinator*

*Dr. Hans Auer*
*Energy Economics Group (EEG)*
*Vienna University of Technology*
*Gusshausstrasse 25-29 / 373-2*
*A-1040 Vienna, Austria*
*Email: auer@eeg.tuwien.ac.at*
*Phone: ++43-(0)1-58801-37357*

*Lukas Weissensteiner*
*Energy Economics Group (EEG)*
*Vienna University of Technology*
*Gusshausstrasse 25-29 / 373-2*
*A-1040 Vienna, Austria*
*Email: weissensteiner@eeg.tuwien.ac.at*
*Phone: ++43-(0)1-58801-37368*

### *Project Consortium*

Energy Economics Group · IER · eERG · SINTEF · APE · Wien Energie Stromnetz · ENERO · Energo Banking Central & Eastern Europe · it Power · ENVIROS · EnBW · PAE RAE