Hans Auer, Carlo Obersteiner, Lukas Weissensteiner and Wolfgang Prüggler

LEAST COST RES-E GRID INTEGRATION IN THE EUROPEAN UNION: ANALYSES OF DIFFERENT COST ALLOCATION POLICIES BASED ON THE SIMULATION MODEL **Green*Net***

Energy Economics Group (EEG), Vienna University of Technology
Gusshausstrasse 25-29/373-2, A-1040 Vienna, Austria
E-mail: auer@eeg.tuwien.ac.at

Overview

Market integration of new Renewable Energy Technologies for Electricity (RES-E) generation is one of the core topics in the energy policy agenda of the European Commission (EC). In 2005, already significant shares of RES-E generation (mainly wind onshore, biomass, hydro-power) are integrated into the European electricity grids. Moreover, in the next years a variety of ambitious offshore wind projects are planned.

But legislation and definition of RES-E policy goals on national as well as EU-level still face a variety of lacks (besides harmonisation of the financial RES-E support instruments), e.g. neglecting

- grid-infrastructure-related and system-related aspects of large scale (intermittent) RES-E integration,
- disaggregated cost allocation of different cost components of RES-E grid integration and
- careful socialisation of the different disaggregated cost elements (RES-E support instruments versus wholesale/balancing markets versus grid tariffs).

The recently finished EC-Project **Green*Net*** addresses these existing inadequacies and models dynamic time paths up to the year 2020 for a variety of least-cost RES-E grid integration cases in the EU15 Member States for different degrees of unbundling and different cost allocation policies (of cost elements for grid connection, grid reinforcement/extension, system balancing, system reserve capacity).

Methods

The general modelling approach in the simulation software **Green*Net*** is to describe both electricity generation technologies (supply curve) and energy efficiency options (demand curve) by deriving corresponding *dynamic cost-resource curves* being characterised by the fact that the costs as well as the potentials can change year by year. These changes are given endogenously in the model depending on the outcome of the previous year (n-1) and the policy framework conditions set for the simulation year (n). The derivation of the dynamic cost-resource curve is followed by an *economic assessment* which includes a transition from electricity generation and saving *costs* to bid and offer *prices* (incl. the selection of the allocation of grid-infrastructure-related and system-related cost of intermittent RES-E generation). The results are finally derived by determining the equilibrium level of supply and demand within each considered market segment on a yearly basis.

In this paper dynamic deployment and economics of intermittent RES-E generation is discussed for the following different cost allocation policies in particular:

- “deep” RES-E grid integration cost approach versus “shallow” cost approach (“shallow”: allocation of grid connection cost as well as grid reinforcement/extension cost to the grid infrastructure and socialisation of corresponding cost via grid tariffs)
- awarding varying capacity credits to wind generation (onshore and offshore) and allocation of corresponding system balancing cost and system reserve capacity cost to different market segments (balancing/wholesale markets, RES-E generators, grid tariffs)

- different depreciation scenarios of RES-E power plants and corresponding grid connection cost in the “shallow” RES-E grid integration cost approach (e.g. addressing the case of re-powering in the future)

Results

The major results derived from **Green*Net*** clearly demonstrate that the degree of unbundling and the implemented allocation principles of different disaggregated cost elements significantly influence dynamic RES-E deployment both on national as well as on EU15 level up to the year 2020.

Moreover, compared to the fully unbundled case (“shallow” RES-E grid integration cost approach; reference case indicating 100% installed RES-E capacity from 2005-2020 (BAU scenario for the EU15)) the allocation of grid-infrastructure-related cost and/or system-related cost (modelled for different capacity credits of wind) to the RES-E generator reduces installed RES-E capacities substantially, see Figure 1.

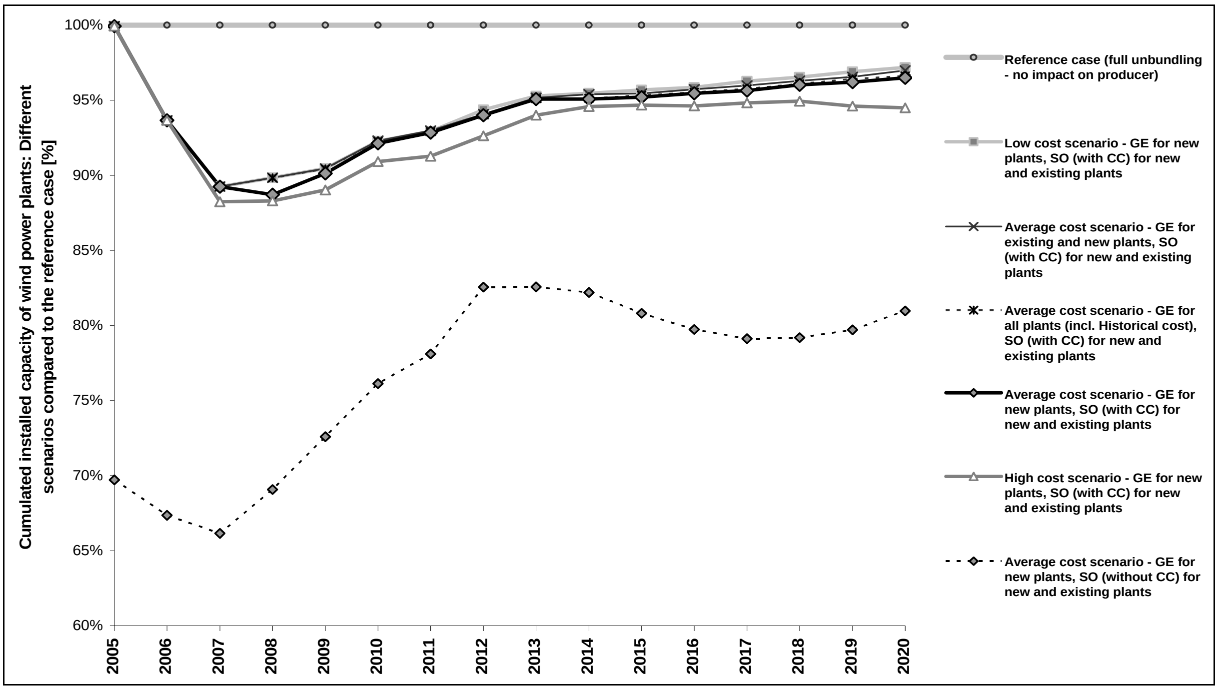

Figure 1. Impact of grid reinforcement/extension cost and system operation cost on cumulated installed RES-E capacities compared to the reference case (full unbundling, “shallow”) on EU15 country level. Legend: GE = Grid reinforcement/extension, SO = System Operation, CC = Capacity Credit

Conclusions

The major conclusion is that serious unbundling and correct allocation of RES-E related grid/system integration cost in the EU Member States are preconditions to guarantee the fulfilment of the ambitious EC goals on future RES-E deployment with minimal costs for European citizens.

References

Auer, H., Huber, C., Resch, G., Faber, T. and Obersteiner, C. (2005): “Action plan for an enhanced least-cost integration of RES-E into the European grid”, *Project Report, WP10*, available online: www.greennet.at.

Auer, H., Huber, C., Faber, T., Resch, G., Obersteiner, C., Weissensteiner, L. and Haas, R. (2006): ‘Economics of large-scale intermittent RES-E integration into the European grids: analyses based on the simulation software Green*Net*’, *Int. J. Global Energy Issues*, forthcoming.