## [MODELLING OF CROSS-BORDER AUCTIONS]

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## Overview

As part of the European Green Deal (cf. EC, 2019), the EU's ambition regarding its energy and climate targets has been raised: the European Union (EU) now aims at full climate-neutrality of all sectors by 2050 and, following that, the European Commission (EC) updated the 2030 GHG reduction target to (at least) 55%, cf. (EC, 2020a,2020b). In consequence, one may expect an increase in electricity demand driven by sector-coupling driven by the overall decarbonization objective of the whole EU economy and a further boost towards renewables across all parts of the energy sector, cf. EC, 2020c. Within the electricity sector, renewables are expected to dominate electricity supply post-2030, requiring high shares of wind and photovoltaics in the power system and dispatchable (RES) technologies to balance the fluctuating generation patterns of wind and PV.

Since renewable resources differ across the EU, cooperation between MS and at the EU level is crucial, helping to make promising RES potentials in certain parts/areas also available to neighbouring regions within the EU and facilitating overall energy and climate target achievements. Cooperation is generally characterized by shared efforts and risks, cost-optimized investments over all countries instead of separate, national strategies and high shares of energy trading (physically or statistically), cf. (Boie et al., 2020). To facilitate RES cooperation, a variety of cooperation mechanisms have been defined in EU regulation in prior, cf. (EC, 2009) or (EC, 2018a). In recent years, only limited progress has been achieved concerning cooperation in the field of RES across the EU – i.e. as stated in (EC 2020d) currently, four binational agreements have been made to collaborate on 2020 RES target achievement. Further agreements can, however, be expected in the 2020 context and beyond. Thus, cross-border cooperation on renewables is currently prominent on the agenda of many MSs and at the aggregated level since the EC is strongly encouraging MSs to make of these cooperation mechanisms, for example, using cross-border or EU-wide RES auctions, for achieving RES targets for 2020, 2030 and beyond in a cost-effective manner, cf. (EC, 2020d).

This paper investigates how RES cooperation in cross-border auctions impacts and contributes to reaching the European RES targets.

## Methods

## This analysis builds on modelling works undertaken using TU Wien’s Green-X model, a specialized energy system model with proper incorporation of various RES policy approaches linked via soft model coupling to the complementary power system model (the open-source model Balmorel). Green-X delivers the first picture of future RES developments under distinct energy policy trends and costs assumptions, indicating details on technology trends (investments, installed capacities and generation) and the geographical distribution of RES deployment as well as related costs (generation cost) and expenditures (capital, operation and support expenditures). For assessing the interplay between RES and the future electricity market, Green-X was complemented by its power-system companion Balmorel. Thanks to a higher intertemporal resolution than in the RES investment model Green-X, Balmorel enables a deeper analysis of the merit order effect and corresponding market values of the produced electricity of variable and dispatchable renewables and, therefore, sheds further light on the interplay between supply, demand and storage in the electricity sector.

Our modelling allows us to conduct a feasibility check of planned RES use by 2030 following the requirements arising from increased RES ambition under the European Green Deal, followed by identifying the need for RES cooperation.

Two distinct scenarios were developed:

• National perspective / without RES cooperation: This scenario aims to reflect the national perspective following Green Deal needs and, similar to above, a 2030 RES target fulfilment using domestic RES only (named “Without Cooperation”).

• European perspective / with RES cooperation: The other scenario offers an EU perspective for meeting the required increase of the RES shares following the European Green Deal, and, accordingly, a proactive use of cooperation mechanism (named “With Cooperation”) to allocate RES investments across the entire EU cost-effectively.

## Results & Conclusions

**Green Deal needs: a substantial increase of the RES ambition at short notice (by 2030) causes a strong demand for RES cooperation across the whole EU**

The EU Green Deal and the corresponding increase in the 2030 climate ambition will require a significantly stronger RES uptake at short notice. Following (EC, 2020c), we predicted an increase of the 2030 EU RES target to (at least) 40%. Modelling revealed that without RES cooperation, only an EU RES share of 37.8% appears feasible, whereas, with RES cooperation, the planned deployment (40%) can be reached. Thus, the conclusion can be drawn that under these new framework conditions, EU-wide RES cooperation appears essential for achieving a more robust RES uptake at short notice (i.e. by 2030).

**Impacts of RES cooperation: facilitating the (renewable) energy transition and lowering the related cost**

Apart from the above-identified needs for RES cooperation, there are several benefits of RES cooperation: Firstly, RES cooperation facilitates a levelling of country-specific risk for RES investors. Secondly, a (more) fair effort sharing can then be triggered by RES cooperation. Thirdly, it can be expected that this lowers the overall cost of reaching ambitious future RES targets.

Modelling revealed that, within this decade (up to 2030), the bulk of support expenditures for RES in the electricity sector will be dedicated to those RES systems installed until 2020. New RES installations being deployed in forthcoming years are expected to come at lower cost (compared to past RES installations) and consequently require less financial support, thanks to technological progress achieved and expected in the forthcoming years. RES cooperation and a selection of an appropriate policy approach can then help to lower the policy cost further:

* RES cooperation can help to lower the cost burden significantly. By the assumed full use of RES cooperation (done, e.g. via EU-wide or cross-border RES auctions) at the EU level, support expenditures for new RES installations (i.e. installed post-2020) can be reduced by 23% to 38% percentage points compared to default case where no such cooperation was presumed.
* The other key parameter is the selection of an appropriate policy framework: Here, our modelling reveals that targeted policies offering technology-specific incentives tailored to individual needs, done, e.g. by use of dedicated RES auctions for feed-in premiums, appear highly beneficial for triggering a cost-effective uptake of RES in the electricity sector. Cost savings in the range of 28% to 42% have been identified when comparing average support under targeted RES policy approaches (e.g. RES auctions) with umbrella policy approaches (e.g. technology-neutral RES quotas with certificate trading).

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