D6.3-HU, August 2020

Proposal for a cross-border auction design for Hungary

A cooperation case study

AURES II has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 817619

D6.3-HU, August 2020, Proposal for a cross-border auction design for Hungary

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Submission date: August 2020 (M22)
Project start date: 01 November 2018
Work Package: WP6
Work Package leader: Navigant

Dissemination level: PU (Public)

This case study is hypothetical, it does not present Member States preferences and it implies no actual commitment of Member States to participate in the cross-border auctions.

Contents

1 Introduction

The European Union encourages cross-border cooperation to help ensure that member states meet their renewable energy targets cost efficiently. One such mechanism is opening a national renewable auction scheme for projects in other member states. Besides being an attractive option for governments having difficulties to meet their renewable targets, renewable electricity (RES-E) developers in countries with more abundant renewable potential have wider opportunities to access financial support. In this way, well-designed cooperation agreements can benefit both parties and reduce the overall support payments needed. Despite this, a cross-border auction has only been implemented once, a mutual opening pilot scheme between Denmark and Germany in late 2016.

The instrument can also serve as a solution to correct for the unequal treatment of domestically produced and imported renewable electricity, when support levies on consumed energy are paid to finance the promotion scheme but only domestic renewables can benefit from the support. As an example, Hungary committed to open its domestic support scheme to outside member states to meet the requirements of the State Aid Decision related to its renewable electricity support system.[1]

The aim of this report is to assist Hungarian policy makers in setting up cross-border auction(s) with prospective partners considering the most important aspects to take into consideration in their design and the factors influencing the outcomes, through a hypothetical cooperation with Slovakia. The study builds on the AURES case study D6.1 on the design options for cross-border auctions (Blücher et al. 2019).

The structure of the paper is as follows. Chapter 2 describes the basic types of cross-border auctions, the rationale behind setting up such partnerships and the expected outcomes. Chapter 3 provides a brief overview of the Hungarian electricity sector and the state of renewable electricity deployment, also touching upon the current developments in renewable support policy and the relevant regulatory framework behind cross-border auctions. Chapter 4 explores the considerations of the government in framing a cross-border cooperation and the implications of current energy policy priorities, including the potential types of relationship and the factors influencing the selection of partner countries. Chapter 5 presents the results of Green-X modelling that quantifies the expected effects of cooperation with various prospective partners on the RES-E generation mix and the level of support costs in the participating countries. Chapter 6 assesses the factors playing a role in a cooperation with the candidate partner countries. Chapter 7 examines how the tender design elements would be adapted to the cross-border relationship with Slovakia, the hypothetical partner country selected. Chapter 8 reviews the aspects to be considered in setting up the cooperation agreement. The last section provides a summary.

[1] C(2017) 4988 final, State Aid SA.44076 – Hungary, Aid for electricity production from renewable energy sources (METÁR),

2 Basic models of cross-border auctions, possible benefits and price-influencing factors

This chapter presents the basic types of cross border auctions referring to Blücher et al. (2019). It also explores the economic rationales for cross-border relationships and draws attention to regulatory, market and social factors that shape investment costs in the participating countries.

2.1 Basic forms of cross-border auctions

Before engaging in a cross-border auction, partner countries must conclude a *cooperation agreement*, agreeing on the most important conditions for supporting renewable electricity in each other's country. The agreement should specify the rules related to the responsibilities and liabilities of the involved authorities and investors, the exchange of information, and the method of allocating support costs and statistical benefits among the partners.

According to the intensity of cooperation, there are three basic models of cross-border auctions: unilateral, mutual, and joint auctions.

In case of ***unilateral opening***, a share of the support to be auctioned by the contributing country is offered to renewable projects to be developed in other countries.

Under the ***multilateral model***, partner countries both implement their own cross-border auctions allowing developers in the other country to participate.

To organize ***joint auctions***, the participating countries need to agree on all elements of the auction design and determine a rule for allocating the statistical attribution of renewable generation.

While in case of the unilateral and multilateral cross-border auctions the partner countries can rely on their own auction systems with some modifications, under the joint model either a new scheme is set up with the participation of both countries, or the scheme of one of the countries is chosen, accompanied by an agreement on how to share the support costs and the statistical benefits of renewable generation. This form requires the highest level of coordination, also increasing administrative costs. (Blücher et al., 2019, p. 21-23)

The cooperation agreement concluded between the cooperating countries determines the way the statistical benefits are allocated and transferred to the participating countries. It is possible that the host country requires the supporting country to contribute to the grid connection costs related to winning projects, which can also be achieved by attributing a share of the statistical benefits to the host country.

2.2 Economic rationales and the role of regulatory, market and social factors

The economic rationale behind cross-border cooperation is to increase the cost-effectiveness of renewable support for the participating countries. Investors in the country where the investment takes place (*host country*) can access additional financial support to develop their planned projects. Host member states can benefit from additional investment and job creation, lower import dependency improving security of supply, and reduce air pollution and greenhouse gas emissions. Depending on the technology concerned, transfer of knowledge can contribute to the efficiency of realizing future projects. However, while contributing to the target achievement of another country, these investments might increase the cost of renewable integration and system costs and affect the availability of potential sites for domestic plants.

Member states providing the support (*contributing country*) can benefit from better resource availability, higher market values (higher electricity price) and/or lower cost of capital in the hosting country, which might result in lower support costs. Additionally, increased competition might further decrease bid prices. (For a more detailed discussion see Blücher et al., (2019, p. 12-15).

However when considering partnerships, the possible effects of the differing regulatory and market and social environment must be taken into account. Several studies have investigated how these might shape the investment choices of RES-E developers. Ecofys and Eclareon, (2018) found that extra costs associated with regulatory barriers might counterbalance the savings from utilizing better natural potential in case of a cross-border auction. The next table outlines these factors (mostly based on Ecofys and Eclareon, (2018) and Blücher et al. (2019)).

Table 1 – Factors influencing renewable generation costs in the different countries

Regulatory environment	
Planning and permitting	The related risks include the lack of coordination between authorities responsible for different permits, lengthy administration procedures and non-transparency.
Grid connection and grid usage costs	These costs can differ substantially among countries depending on the grid connection regime, while there are different methods for the allocation of scarce grid connection points. Some countries have also introduced high grid access/usage costs, increasing the levelized cost of production significantly (e.g. in Slovakia).[2]
Corporate taxation	Varying national tax levels result in different cost additions for developers in the respective countries.
Project realization period/risk of non-realization	While the realization period should be long enough to allow the permitting procedure and construction works to be accomplished, longer time periods can induce developers to calculate expected technology cost decrease in their bids. On the other hand, sunk costs from a possible non-realization can drive bid prices down depending on the pipeline of projects waiting for support.
Site restrictions and requirements	These factors can decrease the available locations for RES-E projects and increase investment costs. More and more countries consider banning the location of PV plants on lands suitable for agricultural production. In Hungary, wind technology is practically banned by strict technical and siting conditions. [3]
Market conditions	
Financing conditions	Financing conditions are influenced by market conditions, although they reflect perceived political and regulatory risks. The level of financing costs largely affects the levelized cost of electricity (LCOE).
Market value	If the reference price used to determine the premium of a winning project is linked to a market with higher prices, the contributing partner might benefit from the reduced support costs.
National schemes and alternative options	Alternative options for receiving support might exist in both participating countries, including the more predictable, administratively set FIT/FIP schemes for smaller installations, corporate PPAs, and various types of domestic auction-based schemes (e.g. technology specific auctions). These options might reduce the number of participants, and thus the level of competition in auctions.
Domestic competition	Opening national auctions can increase the intensity of competition for both

[2] https://spectator.sme.sk/c/20889059/slovakia-is-revamping-support-of-renewable-energy-sources.html
[3] More on the regulation of wind in Hungary can be read at: https://rekk.hu/research-paper/54/from-where-does-it-blow

	countries, helping to achieve lower prices. Investors from the country enjoying the higher level of competition with a bigger project pipeline are likely to win in the auction.
Balancing costs	Different balancing market conditions entail varying levels of costs that developers need to account for when planning their investments.
Social aspects	
Public perception	Negative public acceptance can make it harder, or even impede the realization of RES-E projects in the hosting country. Public concern can also arise in the contributing country due to financing RES-E projects implemented in foreign countries.

3 State of RES-E deployment and the regulatory context of cross-border auctions in Hungary

This section provides an overview of the evolution of Hungary's renewable electricity deployment according to technology and share in gross electricity consumption. It also presents the regulatory context related to cross-border cooperation for RES-E.

3.1 State of RES-E deployment

The total electricity supply in Hungary amounted to 45.9 TWh in 2018, of which 14.3 TWh (31 percent) was imported. Nuclear energy makes up more than half of total domestic power generation followed by natural gas (24 percent) and lignite (15 percent).

Figure 1 shows the evolution of renewable generation in Hungary in the period 2004 – 2018. RES-E deployment was led by solid biomass (about 50%), with wind (18%) and then solar (16%) and other sources (mainly renewable waste) making relative gains.[4] Renewable electricity reached 8.3 percent of gross final consumption in 2018. While wind development halted in 2011 due to regulatory restrictions, solar energy has boomed recently owing to declining cost of technology.

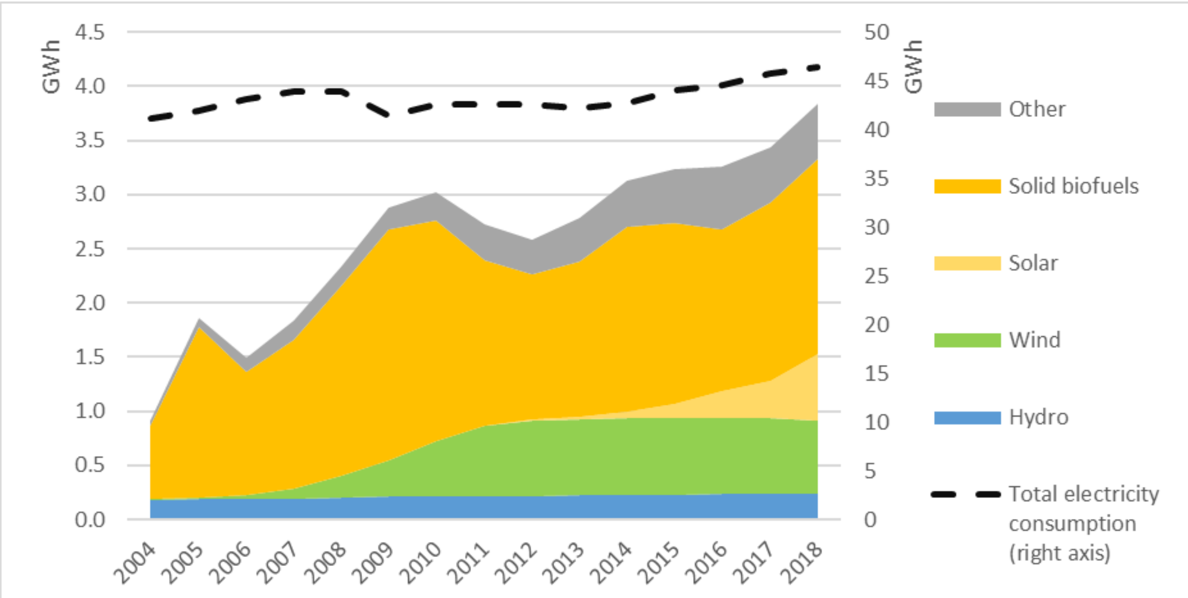

Figure 1: Renewable and gross final electricity consumption in Hungary, 2004-2018, Source: REKK figure based on Shares database, Eurostat, 2019

Hungary's renewable support system transitioned from a feed in tariff system to an auction system in 2017. Under the new support scheme, small power plants below 0.5 MW can apply for FIT and mandatory off-take of their generation, plants between 0.5 and 1 MW are eligible for a feed-in premium, while generating facilities above this size have to compete for support in auctions, granted in the form of two-sided feed-in-premium. However, due to the high initial interest, funds are no longer available in the two small size categories until the end of the current support scheme in 2026 and installations from 0.3 MW can apply for support only in auctions. As of 1 May 2019, premium support can be granted only via competitive procedures (except for demonstration projects, which can receive FIT support, and the so-called brown premium[5]).

[4] Shares database, 2018, https://ec.europa.eu/eurostat/web/energy/data/shares

[5] The so-called brown premium applies to existing biomass or biogas fired power plants in order to ensure their further operation. Entitlement for brown premium is determined by the Hungarian Energy and Public Utility Regulatory Authority (MEKH) at the request of the producer.

The first pilot renewable auction took place at the end of 2019, allowing renewable energy developers to bid in two distinct size categories (0.3 – 1 MW and 1 – 20 MW) eligible for a combined HUF 1 billion for up to 66 GWh/year and 134 GWh/year respectively. This pay-as-bid auction supported 193 GWh/year RES-E generation with some HUF 58 million (EUR 166.5 thousand) gained by winning projects[6]. The weighted average prices received in the auction were EUR 70 and EUR 61 per MWh for the two size categories respectively[7], a positive result compared to the preceding level of administrative FIT in Hungary, but still high compared with the auction outcomes in some other EU countries. Deliverable D2.2-HU of the AURES II project provides detailed information on the Hungarian auction design and the results of the bidding process (Bartek-Lesi et al., 2020).

3.2 Regulatory context

The Renewable Energy (RED I) Directive[8] and the revised RES Directive (RED II)[9] provide for various cooperation mechanisms, including statistical transfer, joint projects and joint support schemes, with RED II specifying additional conditions related to the opening of national support schemes to RES-E generators in other countries[10]. The Hungarian government has not yet considered these opportunities being confident that it will meet its 2020 renewable target. Nevertheless, Hungary has an obligation to open its support scheme to other member states in compliance with the provisions laid down in the State Aid Decision applying to its renewable electricity support.[11]

According to the decision, Hungary committed to offer a share of the support allocated under the METÁR system to non-domestic RES producers. The minimum share offered would be calculated as the ratio of total renewable energy imports (determined by adding up the volumes of imported electricity times the RES-E shares in the neighbouring countries) to the annual electricity supply in Hungary. This percentage will be updated annually based on previous years' values (or of the last year for which data are available). The Hungarian Energy and Public Utility Regulatory Authority (MEKH) published the following percentages for the first four years of the support scheme period: 11.5% in 2017, 11.7% in 2018, 11.7%in 2019 and 13.7% in 2020.[12]

The developers of neighbouring member states can apply for subsidies only if an intergovernmental agreement has been signed previously by the two partner countries. Another condition is that renewable electricity produced by installations outside of Hungary must be physically imported into the country. Since electricity flows are difficult to trace across borders, the decision states that bilateral contracts with the producer or the importer, rights to interconnection capacities, or electricity import scheduled in the day ahead market can serve as evidence.

Government Decree No. 299/2017 includes provisions related to the obligation to open the support scheme, establishing that supporting renewable installations located in foreign countries must be based on reciprocal governmental agreements. This rules out a unilateral auction opening, whereby only Hungary would open its auction to host RES-E project developers located in a cooperation country. The decree also specifies that the terms and conditions applicable to developers in the partner country cannot be less stringent than the ones set for domestic bidders. Although these terms and conditions are not specified precisely, it is a question how they all could be harmonized, and at what administrative cost.

The first pilot tender conducted in the period between November 4 and December 2 of 2019, has not yet been

[6] The annual support cost was estimated using the preliminary market reference price laid down in the auction announcement note.
http://www.mekh.hu/download/f/8e/b0000/metar_kiirasi_dokumentacio_20191028_korrekturaval.pdf
[7] The EUR values were calculated using the average HUF/EUR exchange rate for the period 04.11.2019 – 02.12.2019, based on the data of the Hungarian National Bank, https://www.mnb.hu/arfolyam-lekerdezes
[8] 2009/28/EC, Articles 6-11
[9] 2018/2001/EU, Articles 8-14
[10] 2018/2001/EU, Article 5
[11] C(2017) 4988 final, State Aid SA.44076 – Hungary, Aid for electricity production from renewable energy sources (METÁR)
[12] http://www.mekh.hu/download/9/2a/c0000/metar_megnyitas_celerteke_2020_majus.xlsx

opened for non-Hungarian developers, as the government intended to gain experience first with conducting RES auctions. MEKH is the organizer of the renewable auctions at the request of the Ministry for Innovation and Technology. The Ministry will specify the share of support[13] offered to foreign projects according to the method laid down in the State Aid Decision.

The total amount to be made available for developers outside the borders has to reach the sum of yearly averages determined in the validity period of the Hungarian support scheme (2017-2026). Thus, the goal can be reached either by offering the relevant share of the support budget in regular auctions, or by organizing separate cross-border auctions with the participation of foreign bidders. It is important to note, that the obligation to open the support scheme to RES-E developers in other countries is met even if no projects outside of the border are awarded in the auctions.

[13] The support payments to be considered include the support paid out under the feed-in tariff and feed-in premium systems under the Hungarian support scheme (METÁR) but excludes the sums granted to biomass and biogas plants in the form of brown premiums. For further information on these forms of support see the AURES case study on the Hungarian RES auction (2020).

4 Factors influencing the set-up of cooperation

4.1 Considerations of the government

Based on the interviews with representatives of the competent Ministry[14] the Hungarian government aims for its energy policy preferences as well as its broader economic and political considerations to be reflected in the cooperation agreement. As regards energy policy, one of the most important goals is to increase the security of supply. In this respect, it would be most beneficial to cooperate with neighbouring countries sharing physical connections with Hungary.

Political considerations include maintaining or improving good diplomatic relations with partner countries, while ensuring the social acceptance of financing projects built outside of Hungary.

As regards natural endowment, Hungary has strong geothermal potential, though investments are still limited. Solar irradiation is also relatively strong, but the availability of land for PV plants can become constrained with the country's commitments to increase PV deployment, and the growing concerns over the use of greenfield (as opposed to brownfield) sites. One of the general economic policy objectives is to concentrate on activities that Hungary can exploit to its relative advantage in terms of technological capabilities, like geothermal energy where significant professional experience has been developed but only small-scale projects have been realized so far due to the high risks and associated costs.

Timing is another important issue for the implementation of cross-border auctions. As explained above, the sum of annual support shares calculated for the period of 2017-2026 must be offered to non-domestic project developers. Following the pilot auction, the Ministry is planning two further auction rounds in 2020. Still, talks with potential partners have not been initiated and support for foreign projects is conditional to the conclusion of intergovernmental agreements. According to the representatives of MEKH, the time needed to conclude such agreements suggests that no cooperation will take place before 2021. Investors in other countries also need time to prepare for participating in the auctions of the partner member state.

As regards the timing of realization, there are trade-offs policymakers need to consider. Declining costs of renewable technologies should be reflected in auctions, further supporting the idea to prolong cooperation by shifting the opening towards the end of the committment period (i.e. 2025, 2026). However, technology costs are not the sole determining factor of project costs, and other conditions such as scarcity of area available for new projects, opposition of residents, and network congestion can increase costs over time for countries with higher renewable penetration. One example currently is on-shore wind projects in Germany[15]. Another argument in favour of starting cooperation earlier is that the percentage of RES-E generation to be supported will grow with the expected increase of renewable penetration in neighbouring countries. On the other hand, experience with cross-border auctions is very limited, and thus, countries entering into such cooperation later may benefit from learning from the practices of other countries.

4.2 Impact of existing national policies

One of the conditions set by the above-mentioned regulatory framework is to ensure a level playing field for domestic and non-domestic projects. This, however, would be impossible to achieve and is in fact the justification for countries to enter into these agreements in the first place. Heterogenous natural resources and policies help explain cost differentials and provide potential for harnessing cross-border auctions.

As shown earlier, differing national regulatory, technological and market environments can strongly influence investment costs. Apart from the share of auctioned volumes offered to non-domestic bidders, the overall

[14] Hungarian Ministry for Innovation and Technology

[15] see Sach et al (2019) and https://www.windpowermonthly.com/article/1687615/lacklustre-participation-german-wind-tender-prices-hold-steady

volume and frequency of auctions also affect the level of competition and the prices achievable.

Hungary, for example, prefers promoting PV installations in its territory while inhibiting the development of wind projects. Thus, if the possibility to promote wind projects outside of the borders is not ruled out, a non-domestic wind project can submit lower bids than some Hungarian PV developers, resulting in lower support costs.

4.3 Type of cross-border auction

Keeping the administrative costs the lowest as preferred by the Hungarian government could be achieved by unilateral openings, whereby Hungary would only participate as a contributing country (providing support) without requiring the cooperating partners (host countries) to open their support schemes for Hungarian projects. However, for diplomatic reasons and to enhance social acceptability, the reciprocity of cooperation is prescribed in Government Decree No. 299/2017.

Within the reciprocal types of cooperation, a mutual opening will be preferred to the much more complex joint auctions, where existing national auction rules can be applied with some small modifications and cooperation effort, making it less administratively demanding.

4.4 Considerations related to partner selection

As mentioned above, without signed cooperation agreements in place a support scheme is not expected before 2021. The neighbouring countries that would be considered as possible partners include Ukraine, Slovakia, Austria, Slovenia, Croatia, Serbia and Romania.

When deciding about potential partners, the following aspects are to worth considering:

Experience with auctions: So far, Poland, Hungary and Slovenia are the only CEE countries to execute renewable auctions while Slovakia, Croatia and Ukraine are in the process of setting up their pilot auctions. Slovakia launched a competitive bidding process in February 2020, but the auction was cancelled in April because of the COVID-19 pandemic (Wigand et al. 2020). Croatia has launched the first, 'Expression of Interest Public Call' phase of its two-stage auction process in the beginning of August 2020, which will be followed by the actual tender process in two months. Ukrainian auctions, originally intended to be launched in 2020, will be technology specific. Austria, Romania and Serbia are planning to set up their auction schemes in upcoming years.

Opening obligation: Of these countries, only Hungary and Romania have to make their support budget partially available to RES-E producers in other countries. Romania is transitioning from its current green certificate system to a support scheme providing feed in premiums through auctions in 2021 thought no information is available yet on the planned auction design.[16]

Capital cost level: According to the results of Ecofys et al. (2017), the weighted average cost of capital in Hungary is 1-2% higher than in its neighbouring countries. While in Hungary, investments in PV projects are characterized with WACC 7.3-8.75%, in Slovakia the cost of capital ranges between 4.5-6.0%, in Romania it is about 7.3%, and in Croatia 7.6%. For Austria, the Diacore project found it was 6.5% in 2016. In Serbia, the cost of equity is around 14.5% and the cost of debt is 4.6% (NewClimate Institute, 2019), which corresponds to a WACC close to 10% with 50-50% debt and equity shares. IRENA (2017) uses an average of 8% WACC for South-Eastern European member states and 10% for SEE countries outside of the EU. For Ukraine, the study assumes that the cost of capital for RES-E projects (except hydro) falls between 14-18%. The higher cost of capital in non-EU countries is explained by the higher level or risks associated with the implementation of RES-E projects. In this respect, Hungary should consider cooperation with its EU member state neighbours.

Current level of support / auction results: Concerning the level of project costs and the required support level,

[16] Schoenherr (2019), Roadmap20, https://www.schoenherr.eu/fileadmin/user_upload/roadmap20.pdf

auction prices are better indicators of actual costs than Feed-in Tariffs since they are formed through a competitive process. As mentioned already, from among the countries in the region (besides Hungary), only Poland and Slovenia have implemented renewable auctions. Although Poland is not a direct neighbour of Hungary, its auction results might also serve as a kind of benchmark, reflecting possible outcomes in the region. Poland offers a two-sided premium (CfD) for auction winners, similarly to Hungary[17]. In the last auction, a weighted average price of EUR 74.4/MWh for small-scale projects (under 1 MW) was reached, versus EUR 74.3 received in Hungary in the same size category, while the average price obtained in the large-size category was substantially lower than in Hungary (EUR 48.7/MWh, compared to EUR 65/MWh)[18]. The most important difference was the inclusion of onshore wind projects in Poland. In Slovenia, the average price offered by winning projects in the last auction was EUR 66/MWh (IRENA, 2019, p. 80), which is closer to Hungarian prices. However, the sliding premium applied in Slovenia is one-sided. Although no auctions have been conducted in Croatia yet, the first unsubsidized wind farm (58 MW) has been connected to the grid and will enter full operation in August 2020[19].

Electricity price level and market value: As the next figure shows, average annual day-ahead prices in Germany, Austria and Slovakia are lower than in Hungary and similar in Croatia, Romania and Slovenia. Prices fell from 2018 to 2019 (with the exception of Romania) mainly due to higher renewable penetration and lower gas and coal prices[20]. This also shaves peak prices, affecting the market value of renewables. As a contributing partner, Hungary can only benefit from greater market value cooperating with countries that have higher market prices. However, Hungarian authorities might also decide to determine premiums based on a market reference price linked to the Hungarian Electricity Exchange (HUPX). We will elaborate more on this question in Chapter 6.

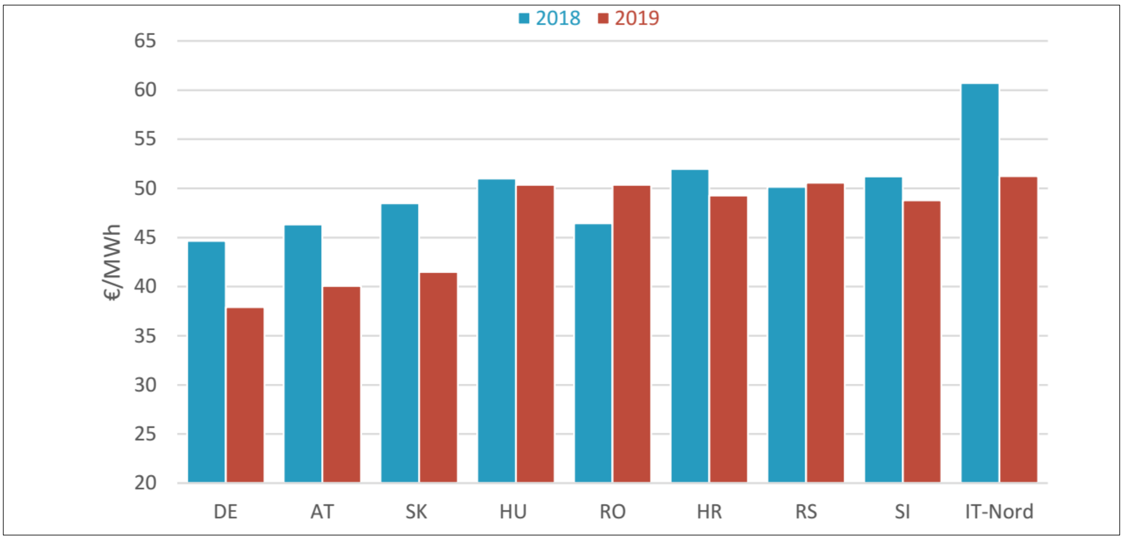

Figure 2: Annual average day-ahead prices in the region, 2018 and 2019, Source MEKH, 2019, based on transparency.entso-e.eu[21]

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[17] Contract for difference (CfD), or two-sided sliding premium means that in case the reference market price is higher than the bidding price of a plant, than the plant has to pay back the difference between them. If a one-sided premium is applied, the support per MWh is zero in this case.

[18] Sources: Diallo, Alfa (2020), Nem fújnak új szelek Magyarországon, https://metazsul.blog.hu/2020/04/17/nincsujszel, April, 2020 and Bartek-Lesi et al. (2020).

[19] HEP starts trial of Korlat, first unsubsidized wind farm in Croatia, Balkan Energy News, May 11, 2020, https://balkangreenenergynews.com/hep-starts-trial-of-korlat-first-commercial-wind-farm-in-croatia/.

[20] Quarterly Report on European Electricity Markets, 2019 https://www.euneighbours.eu/en/east/stay-informed/publications/quarterly-report-european-electricity-markets

[21] MEKH, 2019, Annual electricity market report, http://www.mekh.hu/download/4/0a/c0000/arampiac_eves_riport_2019.pdf, p. 31.

Balancing cost/grid integration costs: Among other factors influencing project costs, the cost of balancing can play a big role in bid levels depending on support requirements. Because the level of balancing costs is relatively high in Hungary compared to countries reaching lower auction prices and is often cited by investors as an important price increasing factor, we looked at its level in the neighbouring countries. As Figure 3 shows, balancing capacity is much cheaper in Austria but about the same in Slovenia and considerably higher in Slovakia and Romania. Thus, as a contributing partner, Hungary could benefit from lower Austrian balancing prices (assuming other costs are similar or lower), while the relatively higher domestic balancing costs would not put Hungarian investors at a disadvantage compared to project developers in Slovakia, Slovenia or Romania.

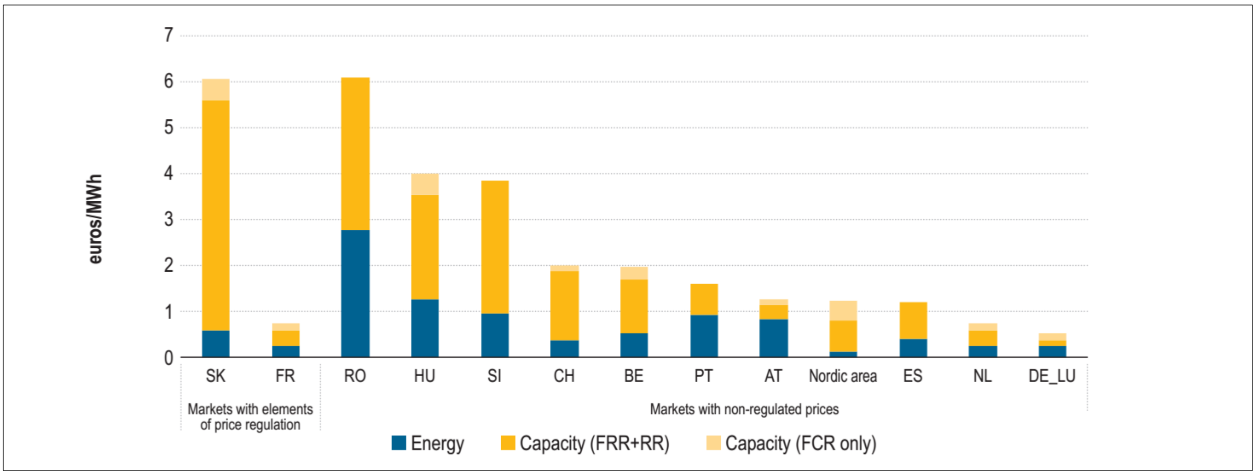

Figure 3: Overall costs of balancing (capacity and energy) over national electricity demand in a selection of European markets – 2017 (euros/MWh), Source: ACER/CEER, 2018, p. 67[22]

Distance from target: Progress towards renewable targets is also a factor for participating in cross-border auctions. The next figure depicts the current RES and RES-E shares in gross final consumption for the neighbouring EU member states. Austria, Romania and Croatia have already achieved their 2020 RES targets and Slovenia is furthest away. However, Croatia and Austria set very ambitious RES-E objectives for 2030, likely making it beneficial to pursue renewable generation at lower costs abroad. The targets of Slovakia and Hungary are moderate, partially as an outcome of their ambitious nuclear energy policies. Countries with strong renewable resources that have already reached their goals might be more willing to participate in cross-border auctions.

Diplomatic relations, political considerations: Based on the interviews with the representative of the Ministry for Innovation and Technology, from among the countries explored, the Hungarian government gives preference to Slovakia, Romania and Austria for intergovernmental agreements based on stable diplomatic relationships.

[22] The cost includes the procurement costs of balancing capacity and the costs of activating balancing energy.

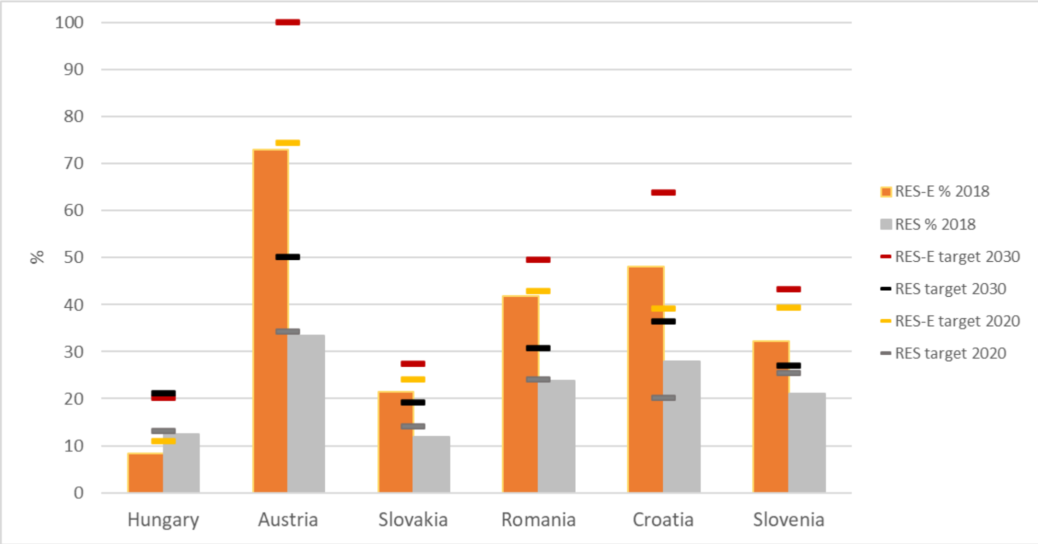

Figure 4: State of renewable deployment and distance from RES and RES-E targets in neghbouring EU member states, Source: REKK figure based on Eurostat's Shares database and NECPs[23]

[23] Shares database, 2018, https://ec.europa.eu/eurostat/web/energy/data/shares, National Energy and Climate Plans: https://ec.europa.eu/info/energy-climate-change-environment/overall-targets/national-energy-and-climate-plans-necps_en#final-necps

5 Modelling results of cross-border auctions with selected countries

This chapter aims to explore possible cross-border auctions between Hungary and selected neighbouring countries using the Green-X model, tailored for energy systems with thorough coverage of support instruments for renewables as well as available resources and corresponding cost of individual RES technologies within Europe.

In general terms, RES cooperation, and specifically a cross-border auction, aims to reallocate RES investments across countries and technologies to maximize their economic impact. This kind of least cost pathway can be instrumental for member states to meet RES or decarbonisation targets.

5.1 Applied approach

TU Wien's Green-X model elaborates how cross-border auctions may facilitate the achievement of targeted RES deployment in the electricity sector up to 2030 as postulated in National Energy and Climate Plans (NECPs) by the assessed EU Member States. Hungary is at the centre of our analysis with neighbouring countries considered as possible cooperation partners.

Two steps help identify the most promising cooperation candidates and assess the impacts arising from cross-border cooperation. The first step is an assumption that all assessed countries form a joint region – a so-called "bubble" – where postulated national 2030 RES targets shall be met jointly. That implies that a regional policy approach would be agreed upon and implemented to allocate RES investments where it is most economically beneficial. The reference case is a continuation of current RES policies to meet the 2030 target only using domestic resources. From a policy perspective this "bubble exercise" can be classified as unrealistic but it helps identify the most favourable cross-border collaboration partners for Hungary.

Thus, building on the lessons learnt from the "bubble exercise", step two involves three different subcases of bilateral RES cooperation between Hungary and neighbouring countries – the so-called "pairing cases". Neighbouring countries are selected according to specific traits: one where Hungary is expected to act as host, one where the opposite situation is likely to occur (i.e. Hungary as off-taker), and a third subcase where it remains unclear from the start how cross-border cooperation may affect future RES investments.

The whole assessment is carried out twice, under high and low energy demand scenarios. This accounts for uncertainty in future demand growth due to underlying drivers like energy efficiency measures and economic stagnation that could reduce aggregate electricity consumption or reflecting strong growth due to electrification and sector coupling where e-mobility is assumed to increase as well as the use of electricity in heating and cooling and for industrial purposes. The expected gross electricity demand trends for selected countries are shown in Figure 5 below. The low demand scenario assumes an average yearly growth of gross electricity consumption by 1.1% for the 2015 to 2030 period for the region as a whole and by 1.4% for Hungary. That leads to a gross electricity consumption of about 275 TWh by 2030 (compared to 233 TWh in 2015) for the defined region. The corresponding average yearly growth rate for the high demand case is 1.4% for the region and 1.6% for Hungary, leading to a regional gross electricity consumption of 287 TWh in 2030.

The differences in electricity demand affect the price formation in the wholesale electricity market. Figure 6 illustrates our assumptions building on a recent electricity sector study with a comparable geographical scope based on REKK's EEMM (Szabo et al. (2020)).

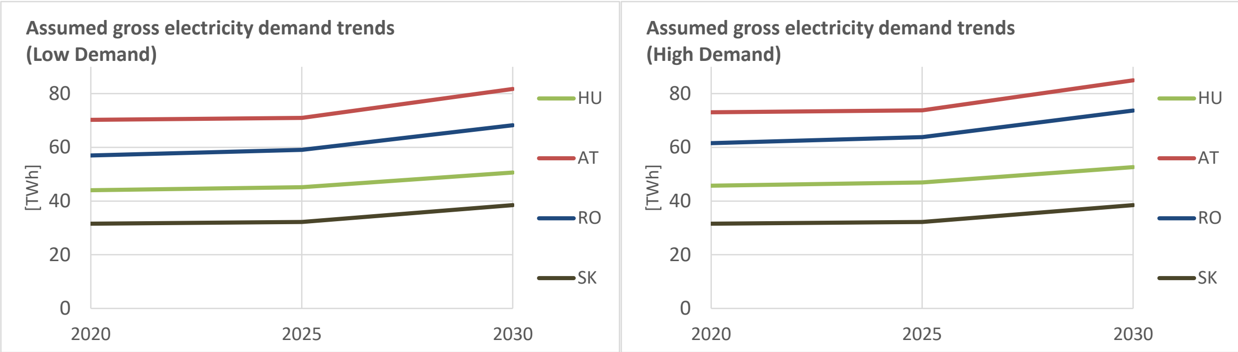

Figure 5: Assumed gross electricity demand trends: Low Demand (left) vs High Demand case (right), Source: Own assessment of TU Wien based on PRIMES reference (EC, 2016)

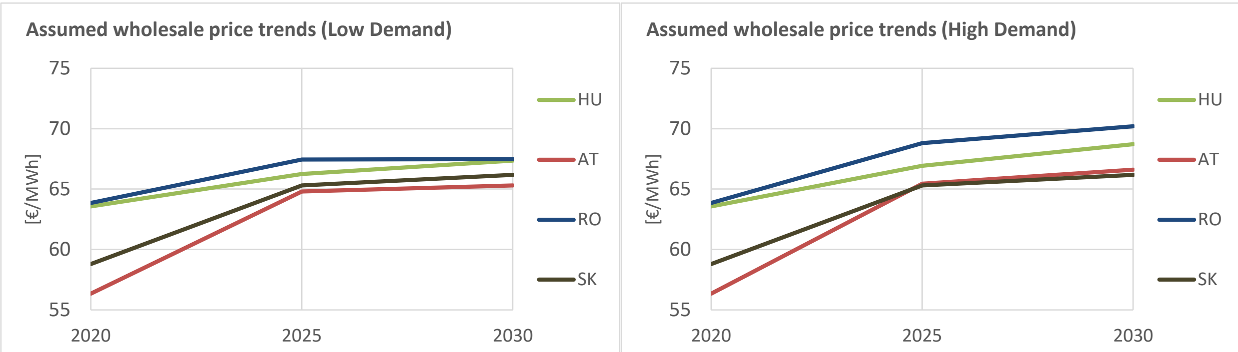

Figure 6: Assumed wholesale price trends: Low Demand (left) vs High Demand case (right), Source: Own assessment of TU Wien based on Szabo et al. (2020)

5.2 Results from the model-based analysis

This section is dedicated to reviewing the results of the model-based analysis concerning the possible implementation of cross-border RES auctions between Hungary and selected neighbours.

5.2.1 Step 1: "Bubble exercise" – a joint regional RES market of Hungary and its neighbours

As outlined above, under the reference scenario current RES policies are implemented to meet national RES targets using only domestic resources. However, the "bubble exercise" forms a regional RES market between Hungary and its neighbours and assumes that national 2030 RES targets will be achieved collectively. Table 2 shows that high and low demand scenarios arrive at the same RES utilization under RES cooperation. Croatia and Romania act as host countries, meaning they achieve a surplus in RES-E generation compared to their own targeted 2030 RES-E deployment, and Austria, Hungary, Slovakia and Slovenia, act as off-taker, counting on (virtual) RES-E imports to achieve a match with planned 2030 RES use.

Table 2: Key results on 2030 RES-E deployment from the “bubble exercise” (i.e. a joint regional RES market of Hungary and its neighbours)

Comparison of results: (Cross-border RES) **Coooperation vs. Reference** (national RES-E target fulfillment)	Unit	Bubble analysis: Austria AT	Croatia HR	Hungary HU	Romania RO	Slovakia SK	Slovenia SI	Region
Targeted RES-E share 2030 (according to NECPs)		92.0%	63.8%	20.0%	49.4%	27.3%	43.3%	
Low Demand case (i.e. low demand growth due to limited economic growth and/or strong energy efficiency)								
Generation balance								
RES-E share 2030								
Reference	%	92.0%	65.0%	20.0%	52.7%	27.3%	43.3%	55.1%
Cooperation	%	89.0%	69.9%	15.2%	56.0%	25.6%	42.8%	54.1%
Deviation (Coop minus Ref)	%	-3.0%	4.9%	-4.8%	3.2%	-1.8%	-0.4%	-0.9%
+...Export, -...Import (both virtual)								
RES-E generation 2030								
Reference	TWh	75.20	12.00	10.13	35.96	10.52	7.34	151.16
Cooperation	TWh	72.76	12.90	7.70	38.16	9.85	7.27	148.64
Deviation (Coop minus Ref)	TWh	-2.44	0.90	-2.43	2.20	-0.68	-0.07	-2.52
+...Export, -...Import (both virtual)	Exchange volumes:	3.1 TWh						
High Demand case (i.e. high demand growth due to strong sector coupling and enhanced electrification)								
Generation balance								
RES-E share 2030								
Reference	%	92.0%	65.2%	20.0%	50.9%	27.3%	43.3%	54.7%
Cooperation	%	87.8%	70.1%	16.6%	56.0%	25.8%	42.7%	54.3%
Deviation (Coop minus Ref)	%	-4.2%	4.9%	-3.4%	5.1%	-1.6%	-0.6%	-0.5%
+...Export, -...Import (both virtual)								
RES-E generation 2030								
Reference	TWh	78.14	13.00	10.55	37.46	10.52	7.56	157.24
Cooperation	TWh	74.57	13.98	8.75	41.22	9.92	7.46	155.91
Deviation (Coop minus Ref)	TWh	-3.58	0.98	-1.80	3.76	-0.60	-0.10	-1.33
+...Export, -...Import (both virtual)	Exchange volumes:	4.7 TWh						

Evaluation: Cooperation characteristics	AT	HR	HU	RO	SK	SI
Low Demand case						
High Demand case						

Source: Own analyses of TU Wien (Green-X modelling)

The “bubble exercise” shows favourable bilateral cooperation cases from a Hungarian perspective. The analyses performed and results derived within this subsequent step are discussed in the follow-up section.

5.2.2 Step 2: "Pairing cases" – assessment of bilateral cross-border auctions between Hungary and selected neighbours

Building on the lessons learnt from the "bubble exercise", the next step applies three different subcases of bilateral RES cooperation between Hungary and a neighbouring country.

Table 3: Key results on 2030 RES-E deployment from the "pairing cases" (i.e. bilateral cross-border auctions between Hungary and selected neighbours)

Comparison of results: (Cross-border RES) **Coooperation vs. Reference**	Unit	Pairing cases								
		Hungary	Austria	Region	Hungary	Romania	Region	Hungary	Slovakia	Region
		HU	**AT**	**Region**	**HU**	**RO**	**Region**	**HU**	**SK**	**Region**
Targeted RES-E share 2030 (according to NECPs)		20.0%	92.0%		20.0%	49.4%		20.0%	27.3%	
		Low Demand case (i.e. low demand growth due to limited economic growth and/or strong energy efficiency)								
Generation balance										
RES-E share 2030										
Reference	%	20.0%	92.0%	64.5%	20.0%	52.7%	65.9%	20.0%	27.3%	23.2%
Cooperation	%	21.1%	91.3%	64.5%	13.8%	53.0%	63.9%	19.5%	27.9%	23.2%
Deviation (Coop minus Ref) +...Export, -...Import (both virtual)	%	**1.0%**	**-0.7%**	0.0%	**-6.2%**	**0.2%**	-2.0%	**-0.5%**	**0.6%**	0.0%
RES-E generation 2030										
Reference	TWh	10.13	75.20	85.33	10.13	35.96	46.09	10.13	10.52	20.66
Cooperation	TWh	10.66	74.63	85.29	7.51	37.18	44.68	9.89	10.76	20.66
Deviation (Coop minus Ref) +...Export, -...Import (both virtual)	TWh	**0.53**	**-0.57**	-0.04	**-2.63**	**1.22**	-1.41	**-0.24**	**0.24**	0.00
		High Demand case (i.e. high demand growth due to strong sector coupling and enhanced electrification)								
Generation balance										
RES-E share 2030										
Reference	%	20.0%	92.0%	64.4%	20.0%	50.9%	67.3%	20.0%	27.3%	54.7%
Cooperation	%	22.1%	90.7%	64.4%	15.2%	52.9%	65.8%	19.9%	27.5%	23.1%
Deviation (Coop minus Ref) +...Export, -...Import (both virtual)	%	**2.1%**	**-1.3%**	0.0%	**-4.9%**	**2.0%**	-1.5%	**-0.1%**	**0.2%**	-31.6%
RES-E generation 2030										
Reference	TWh	10.55	78.14	88.69	10.55	37.46	48.01	10.55	10.52	21.07
Cooperation	TWh	11.65	77.04	88.69	7.98	38.94	46.92	10.47	10.60	21.07
Deviation (Coop minus Ref) +...Export, -...Import (both virtual)	TWh	**1.11**	**-1.11**	0.00	**-2.56**	**1.47**	-1.09	**-0.07**	**0.07**	0.00

Evaluation: Cooperation characteristics	HU	AT	HU	RO	HU	SK
Low Demand case						
High Demand case						

Source: Own analyses of TU Wien (Green-X modelling)

Key results on the expected use of renewables in 2030 under both distinct policy cases are shown in Table 3 for both underlying demand trends (Low vs High Demand case). Similar to the "bubble exercise", under both demand trends an identical picture arises concerning the impact of RES cooperation. The three pairing cases are modelled and discussed in further detail below.

Case 1: Cross-border RES auctions between Hungary and Austria: Hungary acting as host

As can be seen from Table 3, in bilateral cross-border RES auctions between Hungary and Austria the former would act as host country and the latter as off-taker. Figure 7 shares more detailed information about the corresponding policy cost exemplified by means of support expenditures.

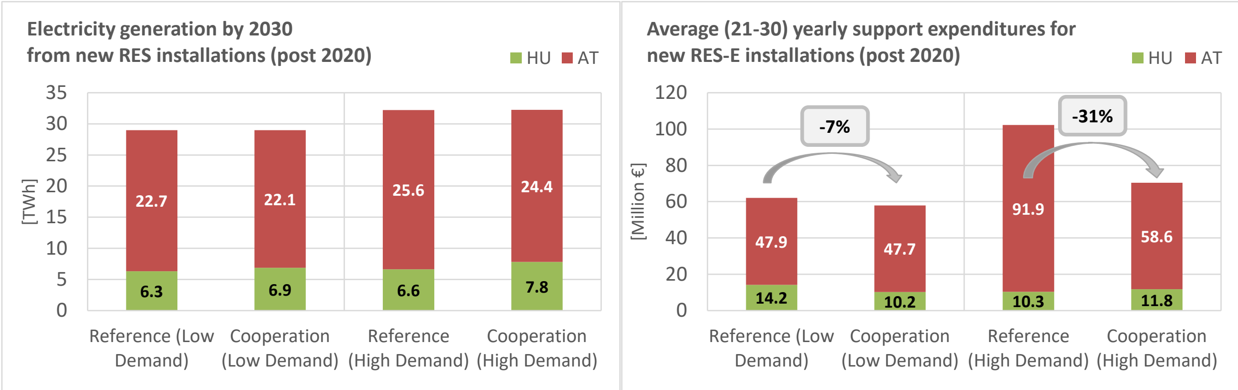

Figure 7: Impacts of cross-border RES auctions between Hungary and Austria on the deployment of new RES-E installations (post 2020) (left) and on the corresponding support expenditures (right), Source: Own analyses of TU Wien (Green-X modelling)

The results indicate that only a minor part of the RES uptake in the electricity sector is affected by cross-border RES cooperation, which is stronger in the High Demand scenario.

In the Low Demand scenario, 2030 RES-E generation from new installations (post 2020) increases from 6.3 to 6.9 TWh in Hungary, a rise by 0.6 TWh. Accordingly, RES-E generation from new plants declines from 22.7 to 22.1 TWh in Austria. Under the High Demand scenario, the change in country-specific RES-E generation is 1.2 TWh.

When comparing the policy cost of support expenditures to refinance the uptake of renewables in both countries until 2030, it is clear that RES cooperation leads to more savings compared to the reference (Figure 7 (right)). Similar to RES-E deployment, savings are significantly greater in the high demand growth scenario at the aggregated level,[24] 31% compared to 7% in the Low Demand scenario.[25] A closer look at the distribution of costs indicates that Austria would largely benefit from the assessed cross-border cooperation.

Case 2: Cross-border RES auctions between Hungary and Romania: Hungary acting as off-taker

Similar to above, Table 3 provides an overview on the impact of a bilateral RES cooperation between Hungary and Romania on RES deployment. Implementing cross-border RES auctions for joint 2030 RES-E targets would lead to a strong reallocation of investments in renewables across the border. Owing to its low RES target, reference conditions for 2030 RES-E deployment would be above the target for Romania, allowing it to offer parts of its RES surplus to Hungary, which is an off-taker under both demand scenarios. Figure 8 provides more information on the deployment of new RES installations in the electricity sector (left) and the corresponding policy cost (right).

[24] Aggregated level means here the two assessed countries together.
[25] Cost savings shall mean here the decline in average (2021-2030) yearly support expenditures dedicated to new RES (installed post 2020) when comparing the Cooperation and the corresponding Reference scenario.

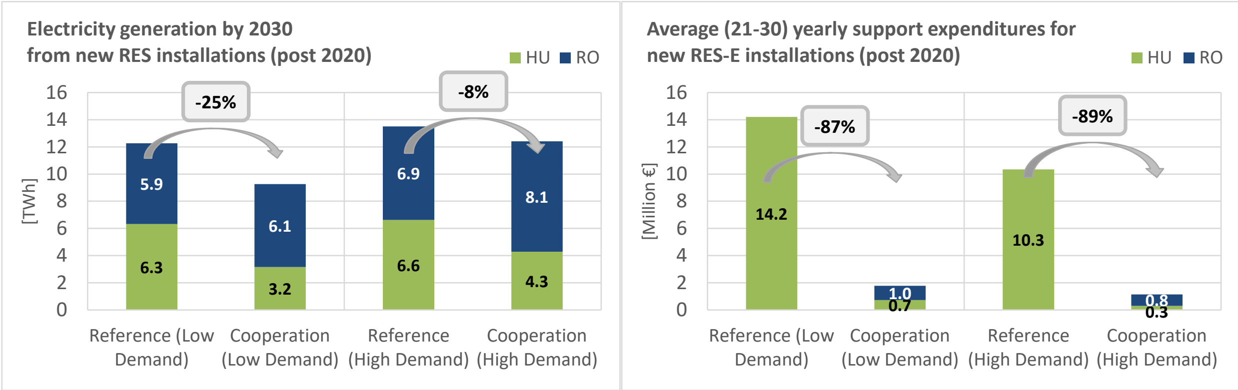

Figure 8: Impacts of cross-border RES auctions between Hungary and Romania on the deployment of new RES-E installations (post 2020) (left) and on the corresponding support expenditures (right), Source: Own analyses of TU Wien (Green-X modelling)

The results show that the RES uptake in both countries is much more affected by the cooperation than in case 1 (cooperation with Austria).

In the Low Demand scenario, 2030 RES-E generation from new installations (post 2020) declines from 6.3 to 3.2 TWh in Hungary, a significant drop by 3.1 TWh. The increase of RES-E generation from new installations in Romania is less pronounced, growing from 5.9 to 6.1 TWh, indicating that Romania can expect a strong surplus in RES-E generation under Reference conditions. This is indicative of Romania's low policy ambition in setting its 2030 RES-E deployment target.

Under the High Demand scenario, the trend is similar but less pronounced. As shown in Figure 8 (left), the decline in domestic RES-E generation in Hungary is now smaller,. 2.3 TWh instead of 3.1 TWh (under Low Demand). Due to the lower surplus in RES-E generation under Reference conditions, Romania experiences a stronger increase in RES-E generation that is 1.2 TWh higher in the Cooperation scenario and only 0.2 TWh in the Low Demand scenario.

Again there is strong savings potential with cross-border RES cooperation. The aggregated cost savings amount to 87% in the Low Demand scenario and 89% in the High Demand scenario[26]. A closer look at the distribution of costs among both countries indicates that Hungary would largely benefit from the cooperation. Romania would, in turn, face higher policy costs compared to the Reference but its economy can benefit from RES-related investments as well as the additional income for domestic RES-E producers. The partner countries can also agree on a redistribution of benefits.

Case 3: Cross-border RES auctions between Hungary and Slovakia: negligible impacts on RES-E deployment accompanied by moderate savings in policy cost

For the third cooperation case, Table 3 offers an overview on the impact of RES-E deployment under bilateral cooperation between Hungary and Slovakia. Overall cross-border RES auctions would not have a big impact on investments and deployment of new RES installations (post 2020). Figure 9 shows how bilateral RES cooperation, impact deployment of new RES installations in the electricity sector in the years up to 2030 (left) and the corresponding support expenditures (right).

[26] Cost savings shall mean here the decline in average (2021-2030) yearly support expenditures dedicated to new RES (installed post 2020) when comparing the Cooperation and the corresponding Reference scenario.

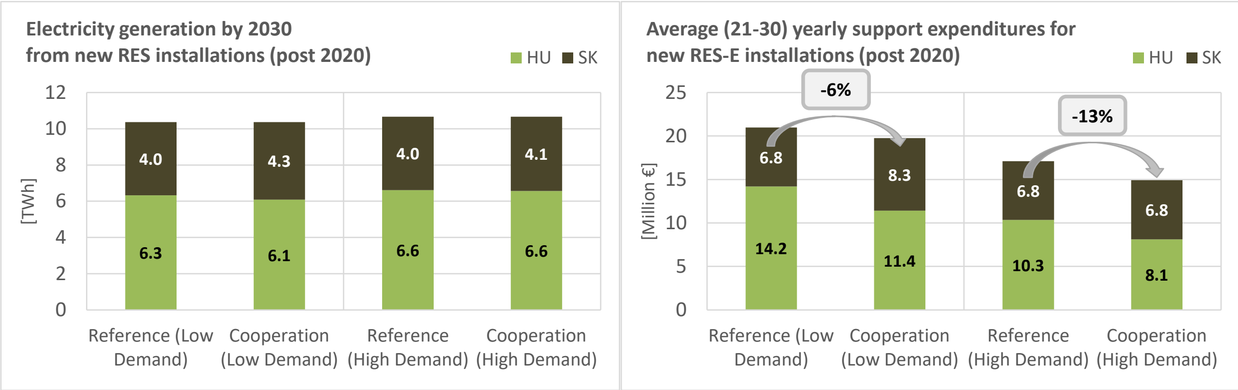

Figure 9: Impacts of cross-border RES auctions between Hungary and Slovakia on the deployment of new RES-E installations (post 2020) (left) and on the corresponding support expenditures (right), Source: Own analyses of TU Wien (Green-X modelling)

As outlined above, the results reveal that RES uptake in the electricity sector of both countries is not greatly affected by cross-border RES cooperation:

In the Low Demand scenario for 2030, RES-E generation from new installations declines from 6.3 to 6.1 TWh in Hungary and increases from 4.0 to 4.3 TWh in Slovakia.

Under the High Demand scenario the changes are significantly smaller in magnitude, with the reallocation of RES-E deployment of only 0.05 TWh, causing a negligible increase in Slovakia and a corresponding decline in Hungary.

A comparison of the impact on support expenditures to refinance the uptake of renewables in both countries shows moderate savings from cross-border RES cooperation, 6% in the Low Demand scenario and 13% in the High Demand scenario[27]. A closer look at the default distribution of costs among countries indicates that Hungary would be the major beneficiary. Slovakia's policy cost would not be changed in the High Demand scenario and moderately increase in the Low Demand scenario. This calls for additional measures/agreements to be taken between both countries to achieve a fair distribution of the overall cost savings.

5.3 Summary of results and findings

To sum up, the modelling outputs demonstrate that cross-border RES cooperation between Hungary and its neighbours lead to a reallocation of RES-E investments across national territories and significant savings in terms of policy cost.

As the pairing case analysis has shown, whether Hungary acts as host or off-taker depends on the partner country chosen. If Austria acts as the pairing twin for cross-border RES auctions, Hungary would be expected to host, and both countries may benefit from the policy cooperation. The reverse is true with Romania, which would serve as host, causing a significant decline of RES-E investments and support costs for Hungary. A cross-border cooperation with Slovakia would result in negligible change in RES-E deployment and bring about moderate savings to the cost of the policy. Both the Romanian and Slovakian cooperation would require additional agreements to end up with a win-win situation for both participating countries.

[27] Cost savings shall mean here the decline in average (2021-2030) yearly support expenditures dedicated to new RES (installed post 2020) when comparing the Cooperation and the corresponding Reference scenario.

6 Selecting the cooperating partner for the case study

Based on the modelling results and the preferences of the Hungarian government, Slovakia and Romania would be the ideal candidates to initiate cross-border cooperation talks. The Hungarian Ministry of Innovation and Technology would consider cooperation with countries that already have strong business ties with Hungary so that activating their networks could further increase participation rates. Grid connection with neighbouring countries, which will further improve in the coming years, is good for regional security of supply and market integration. Furthermore, these countries belong to the same coupled electricity market, linking prices and making it easier for developers to anticipate wholesale price trends and for policy makers to set up the reference price for the auctions.

The following sections provide a short assessment of the options for Hungary to meet its obligation to open its support scheme.

6.1 Cooperation with Slovakia

There are factors working against cooperation with Slovakia. First, Slovakia cancelled its 2020 auction and the new government has not rescheduled or confirmed the current auction design. Second, it does not have an obligation to open its support scheme and would need to be convinced by the Hungarian partner, possibly promising higher compensation for Slovakia to incentivise participation. Third, Slovakia is reluctant to integrate substantial amount of RES-E capacities to its electricity system, reflected in the annual maximum quotas for grid connection and the extra fees for grid access. (See more on this issue in section 5.4). According to the Biannual Renewable Progress Report of the country, published in 2019, Slovakia started negotiations on the possibility of statistical transfers with other countries, but "is not currently planning any joint projects in its territory and does not give preference to joint support schemes"[28].

6.2 Cooperation with Romania

As shown by the Green-X modelling, there is a high potential benefit for Hungary to initiate cooperation with Romania. Although the results indicate that Romania might have to bear some costs, it could be compensated in the terms of agreement to the benefit of both countries.

The main issue affecting the cooperation with Romania is its green-certificate scheme for supporting renewable electricity. Although Romania is exploring the option to move to a premium scheme more suitable for auctions according to the government plans, there is no information available on the timing or future design of the scheme. At the same time Romania reached its 2020 target and is on track for 2030 without a need to rush into new agreements. On the other hand, if negotiations started between Hungary and Romania, Romania could shape its auction to enable a smooth co-operation between the countries. In addition, like Hungary, Romania has an obligation to open up its support scheme, which would serve as a catalyst for the two countries to engage in such negotiations.

6.3 Engaging in auctions implemented via the EU RES financing mechanism

Hungary could also consider a pooled cooperation under the EU's renewable energy financing mechanism, allowing member states to participate as hosting countries offering capacities in their territories, as

[28] Report on progress in the promotion and use of energy from renewable sources (in accordance with Article 22 of Directive 2009/28/EC) Slovak Republic, Years 2017-2018, Bratislava, 2019

contributing partners interested in receiving statistical benefits through providing financial resources, or mixed at the same time.[29]

The EU RES financing mechanism would allow Hungary to acquire statistical transfers of RES-E generation cost-effectively and meet its State Aid obligation without extensive support and administrative costs. The mixed role could also ensure a level playing field between partners. The difference compared to bilateral relationships is that the prescribed share of support would have to be actually paid to non-domestic projects, while opening the national scheme would not necessarily result in financing projects in the partner country (in case none of them wins in the auction).

A clarification is needed to determine if the State Aid decision refers to the assigned yearly budget of support or can be determined as the share of the yearly auctioned volume. In view of the continuous decline of technology costs, the former could lead to unnecessarily high renewable energy procurement.

6.4 Main features of the RES-E sector of the hypothetical partner country: Slovakia

Despite the concerns raised in section 5.1, Slovakia was selected as a hypothetical partner for the purpose of this study in consultation with the Ministry. According to the modelling, the cross-border auctions would result in moderate benefits for both countries, with the primary motivation of the government to meet its obligation.

To provide some context, Slovakia has a 14% RES target for 2020 and reached 11.9% by the end of 2018. Its 2030 goal is to have 19.2% share of renewable energy in gross final energy consumption. Figure 10 shows the composition of renewable electricity generation by technology in 2018. Hydro energy provides the majority of RES-E, followed by solid biomass (16.4%), solar (9%) and biogas (8.3%).

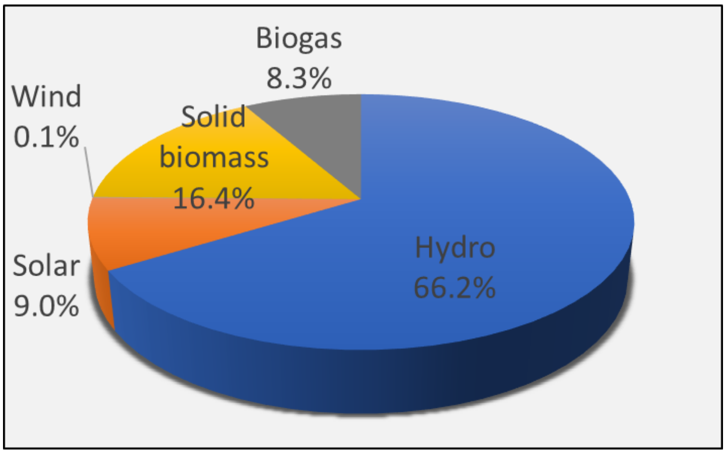

Figure 10: Renewable energy generation by technology in Slovakia, 2018, Source: Eurostat, Shares database, 2019

The original Feed-in Tariff system of Slovakia was introduced in 2009 and provided generous feed-in tariffs. The methodology for adjusting the support level for RES-E plants newly entering the system (digression method) could not properly keep up with the rapid fall of technology costs, which led to an investment boom, especially in PV systems, increasing the support costs and end user electricity prices. The government responded by cutting the FIT level, and electricity system operators announced a grid connection moratorium

[29] The EU's renewable energy financing mechanism is to be set up pursuant to Article 33 of the Governance Regulation (EU) 2018/1999. For a detailed description of the basic structure and the functioning of the mechanism see Gephart and Blücher (2020).

in 2013, to halt RES-E grid connection. To compensate for the high costs of the support system, a relatively high grid access fee was also introduced (the so called G-charge or G component) to all electricity generators at varying levels (depending on technology, voltage level and other factors) (Eurelectric, 2018). This fee reduced the support revenues of renewable plants and thus meant a retroactive change. Due to these interventions, Slovakia's RES-E generation has stagnated since 2015 and the share in the generation mix has even decreased some percentage points (Diallo et al. 2020).

The changes of the Renewable Electricity Act entering into force in 2019 introduced a revised feed-in premium support scheme based on competitive procedures for installations above 500 kW. It stipulates that RES-E producers have to sell their generated electricity on the market and must bear the costs of balancing the deviations of their production from schedule.

FIT can be acquired by hydro, geothermal and biogas plants up to 500 kW capacity, but solar and wind plants can only receive support in RES-E auctions. PV plants with capacities lower than 500 kW can also be developed under the "local energy source" scheme if the plant generates electricity mainly for self-consumption. Although these plants are not entitled to receiving FIT, they enjoy priority connection and are exempt from paying the G-charge and support budget surcharge. The grid connection moratorium has been partially removed under the new system, allowing a relatively small amount of capacity eligible for FIT and "local energy sources" to be connected to the grid each year (about 20 MW) (Diallo et al. 2020).

In the following chapter we compare the tender design between the two countries and highlight some issues that should be addressed in adjusting them to the cross-border context.

7 Tender design

As mentioned earlier, multilateral cross-border auction design is mainly based on the national auction schemes of partners. However, some design elements might need to be reconsidered to reflect the preferences of the governments and to ensure a higher level of harmonisation between the involved countries. In this chapter we compare the most important design elements of the Hungarian and Slovak national auctions to identify where changes in the design should be considered.

7.1 General design elements: technology focus, timing and volume

We assume that the design of the next Slovak RES auction will be similar to the one which was introduced in the spring of 2020[30] .

7.1.1 Technology focus and project size

As Table 4 below shows, both the Hungarian and the Slovak auction schemes are designed to be technology neutral but in practice are not. In Hungary, wind technology is effectively blocked by strict regulation, as mentioned earlier, while in Slovakia different size limit applies to PV technology.

Table 4: Technology focus and project size in the Hungarian and Slovak RES-E auctions

	Hungary	Slovakia
Technology focus and differentiation (eligible technologies)	Technology neutral auction. However, because of the restrictions with respect to wind deployment in Hungary (253/1997 Governmental Decree), wind power plants were not able to participate.	Technology neutral auction (all renewable technologies can participate).
Min./max. size of project	The size limit was 0.3 MW to 20 MW in the pilot auction and up to 0.3 MW to 50 MW in the recent auction. The two separate baskets based on size are: small installations: 0.3 MW – 0.99 MW large installations: 1 MW - 50 MW.	The minimum size limit on the auction is 0.1 MW for PV projects and 0.5 MW for other renewable technologies. The maximum for PV projects was set to 2 MW and 10 MW for other technologies.

Sources: Bartek-Lesi et al. (2020) and Diallo et al. (2020)

Although the Hungarian energy policy does not favour wind energy, allowing wind projects to participate from the partner country can generate potential gains in terms of increased competition and lower support cost. Depending on the costs of wind projects in Slovakia, this can result in less Hungarian projects winning in the auction, but would be very difficult to avoid due to the technology neutrality principle undertaken by the country.

In Slovakia, the size of solar PV plants which can participate in the auction is limited to 2 MW as opposed to other technologies eligible up to 10 MW. In Hungary the upper limit is 50 MW. If Slovakia did not ban larger PV plants on its territory, large installations could be installed and receive support from Hungary. However, in Slovakia only PV plants up to 500 KW are permitted be built if they produce electricity for self-consumption, in order to limit the connection of variable renewable capacity to the system. Therefore, it is not likely that the

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[30] For more details on the Slovak auction design see Diallo et al. (2020).

development of plants up to 50 MW would be allowed by the Slovak government, especially to generate electricity for the statistical benefit of another country. This situation could change once the new interconnector between Hungary and Slovakia is be commissioned, providing more flexibility to the grid.

Because both countries set technology neutrality in their state aid decision documents, it is unlikely that this can be altered. However, the size limits of projects would need to be harmonized. Although Hungary prefers procuring RES-E from larger, more cost-efficient plants, the upper limit of plants eligible to participate in the opened auction will have to be decreased to ensure a level playing field. Slovakia might also consider removing its 2 MW upper limit for PV plants in an effort to receive lower cost statistical transfers from winning Hungarian installations. Hungary would be unlikely to provide special treatment to small-sized projects in Slovakia so only one size category should be included in the opened Hungarian auction.

7.1.2 Timing

Besides deciding when to start implementing cross-border auctions (see section 3.1) another issue is whether all of the upcoming national auctions shall be opened, or the opened auctions should be separately held. In the latter case, the domestic auctions can be organised without changing the original format and cross-border auctions can be tailored to the cross-border context.

For separately held cross-border auctions, a large share or all of the auctioned support has to be offered to non-domestic projects, and there is a chance that the majority or, at the extreme, all of the support will be won by investors from the cooperating country, which might negatively affect social acceptance. On the other hand, opening all or most of the regular auctions to a smaller extent could eliminate this problem, and could have positive effects on the results through broadening the involved technologies and increasing competition. However, in view of the specific design elements of the Hungarian and Slovak auctions, it would be very difficult for the Hungarian government to pursue its goals related to cost-efficiency (involving large-size projects), and the promotion of smaller domestic projects (having a separate small-size category). Therefore, separately held and differently designed auctions would be the better alternative.

As regards the scheduling of auctions, it is important to agree on a timetable with Slovakia to avoid overlapping auctions, because more options for developers can result in reduced interest and higher prices.

7.1.3 Auction volume

The planned auction volumes should be determined in a way to help achieve national 2020 and 2030 targets. Although Hungary is closer to its 2020 target it has auctioned far higher volumes than Slovakia planned for its pilot tender. Hungary started with 200 GWh and increased the volume to 390 GWh in the presently announced auction round. The pilot auction resulted in supporting 132 MW capacity in Hungary, while Slovakia's pilot was set for 30 MW through substantially smaller projects.

The difference in auctioned volumes does not necessarily lead to different competition intensity, but the small capacity volume offered to small plants would likely result in higher prices. Therefore, Hungary should lower the maximum capacity limit of bidding projects on the opened auction the auction volumes should converge in the two countries.

As regards the share of support offered to non-domestic bidders, it is important to clarify whether the rate of opening should be based on the projected support costs in the METÁR State Aid decision or according to the share of the auctioned volume, irrespective of the envisaged budget. This is an important question, given that with the continuous fall in technology costs, the projected support costs might be substantially lower than the planned support budget. In case a share of the budget has to be offered, the auction could result in excessive RES-E capacities.

7.1.4 Qualification requirements

Prequalification is based mainly on financial collaterals in both countries shown in Table 5. However, the level and timing of payments (bank guarantee) is quite different. Slovakia's bid bond is extremely high, EUR 75000

€/MW of the proposed capacity, while in Hungary it is 1.5% of the investment cost (somewhere around EUR 11000-13000 /MW) and 5% after the project is selected (EUR 38000-42000 /MW). The high bid bond in Slovakia could be compensating for the low material prequalification requirements.

In Hungary, material prequalification is more pronounced, especially after the selection of winning projects.

Table 5: Prequalification requirements in the Hungarian and Slovak RES-E auctions

	Hungary	Slovakia
Pre-qualification requirements - Financial	In order to participate, the bidder must present a bid bond of 1.5% of its investment cost, based on a unit benchmark published by the regulator. Winning projects must deposit a 5% performance bond. The form of the bid bond and performance bond must be a bank guarantee.	A bid bond of 75 000 EUR/MW should be paid upon entering the auction. The financial security can be in the form of bank guarantee or direct money transfer to OKTE's account (market operator providing the support). The one-stage bid bond is returned in case of not being selected, or in case of winning it is returned upon project completion.
Pre-qualification requirements - Material	Information on - the technical specifications of the power plant, - the company (ownership structure) - other support (e.g. investment grant) received Letter of intent by the grid operator specifying the planned point of connection. Awarded bidders must in addition submit • 'Small power plant operation licence' (above 0.5 MW) • Network connection contract • Building permit • Certificate of commencement of commercial operation	-Draft contract awarded by OKTE -Participant needs to specify which regional DSO the project will connect to.

Sources: Bartek-Lesi et al. (2020) and Diallo et al. (2020)

If the countries can agree to harmonize the maximum project size limits, Slovakia could lower the sum of its bid bond to maintain interest in its own auction scheme. However, as it is very difficult to impose controllable material prequalification requirements on investors in other countries, Hungary should also consider abolishing the requirements related to the submission of licences, permits and the connection contracts, and increasing the amount of bid and performance bonds in its opened auction.

7.1.5 Remuneration design options

Both countries conduct price only, static auctions but the type of premium differs. While in Hungary the bid price is ensured for investors by providing two-sided sliding feed-in premium, Slovakia applies a one-sided sliding premium, which is equal to zero if the market price rises above the bid price. In this respect, the Slovak premium system is more favourable. The support is provided for 15 years in both countries.

Concerning the remuneration design, one issue already raised in section 3 is related to the market value and the reference price used to determine the premium. Plant operators usually prefer selling their production on their national markets. There are two options to consider:

1) The market reference price is determined based on the prices of the national power exchange.

This approach was used in the German-Danish mutual opening of support schemes. In this case, the contributing country bears the risk of higher support cost requirements if the market price tends to be higher in the hosting country. Even if lower foreign bids win in in the auction, the size of the premium might be higher than in case of a less favourable domestic bid. On the other hand, if the market value is lower in the hosting country, the contributing country might save on support costs.

2) The other option is to link the market reference price to the power exchange of the contributing country (e.g. the HUPX in case of Hungary). Then the investors in the host country with lower RES-E market value can benefit from the higher prices of the contributing country. Conversely, if the market price is lower in the contributing country, investors from the host country cannot receive the entire difference between their bid price and the market price in their own country. In this case, they might choose to sell their electricity in the power exchange of the contributing country or submit higher bids in the opened auction to make up for the difference, though this would harm their competitiveness.

Blücher et al. (2019) discuss two other options (pp. 40-43). One of them is the application of a fixed premium, which is a non-risk solution for the auctioneer from the aspect of support cost predictability. However, it increases risks to the RES-E developers and can also result in overcompensation in case of rising prices. Another option is to use the average of market values in the participating countries to determine the reference market price, which would increase the complexity of calculating premiums and only partially mitigate the problems presented above.

The commissioning of the two high capacity interconnection lines between the two countries will increase the access of the Slovak market to the South East European markets via Hungary which will pressure price convergence and reinforce the argument for using own country prices as reference market prices.

Switching to a one-sided premium could be too complicated for Hungary as the METÁR state aid decision specifies two-sided premium for its support scheme. We would not recommend switching anyway, as the two-sided premium ensures receiving the required compensation level for the RES-E projects in a predictable way.

One of risks exposed in the Hungarian pilot auction is related to changes in the exchange rate (Bartek-Lesi et al., 2020). Some market participants would choose EUR as the currency for auctions in Hungary. This would eliminate most of the risks associated with the exchange rate because investment costs and the market prices are incurred in EUR while the operation and maintenance costs to be paid in HUF make up only a smaller portion of overall costs. At the same time, it would place the currency risk on the large industrial consumers presently financing the Hungarian renewable support scheme. As their burden is already sizeable, and most of their revenues are denominated in HUF, this risk would probably be perceived excessive by the large industrial consumers.

Another issue is related to the ceiling prices used in the two cooperating member states. The ceiling price in Hungary is about EUR 78 per MWh and in Slovakia 84.98 EUR/MWh for solar and 106.8 EUR/MWh for all other technologies. In case LCOEs differ substantially, ceiling prices might put investors from the host country at a disadvantage, while investors from the other country might even consider raising their bids (unless the auction is highly competitive). Alternatively, choosing different ceiling prices for the participating countries can be burdensome, as the costs of different projects depend on numerous factors including the quality of local resources and sites and related pieces of national regulatory environment. With this all increasing administrative costs substantially, Blücher et al. (2019) recommends not to set different ceiling prices for the domestic and non-domestic projects.

7.1.6 Deadlines and penalties

The Hungarian auction scheme does not differentiate among deadlines for projects according to technologies, investors have 3 years to install their RES-E plants. In Slovakia, 21 months are available for PV projects, 39 months for wind projects, and 51 months for all other technologies. Although PV plants can be expected to be the almost exclusive winners, in the cross-border auction, where more technologies might have chances to gain support, differentiation in the deadlines can be adjusted to ensure a level playing field for all technologies. Differentiation by countries might be also required depending on the time requirements of the planning and permitting processes in the member states involved.

Penalties are linked to the financial guarantee in both countries. In Hungary, 30% of the performance bond is released upon receiving the building permit and a network connection contract within 6 months after the announcement of auction results. If the project is not completed in time, the promoters lose the performance bond, and after a year's delay they lose the right to participate in RES-E auctions for 3 years.

The Slovak penalty scheme is stricter than the Hungarian because of the higher bid bond (as previously presented) and a daily fee of 1500 EUR/MWh for each day of delay up to 40 days after which the project loses its eligibility and the investors cannot recover their bid bonds. The likeliness of timely realisation is endangered by the fact that the grid connection is not ensured for winning projects in Slovakia, making the participation in auctions even more risky. The less favourable conditions of the Slovak auction scheme might encourage Slovak investors to participate in the Hungarian auctions unless some alignment over the penalty schemes is agreed upon.

8 Contractual arrangements

The conclusion of a cooperation agreement between the participating countries is a precondition for organising cross-border auctions. The agreement specifies the scope of the cooperation, the liabilities of each partner, the allocation of costs and benefits and the rules related to the exchange of data.

The scope of cooperation would be the organisation of technology-neutral, mutual cross-border auctions, where the partners offer a specific size of their support budgets or supported auction volumes to RES-E projects in the partner countries. Those conditions which are not covered by the design features of the support schemes should be addressed in the cooperation agreement between the participating countries.

8.1 Responsibilities and legal liabilities of partners

Although it is recommended to restrict the material prequalification criteria to the minimum, checking some of the information provided by non-domestic bidders might require the involvement of the authorities of the hosting country. Since additional subsidies are deducted from the support payments, authorities must ensure that everything is declared by the winning projects. Checking the validity of permits, licences and grid-connection contracts should be left to the established national procedures in each country, assuming that bidders will comply with national rules in order to realize the project, regain their bid bonds and receive support.

The bank guarantees to be placed as a bid bond and performance bond would be most likely administered by the auctioneer in both countries. However, if the bank of the developer is not recognized by the authorities of the contributing partner, the auctioneer might request some information on its reliability from the authorities in the hosting country.

Upon a winning a bid from the host country, a contract between the provider of the support (in case of Hungary, the Hungarian TSO, MAVIR) and the beneficiary will be concluded, specifying the rights and obligations of both parties. Authorities of the host country can help monitor project implementation and defend delays which might be beyond the control of project developers.

During the operation of the supported RES-E plants, the relevant electricity system operator in the host country needs to be involved to provide the generation data needed for calculating the premium.

Liabilities need to be specified for the case of non-implementation. The hosting partner can help identify the reasons behind a failure and determine the liability owed by the RES-E developer. Risks related to the output of the facility might also arise from improper maintenance or the curtailment of the production due to grid congestion problems. To address deviation from the expected production level, cooperation countries can state in good faith that projects supported by the contributing country should not be disadvantaged by curtailment or other system operations. At the same time, developers of the host country might face the risk of non-payment of support due to regulatory changes or other political reasons in the contributing country. The cooperation agreement should rule out any retroactivee changes affecting the support of awarded projects (as is stated in RED II also)[31].

The cooperating countries also have to agree on the place of jurisdiction to settle any legal conflicts.

8.2 Allocation of costs and benefits

Countries are likely to engage in cross-border auctions for mutual benefit (in addition to having an obligation to do so). The model calculations related to the Slovak-Hungarian cross-border cooperation revealed that hosting projects for the statistical benefit of the other country might actually raise domestic support requirements. Although additional benefits always arise in the host country (e.g. environmental benefits, job

[31] Directive (EU) 2018/2001, on the promotion of the use of energy from renewable sources

creation, increased energy security) it can also face associated costs that outweigh the benefits (e.g. grid reinforcement, less suitable plant sites, change in landscape, energy system impacts, effects on wholesale price). Therefore, the countries need to agree on how these costs can be compensated by the contributing country. One option is to agree on allocating the statistical benefits so that some remain at the host country.

If the auction results in very low costs for the contributing country while other associated costs increase, in the host country (i.e. due to increased grid integration costs), the question becomes whether it is fair to allocate all statistical benefits to the contributing member state. Blücher et al. (2019) recommends that the cooperating countries can agree in advance to split the target achievement statistics among each other contingent upon such a situation (e.g. dividing the benefits equally).

It is expected that some of the additional costs will gradually be incorporated in project costs, e.g. by the inclusion of the costs of grid connection and grid reinforcement either by changing the grid connection regimes in the countries (making RES-E projects responsible for the full costs of their grid integration) or through competitive allocation of available grid connection points.[32] Such market-based options could improve the situation in Slovakia by making grid contributions more efficient and transparent, and when applied in the partner country (as planned in Hungary) the cost disadvantage of Slovak partners could be mitigated. It would be advisable for Slovakia to incorporate a guarantee of grid connection for auction winners in the current version of the support scheme to decrease risks for investors.

8.3 Exchange of data

Supporting RES-E projects in other countries requires the cooperation of the responsible bodies in the partner member states (system operators, regulatory authorities, financial institutions, etc.) to have access to the necessary information required to implement RES-E projects.

Assistance is needed in the building phase for in monitoring the implementation of projects during the realization period and informing the exact time of commissioning.

The cooperating countries must agree on the data provision rules required for the calculation of support payments (market prices) and the statistical transfer of renewable energy (generation data).

The production and technical data related to electricity generation has to be accessed with the assistance of local grid operators. Information needed to calculate the reference market price has to be provided by the entities managing the promotion system (the TSO, MAVIR in Hungary, and the short-term electricity market operator, OKTE in Slovakia).

The form of collecting and transferring data needs to be specified, including the periodicity and exact content. It is useful to elaborate procedures for the exchange of necessary data in a specific format and to specify the frequency of data transfer between the national authorities (Blücher et al., 2019, p. 50).

[32] See for example the RES-E auction scheme of Portugal (Del Río et al. (2019).

Summary/Conclusions

Hungary has an obligation to open its support scheme to other member states in compliance with the provisions laid down in the State Aid Decision related to its renewable electricity support scheme (METÁR). According to the relevant legislation, supporting renewable installations located in foreign countries must be based on reciprocal governmental agreements and on the physical transmission of electricity. The rules also state that the terms and conditions applicable to developers in the partner country cannot be less stringent than the ones set for domestic bidders.

This case study provided an overview of the most important factors influencing the set-up of a cross-border auction between Hungary and possible partner countries using the Green-X model to assess the likely impacts. The results showed that Hungary would be the host country in cooperation with Austria and the contributing country with Romania, while cooperation with Slovakia would lead to only small changes in RES-E deployment.

Although the model predicted that the greatest benefits can be reached in cooperation with Romania, Slovakia was chosen as the hypothetical partner country for this case study after consulting with the responsible Ministry in Hungary and taking into account developments in the support schemes of neighbouring countries.

The case study compared the tender design of the two countries to provide recommendations on how to harmonize to a cross-border relationship:

- The size of plants eligible for support in Slovakia are much smaller than in the Hungarian auction scheme where projects can compete in two size categories (0.3 – 0.99 MW and 1-50 MW). Although Hungary would prefer involving larger installations in the opened auction to keep the support costs low, the planned pilot auction in Slovakia offered support for only 30 MW, setting a 2 MW maximum capacity for PV and 10 MW for other RES-E plants. To provide a level-playing field for the investors from the two countries, the size of eligible projects should be harmonized in an opened up auction. To do this, Hungary can organize separate cross-border auctions with a different design instead of offering a share of support from regular auctions.
- The prequalification requirements used in the opened auction need to be reconsidered. Slovakia set very limited material prequalification requirements against a financial collateral deposit much higher than in Hungary (EUR 75000/MW). As it is very difficult and therefore not recommended to use material prequalification with cross-border auctions, we recommend that Hungary minimizes this and raises bid and performance bonds to a level still acceptable for investors in order to compensate for the lower material prequalification requirements.
- Both countries conduct price only, static auctions, however the premium offered by the Slovak scheme is one-sided and two-sided in Hungary. Changing the type of FIP would be complicated as it is specified in the state aid decision related to the Hungarian support scheme, and switching is also not recommended as the two-sided premium ensure that the required compensation is received in a predictable manner. Another dilemma related to the remuneration of RES-E plants is setting the market reference price for the winners in the host country. This can be based on either the market prices of the contributing country, of the host county or a combination of them. Based on the fact that the Hungarian and Slovakian market prices will likely converge in the near future with the commissioning of new interconnectors, we recommend domestic market values as a basis for calculating premiums.
- Hungary set a 3-year realization period for all winning projects while in Slovakia they are differentiated by technology. In an opened auction it would be recommended to set technology specific deadlines in order to ensure a level playing field for all technologies.
- Deadlines and penalties that are stricter in Slovakia should be negotiated and balanced out. It is important that the Slovak auction scheme ensure grid connection for winning projects to decrease the related risk for Slovak investors.

At the moment, setting up a cross-border cooperation is not among the priority actions of the Hungarian government and no negotiations have been initiated. At the same time, Slovakia's biannual renewable energy progress report revealed that the government is in negotiations with other countries on the possibility of statistical transfer and is not considering any joint support schemes on its territory.

The Green-X modelling results suggested that the cooperation with Romania could bring the highest benefits for Hungary which can be evenly distributed to make the relationship mutually beneficial. However, it is not yet clear when and how Romania will shift to an auction scheme.

Another option for Hungary to consider participation in the EU's renewable energy financing mechanism. This option would bring the benefits of cost-effective RES-E statistical transfer, ensure compliance with the auction opening obligation, and preclude negotiations with partner countries and associated administrative costs. Involvement in a mixed role could also establish a level playing field between partners.

References

ACER/CEER (2018) Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2017 Electricity Wholesale Markets Volume, October 2018, https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/MMR%202017%20-%20ELECTRICITY.pdf

Bartek-Lesi, M., Diallo, A. Dézsi, B. Szabó L., Mezősi, A. (2020) Auctions for the support of renewable energy in Hungary, AURES II Project deliverable D2.2-HU, June 2020, http://aures2project.eu/wp-content/uploads/2020/09/AURES_II_case_study_Hungary.pdf

Del Río, P., Lucas, H., Dézsi, B., Diallo A. (2019), Renewable Electricity Auctions in Portugal, AURES II Project, Deliverable D2.1-PT, December 2019, http://aures2project.eu/wp-content/uploads/2020/02/AURES_II_case_study_Portugal.pdf

Diallo, A., Dézsi, B., Bartek-Lesi, M. Szabó, L., Mezősi, A. (2020) Auction design for the support of renewable energy in Slovakia, AURES II deliverable D2.2-SK, August 2020, http://aures2project.eu/wp-content/uploads/2020/09/AURES_II_case_study_planned_Slovakia.pdf

Blücher, F. Gephart, M., Wigand, F., Anatolitis, V., Winkler, J., Held, A., Sekamane, J. K. and Kitzing, L. (2019) Design options for cross-border auctions, AURES Project deliverable D6.1, April 2019, http://aures2project.eu/wp-content/uploads/2019/06/AURES_II_D6_1_final.pdf

Ecofys and Eclareon (2018) Cross-Border Renewables Cooperation, Study on behalf of Agora Energiewende, https://www.agora-energiewende.de/fileadmin2/Projekte/2017/RES-Policy/144_cross-border_RES_cooperation_WEB.pdf

Ecofys, Eclareon, Starfish Energy (2017) Mapping the cost of capital for wind and solar energy in South Eastern European Member States, https://energy-community.org/dam/jcr:51e6b697-eb69-4e23-a75a-e29e3496549a/RECG032017_Ecofys.pdf

Eurelectric (2018) Charges for Producers Connected to Distribution Systems, https://cdn.eurelectric.org/media/3440/charges-for-producers-connected-to-distribution-systems-lr-2018-2322-0001-01-e-h-1B7D0BD3.pdf

Gephart M. and Blücher, F. (2020) The new renewable energy financing mechanism of the EU in practice, AURES II, D6.3-EU, August 2020.

IRENA (2017) Cost-competitive renewable power generation: Potential across South East Europe https://www.irena.org/publications/2017/Jan/Cost-competitive-renewable-power-generation-Potential-across-South-East-Europe

IRENA (2019) Renewable energy market analysis, South East Europe, https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Dec/IRENA_Market_Analysis_SEE_2019.pdf

NewClimate Institute (2019) De-risking Onshore Wind Investment – Case Study: South East Europe. Study on behalf of Agora Energiewende, https://www.agora-energiewende.de/fileadmin2/Projekte/2019/De-risking_SEE/161_Unlocking_SEE_EN_WEB.pdf

Noothout et al. (2016) The impact of risks in renewable energy investments and the role of smart policies, DiaCore Project, Final Report, http://diacore.eu/images/files2/WP3-Final%20Report/diacore-2016-impact-of-risk-in-res-investments.pdf

Sach, T., Lotz, B., Blücher, F. (2019) Auctions for the support of renewable energy in Germany, AURES II Project, Deliverable D2.1-DE, December 2019, http://aures2project.eu/wp-content/uploads/2020/04/AURES_II_case_study_Germany_v3.pdf

Wigand et al. (2020) Impact of COVID-19 on Renewable Energy Auctions, Policy Brief, May 2020, http://aures2project.eu/wp-content/uploads/2020/05/AURES_II_Policy_Brief_Covid-19.pdf

AURES II is a European research project on auction designs for renewable energy support (RES) in the EU Member States.

The general objective of the project is to promote an effective use and efficient implementation of auctions for RES to improve the performance of electricity from renewable energy sources in Europe.

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AURES II has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 817619