Integration of electricity from renewables to the electricity grid and to the electricity market – RES-INTEGRATION

National report: Slovenia

Client: DG Energy

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Executive summary

Grid connection	
Effect on integration of RES-E	Negative
Obligation to reinforce if necessary	No
Distribution of costs	Shallow for RES-E
Relevant grid level	Distribution
Main barriers to integration	Administrative procedures
	Long lead times
	Enforcement of RES-E producers' rights

Grid operation	
Effect on Integration of RES-E	Neutral
Purchase obligation	Yes, by choice of applicant
Occurrence of grid curtailment	None, currently, possible in the future
Main barriers to integration	None, given the low share of variable RES-E

Grid development	
Effect on Integration of RES-E	Neutral
Regulatory instruments	Sufficient
Nationwide grid development studies	Not existent
Main barriers to integration	Planning every 2 years

Market design	
Functioning markets	Over-the-Counter trade and power exchange
Intraday market and gate closure	No intraday market yet
	Gate closure on the EX 9 am / bilateral contracts till 14:30 (d-1)
Main issue	High concentration, balancing and intra-day market planned

Support scheme	
Support scheme	FiT (only below 5 MW) and Premium scheme
Market integration and/or risk sharing elements	Option to switch between FiT and premium for plants below 5 MW
Balancing responsibility for RES producers	Only for producers under the premium scheme

Table 1: Overview on grid and market integration Slovenia

In Slovenia, the share of electricity, produced from RES is rising. It has reached around 30%, which means that Slovenia is reaching its set goals. The main RE source in Slovenia is still hydropower, followed by solar and biomass. The use of the latter two (especially solar energy) has increased vastly in the past years, as the conditions for their use are good.

The framework for connection of the RES power plants to the power grid is legally defined. The transmission and the distribution network operators are obliged to connect the RES power plants to the power grid. The connection procedures are unified for all RE technologies. However the main problem

and the biggest barrier within these procedures are the administrative procedures of obtaining all of the necessary permits. These administrative procedures make the connection procedures complicated, non-transparent and often also very expensive. Another problem within these procedures, is the enforcement of the RES producer's rights. The system network operators are obliged to connect the RES producers to the power grid. However, the enforcement of these rights is in practice very difficult. In the case of rejection of the connection to the grid they only have the possibility to appeal at the Energy Agency, which decides about the appeal in an administrative procedure. They have no claim for damages.

After connection to the grid, the system network operators are obliged to purchase the electricity, produced from RES. The RES producers can decide for the purchase option by themselves. They can choose between the guaranteed purchase of electricity and the operational support. In the first case the system network operator is obliged to purchase the electricity, produced from RES, from the producer. In the case of operational support the RES producer sells the electricity on the free market and obtains the operational support as the difference between the price the system operator would pay him within the guaranteed purchase and the average yearly market price of the electricity. After the connection to the power grid, the system network operators are also obliged to reinforce the grid if necessary. However in practice this right, as many other RES producer's rights, is hard to enforce. Another important question within the power grid operation is the question of curtailment. As in Slovenia the scope of electricity, produced from RES is still relatively small, the problem of curtailment has not occurred yet. There are also no relative legal provisions in this regard.

Within the obligation of ensuring transmission and the distribution of electricity, produced from RES, the system network operators are also obliged to develop the power grid. The development of the power grid in Slovenia is based on the development plans, made by the distribution system operator and the distribution companies. Except for the National Renewable Energy Action Plan no other official national studies on this topic exist. The use of intelligent and active networks is not in place in Slovenia yet. However there are some pilot projects of installing progressive meters for households that have already begun.

Important for the purpose of this study is also the question of costs. Within the connection procedure the RES producer only covers the costs of the connection ("shallow approach"). The costs of the use of the power grid are integrated in the network fees and are partly covered by the end-consumers.

As seen above, the electricity, produced from RE sources in Slovenia is good integrated into the power grid. However some improvements would still be needed, especially in the phase of obtaining all of the necessary administrative permits and in the phase of enforcing the RES producer's legal right in the case of rejection of the connection of its power plant to the power grid.

Interviewed Experts

We would like to thank all interviewed experts for their very valuable input and their support for this study. We highly appreciate their expert knowledge and their availability in the framework of the RES Integration Project on behalf of the European Commission.

For this country study, the following experts were interviewed:

Matej Gustin, Slovene Photovoltaic Industry Association

Polona Lah, Institut „Jožef Stefan“

Matjaž Miklavčič, SODO d.o.o., Slovene Distribution System Network Operator

Borut Rajer, Borzen d.o.o., Slovene Market System Operator

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Renewable electricity deployment

This chapter aims at providing a general introduction to the context for the deployment of renewable electricity in Slovenia in terms of electricity production, consumption, and grid operation.

Current generation mix and net generation capacity

A graphical overview of Slovenia's electricity generation mix in 2010 is shown in Chart 1.

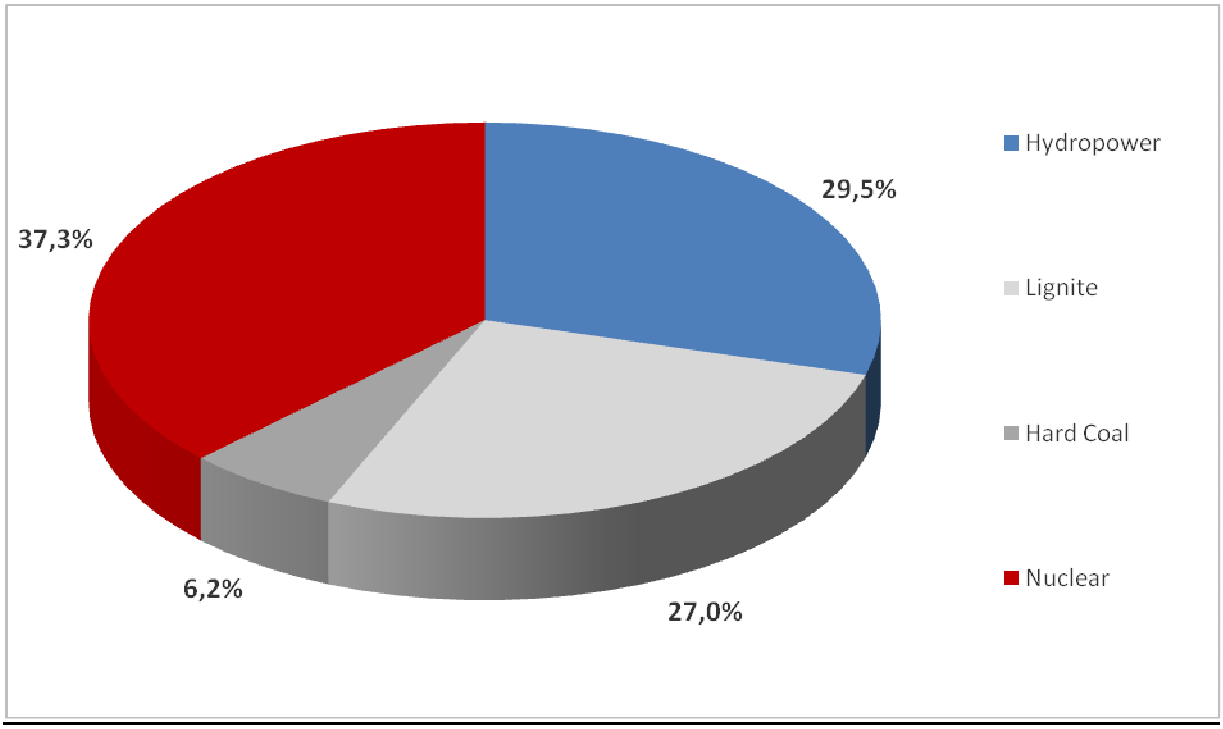

Chart 1: Generation Mix - 2010 (%), Source: own elaboration of Entso-e online database of Detailed Monthly Production. Sources not explicitly mentioned are included either in other renewable or other fossil fuels.

The chart above is based on ENTSO-E data, assumed to reflect real generation data of 2010. Surprisingly, ENTSO-E reports zero generation from wind, solar and "other renewables", i.e. all renewables except for hydro. This contradicts the data provided by the Slovenian government in the NREAP (see Charts 2 and 3 below), which indicates 4510 GWh RES generation for 2010, of which 4198 from hydro. The difference is 312 GWh (12 solar, 2 wind, the rest presumably biomass), which would correspond to 2.16% of the total generation reported by ENTSO-E. Aligning the data of ENTSO-E and of the NREAP is not a task of this study. However, it can be noted that the NREAP has been drafted months before the real data for 2010 was available. Nonetheless, it seems unlikely that an expected 2.16% of generation has disappeared. One possible explanation could be that ENTSO-E data have not fully considered generation fed into the distribution level, though this hypothesis would imply that either the total Slovenian generation data of ENTSO-E are underestimated, or the generation data for one of the sources reported by ENTSO-E are overestimated.

The chart above gives however a clear overall picture: with circa 70% combined share of coal and nuclear and hardly any gas, the Slovenian generation mix is dominated by inflexible thermal power plant. However, given the marginal share of variable generation and the high share of hydro, the available hydro resources should be sufficient to balance the growth of variable generation for the foreseeable future, though this balancing capacity could also be made available to other European countries with higher shares of variable generation and lower hydro capacities.

The net generating capacity is provided in Chart 2.

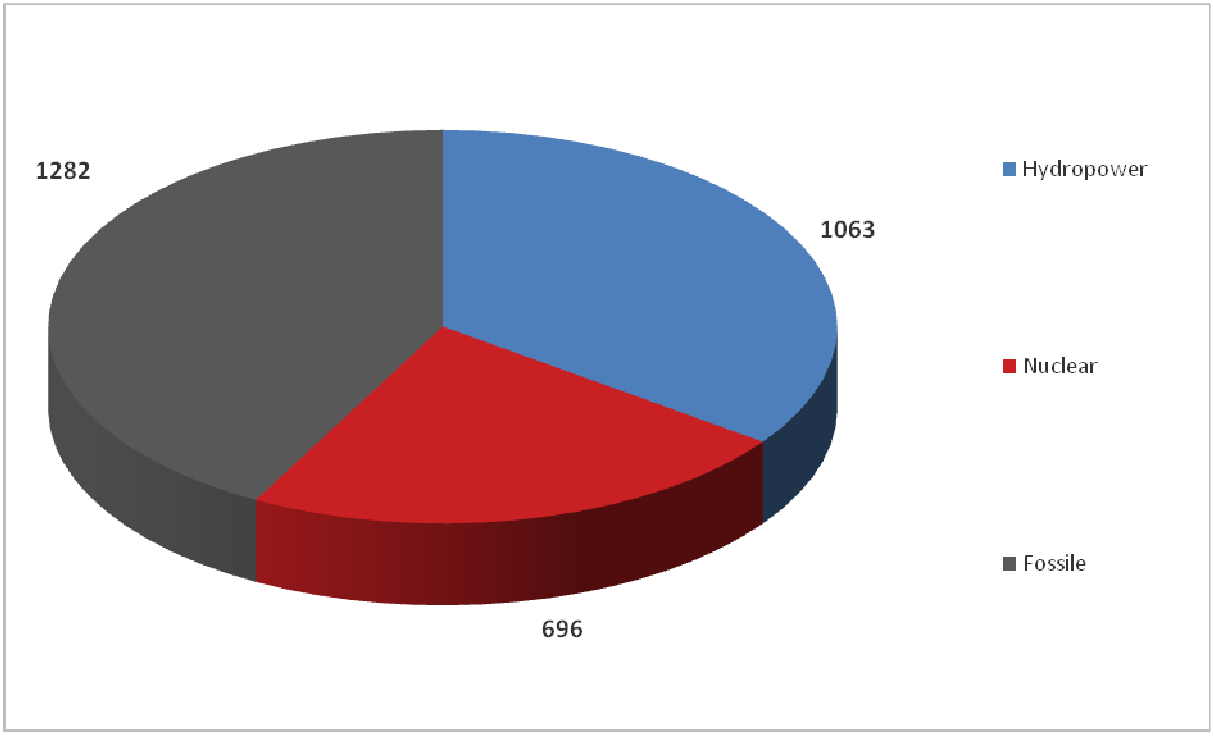

Chart 2: Net generating capacity - 2010 (MW), Source: own elaboration of Entso-e online database of Net Generating Capacity.

Electricity consumption

In 2010, Slovenia consumed 12.2 TWh (ENTSO-E 2011), i.e. 6 MWh per inhabitant. This is slightly below the EU average of 6.2, MWh (ENTSO-E 2011, Eurostat 2011). In terms of electricity intensity of the economy, Slovenia in 2010 consumed 342.1 MWh/ million EUR GDP. This is substantially higher than the EU average of 257.7 MWh/ million EUR GDP, but the lowest value among the former socialist economies (ENTSO-E 2011, Eurostat 2011).

Considering the development of electricity consumption in time (EEA 2010), Slovenia registered an average growth rate slightly above 2% in the period 1990/2007. This is slightly above the EU average, and the highest growth among the former socialist economies, some of them even registered a decrease in the same time period.

RES-E share

Chart 3 provides an indication of Slovenia's total electricity consumption and RES electricity production up to 2020, according to the submitted action plan (NREAP). In other words, this is not a forecast, but the plan according to the government.

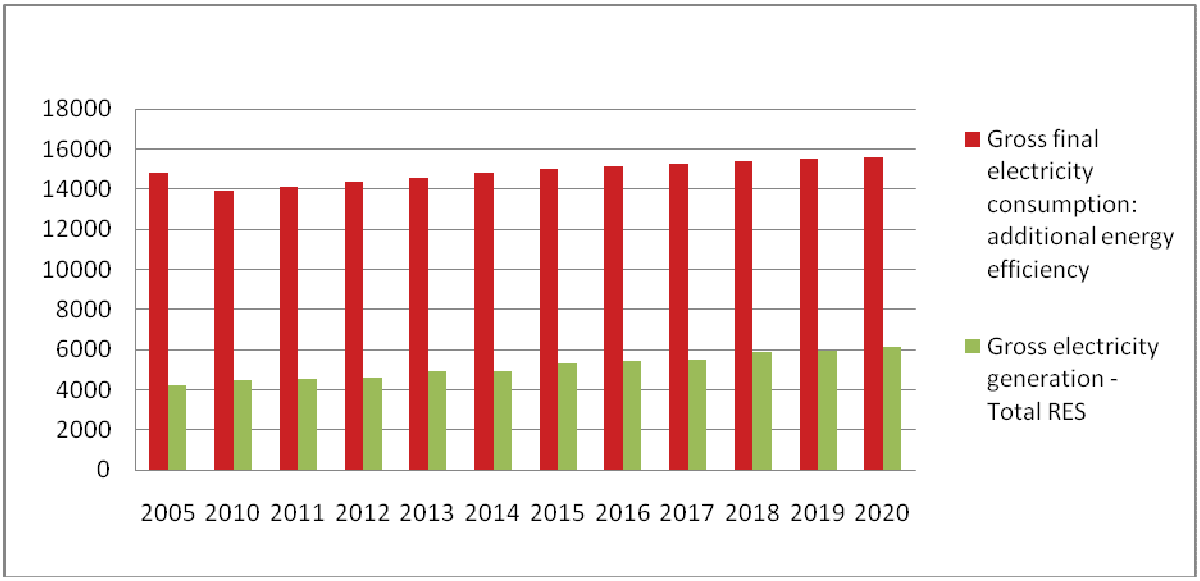

Chart 3: Electricity consumption and RES-E generation (GWh). Source: own elaboration of the country's NREAP

According to the Slovenian NREAP, gross final electricity consumption is forecasted to grow from 13.9 TWh to 15.6 TWh (+12.2%) between 2010 and 2020. RES-E production, in the same period, should grow from 4.5 TWh to 6.1 TWh (+35.8%), leading to a growth of the share of RES-E generation over gross final electricity consumption from 32.42% in 2010 to 39.25% in 2020. In comparison, historical data indicate that the share of RES-E generation over consumption went from 25.8% in 1990 to 29.2% in 1998, to 22% in 2003, to 29.1% in 2008 (Eurostat 2011).

The evolution of renewable electricity generation is further broken down in Chart 4, which outlines the generation shares of wind, solar, hydropower and other RES-E to 2020.

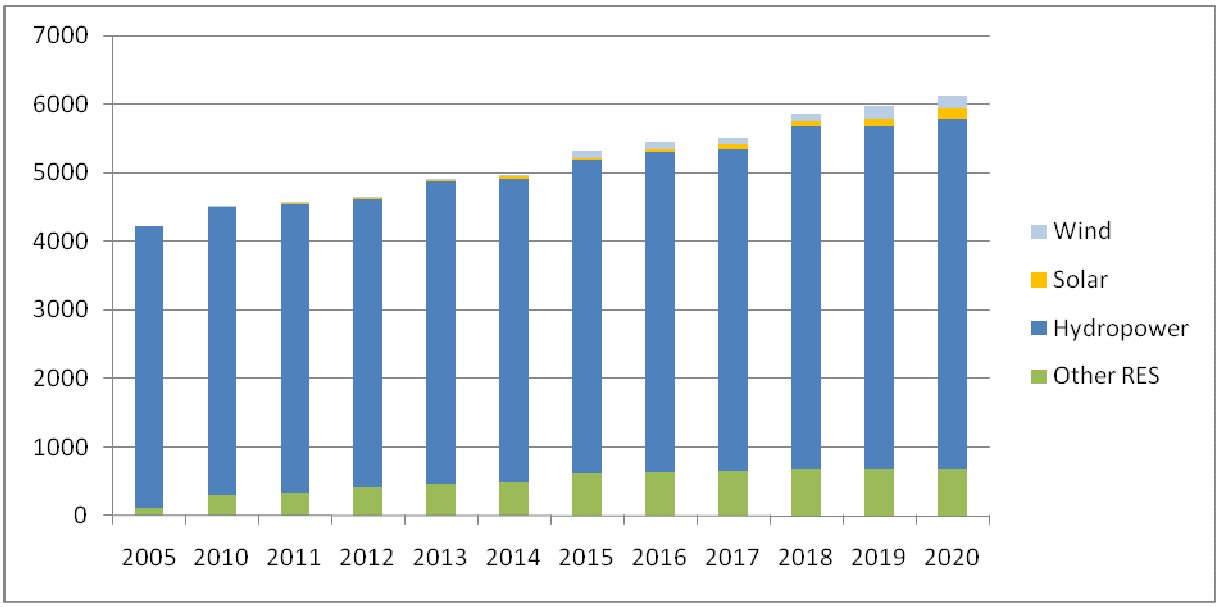

Chart 4: RES-E generation (GWh). Source: own elaboration of the country's NREAP

The largest part of the planned RES growth in Slovenia is expected from hydro and biomass, while wind is assumed to play a remarkably low role. Within the Slovenian power system, the balancing challenge will not be significant.

Natural resources and geographical structure

In general Slovenia has good wind resources. However, since Slovenia is a small and densely populated country, there are only limited areas suitable for wind power (Jungbauer 1998, aenmos 2010, see Figure 1 below). These areas are also mostly considered as ecologically very sensitive, and some environmental organizations started a very strong formal and informal opposition against them. Figure 2 shows that Slovenia has good conditions for PV.

Because of its geographical position and natural resources Slovenia has a big hydropower potential. Hence the hydropower plants have the largest share among the renewable energy sources in Slovenia and also the largest potential for development.

Beside the large hydro power plants on the Sava and Drava River the number of small hydro power plants is rising. In terms of power storage capacities, Slovenia possesses a large amount of hydro systems, especially in the northern and central region, that were developed in the last decades and are well integrated in the grid.

Forests cover more than 56% of Slovenia, so the use of biomass could present a sizeable potential. Also the regulatory framework for the use of biomass as a renewable source in Slovenia exists. However the installed capacities for producing electricity from biomass are still developing. In the past few years there have been some improvements in terms of greater exploitation of wood biomass for the production of electricity.

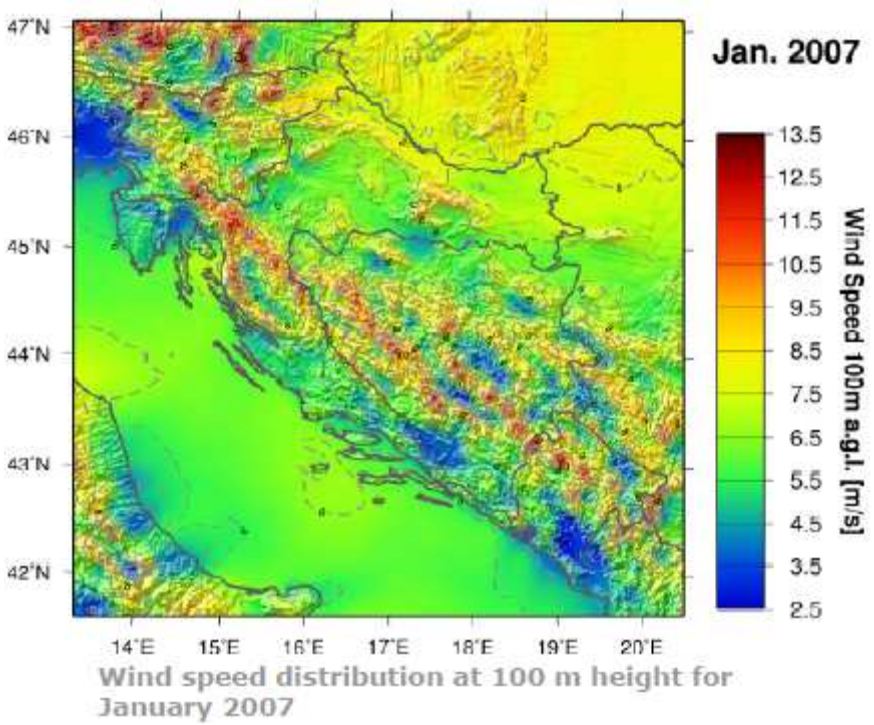

Figure 1: Map of wind resources at 100 meters above ground level (Source: anemos 2010)

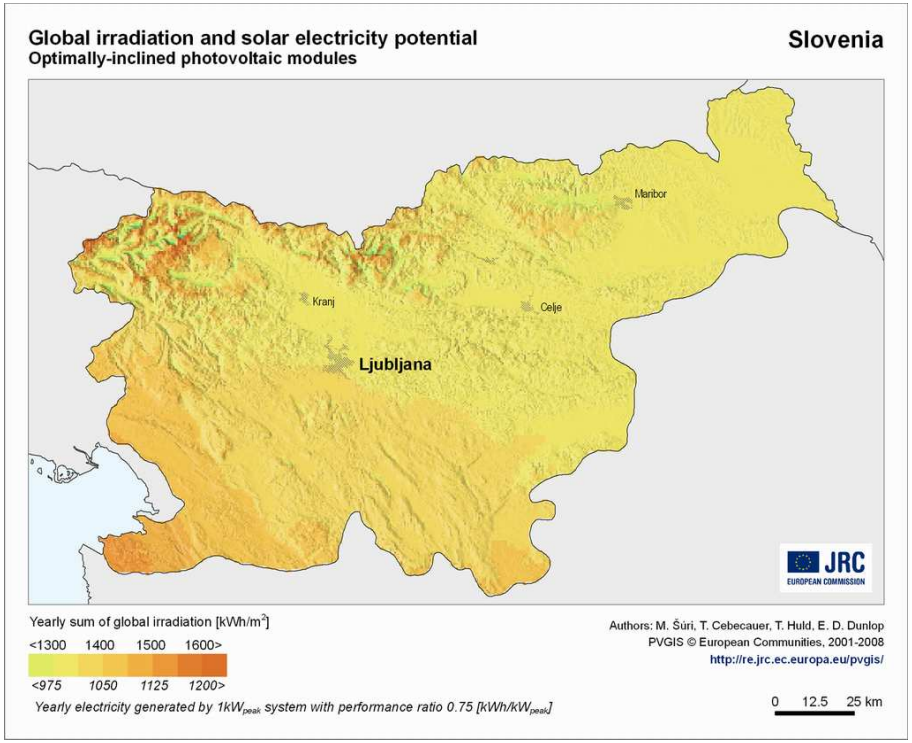

Figure 2: Yearly sum of global irradiation on horizontal and optimally inclined surface, 8-years average of the period 2001-2008 [kWh/m2]. (Source: EC JRC 2007)

Grid operators & dominant generators

Dominant generators

One of the dominant generators of electricity in Slovenia is the Nuclear power plant in Krsko. This power plant was built on the basis of self-government agreement between the Republic of Slovenia and Republic of Croatia. Every state owns half of it. The power plant is being managed by the company Nuklearna elektrarna krsko (NEK), which is half owned by the Croatian company Hrvatska elektroprivreda (HEP) and half by the Slovene company Eles-Gen, a subsidiary of Elektro Slovenija. Both companies are 100% state-owned.

The biggest coal power plants (Termoelektrarna Sostanj and Termoelektrarna Trbovlje) and the biggest hydro power plants (Dravske elektrarne Maribor d.o.o., Soske elektrarne Nova Gorica d.o.o. and Hidroelektrarne na spodnji Savi d.o.o.) are owned by Holding Slovenske elektrarne d.o.o., a company, which is 100%-owned by Republic of Slovenia.

Transmission System Operator

ELES – Elektro – Slovenija, d.o.o. was established in 1991 by the government of Slovenia and is 100% state-owned. ELES operates the network of 400 kW, 220 kW and 110 kW transmission lines. As the only transmission system operator it is responsible for the reliable operation of the Slovenian power grid and for offering quality electricity supply to consumers. ELES buys the electricity from the generation companies and sells it to the distribution companies and to some big end-consumers.

Distribution System Operator

In Slovenia there is one distribution system operator (SODO d.o.o.) which was established by a decision of the Government of Slovenia in 2007. Also SODO is state-owned. In the same year, it received the licence to perform the tasks of the DSO from the Energy Agency of Slovenia. In 2007 SODO also received a concession for the public service of distributing electricity for 50 years from the Government of Slovenia. SODO d.o.o. has contracts on the lease of infrastructure with five distribution companies (Elektro Gorenjska d.o.o., Elektro Ljubljana d.o.o., Elektro Celje d.o.o., Elektro Maribor d.o.o. and Elektro Primorska d.o.o.) which are responsible for the distribution of electricity to end-consumers in different regions of Slovenia.

Interconnections, import/export

GWh (2010)	AT	HR	IT	Total	% of consumption
Export	584	2647	7513	10744	87.72%
Import	2011	6480	120	8611	70.31%
Net	**-1427**	**-3833**	**7393**	**2133**	**17.42%**
Total flows	**2595**	**9127**	**7633**	**19355**	**158.03%**

Table 2: Physical exchanges in Slovenian interconnected operation (Source: ENTSO-E 2011)

Slovenia is interconnected with all its neighbours, except for Hungary. In 2010, the total power flows in interconnection amount to more than 130% of its consumption. This is the second highest value in the EU after Luxembourg. In 2010, Slovenia was a large net exporter of electricity. Its net exports amounted to nearly 15% of its own consumption. This is the 4th highest value in the EU, after Estonia, Bulgaria and the Czech Republic. This is the result of significant net imports from Austria and Croatia, and strong exports to Italy. Slovenia is frequently acting as a transit country for electricity headed to Italy.

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Grid Connection

Summary

The connection of RES power plants in Slovenia usually happens on the level of distribution grid, as the RES power plants are mostly small (SODO 2011). The connection procedures are legally defined and are by themselves also not complicated. They are unified for different technologies and for different sizes of power plants. However the process of obtaining all of the administrative permits for the connection to the power grid still poses a problem in Slovenia. The administrative procedures for connection are very long, complicated and often also very expensive (Association of the Slovenian photovoltaic industry 2011). This is one of the most important barriers for the RES investments in Slovenia.

Information management during the connection procedures is according to all of the relevant stakeholders good (Association of the Slovenian photovoltaic industry 2011, SODO 2011). During the connection process the RES producer usually obtains all of the necessary information, connected to the procedure.

Another problem within these procedures, as can be read from the relevant legislation and as has been reported by some stakeholders is the enforcement of the RES producer's rights. The system network operators are obliged to connect the RES producers to the power grid. However, the enforcement of these rights is in practice very difficult. In the case of rejection of the connection to the grid they only have the possibility to appeal at the Energy Agency, which decides about the appeal in an administrative procedure. They have no claim for damages (Association of the Slovenian photovoltaic industry 2011). .

The costs of the grid connection in Slovenia are "shallow". The RES producers only have to pay for the connection to the power grid. The costs of using the power grid are partly being charged to the end consumers within the network fees (NREAP 2010).

As already pointed out, the connection procedures in Slovenia are legally defined and transparent, however some improvements would be needed in the phase of obtaining all of the necessary permits. This phase should be shortened and simplified in order to encourage more investments in the RE sources.

Relevant legal sources

The legal framework for grid connection is mainly defined by the *Energy Act* ("Energetski zakon"). The Energy Act regulates the generation, transmission, sale, export, import and transit of electricity and the economic and technical management of the power system. It also prescribes the main principles for the connection of RES plants to the grid. The other two important legal sources, which define the connection of the RES power plants to the transmission and to the distribution grid more

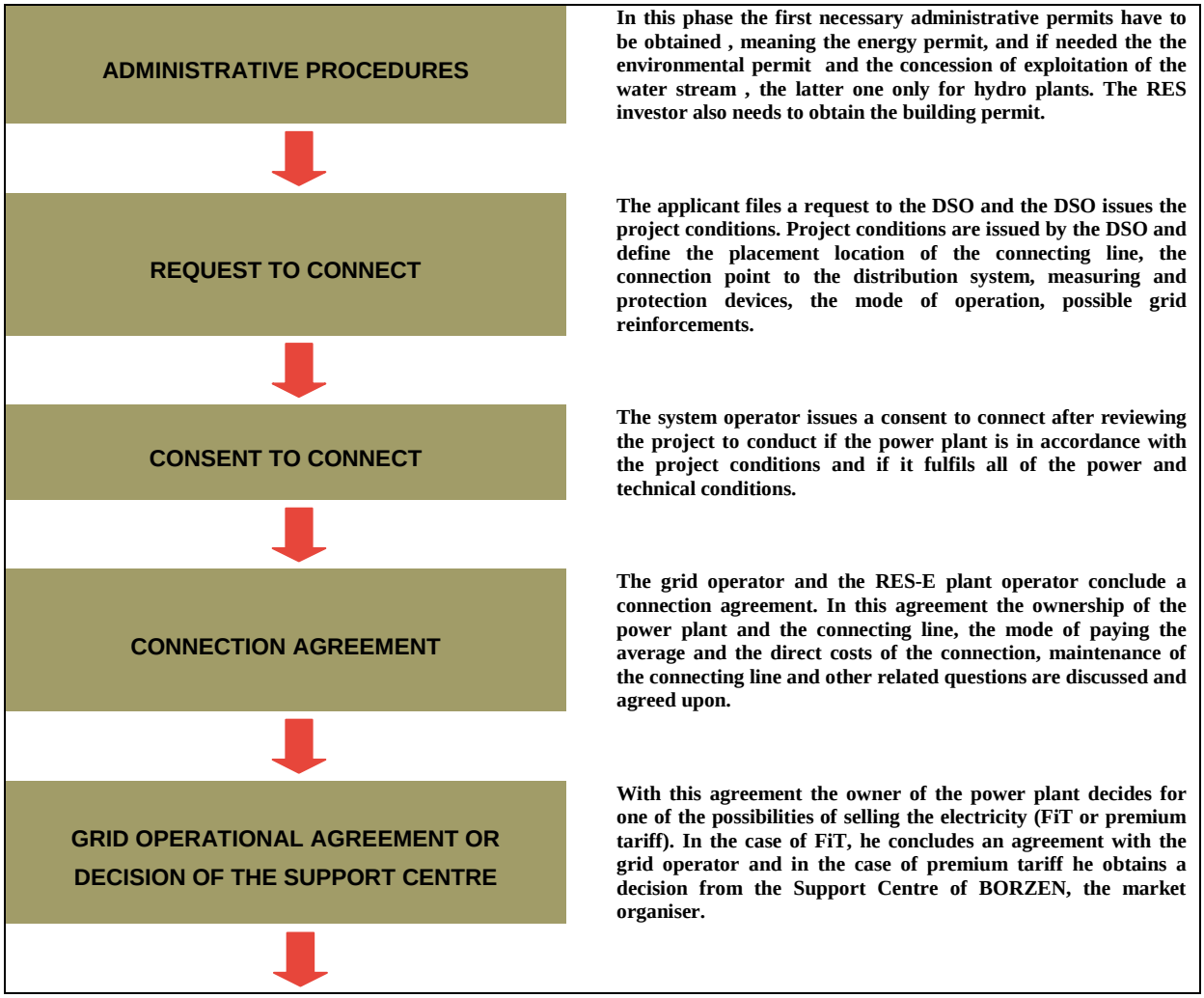
precisely, are the *Regulation on general conditions for the supply and consumption of electricity* valid for transmission system operator ("Uredba o splošnih pogojih za dobavo in odjem električne energije") and the *General conditions for the supply and consumption of electricity* valid for the distribution system operator ("Splošni pogoji za dobavo in odjem električne energije iz distribucijskega omrežja električne energije").

Connection procedures, deadlines, and information management

Only the procedure related to small and medium plants connected to low and medium voltage grids is reported. As of now, no large power plants are planned and in any case the relevant sizes for RES-E in Slovenia are the small and medium.

Small and medium plants connected to low and medium voltage level

Details on the various permits and agreements are provided after the diagram.



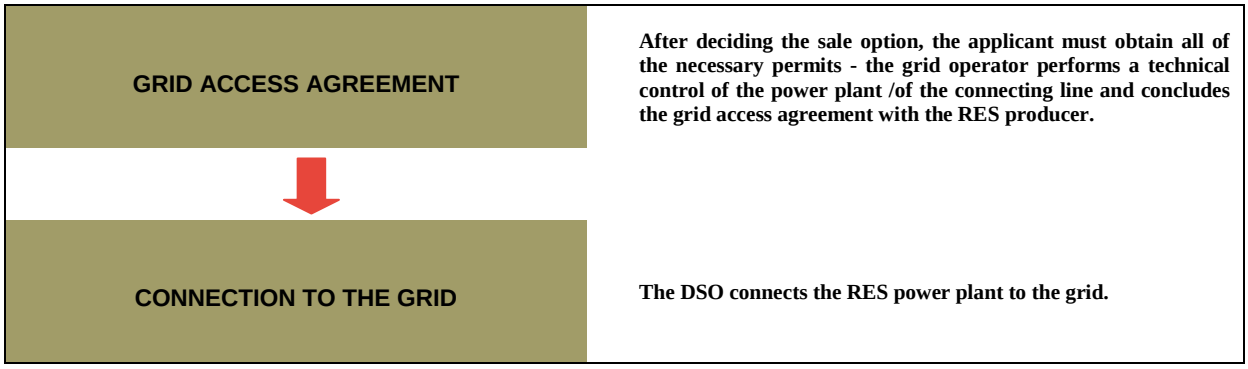


Diagram 1: Connection procedure of small and medium plans connected to low and medium voltage level

In Slovenia the connection procedures are legally defined. According to the relevant stakeholders the connection procedures themselves appear not to be problematic. Problems, instead, arise as regards the administrative procedures of obtaining all of the necessary permits for the connection, which are still long, non-transparent and often also very expensive (Association of the Slovenian photovoltaic industry 2011, SODO 2011, AEON Study 2010).

It will be necessary to change the current complicated administrative procedures for the connection of renewable and diffuse sources of energy to the electricity grid through the introduction of simple, clear and safe standardised connection procedures.

The vast majority of the RES power plants in Slovenia are connected to the distribution grid. The connection procedure for different technologies as well as for different sizes of the RES power plants is unified.

Permits and agreements

- energy permit (a permit, issued by the Ministry for Economy for the power plants with the rated power of more than 1 MW; in this permit the location of the RES power plant as well as the type of the RES power plant, the type of the fuel and the way as well as conditions of providing electricity are set out) and, if needed, other specific permits, like the Concession for the exploitation of the water stream for the production of electricity and Environmental permit)

- project conditions. These are issued by the DSO and set out the conditions for the location of the RES power plant and of the connecting line (according to the spatial planning), connection to the distribution system, measuring and protection devices, the operation mode and possible grid reinforcement.

- project to conduct, on the basis of which the connecting line will be built. The project to conduct sets out the plans for more detailed technical solutions.

- consent to connect the power plant to the power grid (in this consent the DSO agrees that the power plant is connected to the power grid).

- building permit. (this permit, according to the Law on construction, is not needed for solar power plants with the rated power of more than 1 MW and for wind power plants with the rated power of more than 50 kW.

- grid connection agreement with the RES producer (this agreement defines the ownership of the connecting line, the way of paying the costs of the connection maintenance and other issues, connected to the connecting line as well as to the possible reimbursement of the costs for reinforcement of the grid).

- grid access agreement – with the grid access agreement the DSO enables the RES power plant to be connected to the power grid

When all this documentation is prepared and all of the necessary permits have been obtained, the building of the power plant can begin. The project developer also has to perform the measurement and separation point. During the construction of the RES power plant, the connection to the power grid has to be built. The RES project developer has to inform the DSO at least 8 days before the start of the building of the connection, as the DSO is responsible for controlling the building of the connecting line.

When the construction of the RES power plant and the connecting line is finished, the RES producer and the project developer have to prepare the “project of performed works” and the operational instructions. These are used for the maintenance of the RES power plant and the connecting line. The “project of performed works” is also necessary for obtaining the operational permit for the RES power plant.

In this phase the RES producer already has to also conclude the grid operational agreement or obtain the decision from the Support Centre. With this agreement the owner of the power plant decides for one of the possibilities of selling the electricity (FiT or premium tariff (so called “operational support”)). In the case of FiT he concludes an agreement with the grid operator and in the case of premium tariff he obtains a decision from the Support Centre.

Once all of the conditions from the consent to connect are fulfilled and after the connecting line is being controlled, the DSO concludes the grid access agreement with the RES producer.

After that the RES producer has to apply for the inspection check of the RES power plant/the connecting line. On the basis of this technical control the operational permit for the RES power plant/connecting line is issued. When the operational permit for the RES power plant is obtained, the grid operator can connect the RES power plant to the power grid.

Because all of the above permissions are needed to connect the RES power plant to the grid, the connection to the grid itself can be prolonged for unreasonably long time (Association of the Slovenian photovoltaic industry 2011, AEON Study Slovenia 2010). Therefore, grid connection procedures can represent an important barrier for the implementation of renewable energy projects.

Deadlines:

Within the connection procedures different deadlines are to be followed.

The consent to connect is valid for two years, within which the applicant must fulfil all the conditions for the connection to the grid (§ 14 General conditions for the supply and consumption of electricity*)* The system operator can extend this deadline for a year, for a maximum of two times. The applicant must apply for this extension at least 30 days before the expiration of the consent (§14 General conditions for the supply and consumption of electricity).

When the owner of a RES power plant fulfils all of the conditions, set out in the consent to connect, and after the conclusion of the grid connection agreement, the system operator has eight days to connect the power plant to the grid (§ 36 General conditions for the supply and consumption of electricity). In the case of changes or reconstructions of the power plant the RES producer is obliged to notify the system operator about the possible changes or reconstructions of the power plant at least eight days before the beginning of the construction works (§ 23 General conditions for the supply and consumption of electricity).

Information management:

In the opinion of the relevant stakeholders, the requirements of the Directive 2009/28/EC considering the information management during the connection procedure are fulfilled as the RES producer becomes all of the relevant information from the system operator during the procedure (Association of the Slovenian photovoltaic industry 2011, SODO 2011).

It should be underlined, however, that there is one distribution company with five different subcontractors, leasing the distribution system in Slovenia, and each of these subcontractors has slightly different criteria for connection, making the connection procedures non-homogenous (AEON Study Slovenia 2010, Association of the Slovenian photovoltaic industry 2011). For that reason some of the stakeholders advocate the solution of relying on external subjects, specialised in the topic and able to easily navigate through the different requirements and arranging all necessary documentation and usually also knows the requirements and conditions of the individual distribution company (Association of the Slovenian photovoltaic industry 2011).

The distribution system operator therefore developed a unified grid code for the distribution grid level which introduces standardized technical rules and procedures.

Obligation, legal responsibilities and enforcement of legal rights

According to the § 64.j Energy Act, the system operator is obliged to connect every RES power plant within eight days after all the above-mentioned conditions have been fulfilled. One of the prerequisites for the connection to the grid is also the conclusion of the grid connection agreement. The conclusion of this agreement itself does usually not constitute a barrier for the connection procedure (Association of the Slovenian photovoltaic industry 2011). The connection may be however refused in case the plant does not fulfil all of the conditions for the connection. In this case the RES producer can first ask

the grid operator for an explanation on the reasons for which the connection was rejected. According to the § 88 Energy Act the grid operator has to provide this explanation within two months. After receiving this explanation, the RES producer can only appeal to the Energy Agency within 15 days after the receiving the answer. The Agency decides about the appeal in an administrative procedure. If irregularities are found, the Agency orders the system operator to adopt the necessary measures to solve the situation or to conclude the grid connection treaty with the RES producer (§ 88 of the Energy Act). Within the legal obligation to connect the RES power plant to the grid, the biggest barrier is the rejection of the connection (Association of the Slovenian photovoltaic industry 2011).

In this context some of the stakeholders also point out the difficulties in enforcing the RES producer´s rights in practice. The RES producer, whose application for connection has been rejected, can contact the DSO to require clarification on the grounds of the rejection. However this is in practice usually also not very successful. The five different subcontracting distribution companies, in fact, show slight differences in their grid codes, which may be the grounds for the rejection. The distribution network operator (SODO) is indeed responsible for preparation of the System Guidelines for the connection to the grid, which should unify the connection procedures. However, some details are left to the decision of the different companies (Association of the Slovenian photovoltaic industry 2011, AEON Study Slovenia 2010).

Costs of grid connection

According to the § 40 Energy Act the system operator is obliged to provide the RES producers a comprehensive and detailed assessment of the connection costs.

For non renewable generators, a deep cost allocation is applied. For renewable generators, cost allocation is ´shallow´ (§ 70 Energy Act, NREAP 2010). The RES producers only pay the costs of the connection to the grid. If the connection causes disproportionate costs or if it would cause disproportionate disturbances to the grid, grid operator can, according to the § 71 Energy Act, reject the connection of such RES power plant to the grid. However the connection of such power plant is still possible if the RES producer covers a part of such disproportionate costs. No quantification is provided in the Energy act as regards the term “disproportionate”.

Under the provisions of §§ 64.k and 64.m the system operator is bound to provide an analysis for granting the consent for connection to the grid and to adequately reinforce the grid (if necessary). Grid reinforcement, however, is usually planned in the medium term, thus planned RES-E installation are considered in this sense, however the system operator would usually not reinforce the network only because of the connection of one RES producer as usually the capacity of new RES power plants are usually so low that they do not require the reinforcement of the grid. In case a RES plant requires connection but would cause imbalances as it was not included in the plans, the applicant will have to wait to be included the next grid plan (Association of the Slovenian photovoltaic industry 2011, SODO 2011).

The costs of the system operator to reinforce the grid in the case of connection of a RES power plant are socialized and are covered by network fees. In the future no changes of the rules on division of the grid connection costs are foreseen (NREAP 2010).

Stand Alone	Barriers identified		Solution proposed	Detailed description (Page)
	Cause	Consequence		
	Long, non-transparent and expensive administrative procedures to obtain permits	**Long delays to connection due to administrative procedures to obtain permits**	It will be necessary to change the current complicated administrative procedures for the connection of renewable and diffuse sources of energy to the electricity grid through the introduction of simple, clear and safe standardised connection procedures.	19
	All 5 DSOs have slightly different grid codes	**Non-homogenous connection procedures**	The grid operators will have to develop a unified grid code for all grid levels which introduces standardised technical rules and procedures.[1]	21
	Grid reinforcement foreseen every 2 years only	**No right to reinforcement for a new (not foreseen) plant, applicant should wait for next planning round**	It could be considered to introduce a grid reinforcement procedure which would take the current development of the RES-E sector more into consideration.	22

Table 3: Connection: Summary of identified barriers and proposed solutions to overcome barriers

[1] The unified grid code was adopted after finalising this study but is already valid and represent the legal basis now. Its effectiveness has however not yet been tested, thus the authors considered appropriate to preserve this barrier and to add this footnote as a clarification.

Literature and other sources

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NREAP (2010): National Renewable Energy Action Plan 2010 – 2020 Slovenia, July 2010

SODO (2011): Miklavčič Matjaž, *Distribution system operator*, interview on 12 May 2011

Association of the Slovenian photovoltaic industry (2011): Gustin Matej, Association of the Slovenian photovoltaic industry, interview on 20 April 2011

Grid Operation

Summary

In Slovenia, the transmission and the distribution system operator are obliged to purchase and distribute the electricity, produced from RES. According to the relevant legislation, the RES producers have guaranteed access to the power grid and the electricity, produced from RES, also has the priority within the dispatching process. However, the obligations are also valid for the RES producers. They have to ensure, that their power plants or connecting lines fulfil all criteria set by the system network operator to ensure a safe and stable operation of the power grid.

Until now no curtailment within the power grid was needed as the scope of electricity, produced from RES, is still relatively small.

Relevant legal sources

The relevant legal framework for the operation of the power grid in Slovenia is mainly defined by the *Energy Act* ("Energetski zakon"). This law defines the purchase and transmission obligations for the power grid operators. Other two relevant legal acts defining these issues more in detail, are the *Regulation on general conditions for the supply and consumption of electricity* ("Uredba o splošnih pogojih za dobavo in odjem električne energije"), which applies to the transmission system operator. and the *General conditions for the supply and consumption of electricity* ("Splošni pogoji za dobavo in odjem električne energije iz distribucijskega omrežja električne energije"), which applies to the distribution system operator).

Obligations, legal responsibilities and enforcement of legal rights

RES producers have two possibilities for selling electricity:

1. A feed-in-tariff

2. the so-called operational support, i.e. a premium on the electricity they sell on the free market.

In the former case, the TSO or DSO are obliged to buy the electricity at a fixed feed-in tariff, under the provisions of the § 22a and 23 Energy Act. In the latter case, RES Producers are entitled to receive from the system operator a premium ("operational support") set by the government. This premium represents the difference between the feed-in tariff, and the average yearly market price of electricity. There is a possibility of moving from one model to the other: the RES producers can first change the model after two years and then every three years (Association of the Slovenian photovoltaic industry 2011, Institut „Jožef Stefan" 2011, SODO 2011, BORZEN 2011).

In Slovenia RES producers have guaranteed access to the power grid. According to the § 64l(1) Energy Act, in fact, the system network operators (transmission system operator (ELES) and distribution system operator (SODO)) are obliged to ensure the transmission and the distribution of electricity produced from RES (Association of the Slovenian photovoltaic industry 2011).

In accordance with § 64l(2) of the Energy Act, the system network operator is obliged to dispatch electricity from RES as a priority. However, priority dispatching is only possible if it is technically possible, i.e. if grid stability is not at risk. Moreover, according to an agent from the PV association, this system does not work well in practice because it may happen that electricity is purchased because of the purchase obligation, however the electricity is not dispatched as priority. However the DSO as well as the Market system operator denied this, stating that priority dispatching is always assured for electricity, produced from the RES.

If the statement of the PV Agent is true, then the identified barrier represents a clear breach of the current legal framework. The Slovenian government should therefore ensure compliance of grid operators with their legal obligations. In those cases, where the operator is not meeting its legal duties, a compensation should be paid to those installation operators, being affected by the non compliance, namely the non priority dispatch of produced electricity.

For the good operation of the power grid, RES producers also have the obligation to ensure that their power plants or connecting lines fulfil all criteria set by the system network operator to ensure a safe and stable operation of the power grid. However, apart from this, according to the Slovenian DSO and the Association of the Slovenian photovoltaic industry the RES producers have no further special obligation s to provide ancillary services.

Grid curtailment

In Slovenia the measures to ensure stability of the grid are only indirectly defined by the Energy Act. Under the provisions of the §§ 64k and 64m, the system network operators are bound to provide an analysis for granting consent for connection to the grid, to grant consent and to adequately reinforce the power grid.

The existing shortages regarding grid capacities have led to conditions that require for the curtailment of installations under certain circumstances. Even though this situation might be a new phenomenon, it requires for the immediate action of the national and especially of regional governments. A clear defined legal framework for curtailment is required to avoid any legal uncertainties for the installation operators. In the longer run, the root cause for curtailment has to be addressed, namely the shortages of capacities, requiring for a further development of the grid.

However, currently there are no physical limitations on the transmission of renewable electricity, i.e. the grid can accept all currently produced electricity from RES-E. RES producers stated that they have never faced curtailment, as the amounts of electricity produced from RES (except pre-existing hydro) is still small and does not pose a problem in the transmission and the distribution network (Association of the Slovenian photovoltaic industry 2011).

Stand Alone	Barriers identified Cause	 Consequence	Solution proposed	Detailed description (Page)
Priority dispatch in place but not always respected			The Slovenian government should enforce the existing right as well as the compliance with legal obligation. Grid operators that are in breach of their obligation should at least provide for a compensation for affected installation operators.	26
Indirect regulation of curtailment only			It should be considered to introduce clear, transparent and adequate curtailment rules. In particular, an appropriate compensation mechanism should be installed.	26

Table 4: Operation: Summary of identified barriers and proposed solutions to overcome barriers

Literature and sources

AEON (2010): ECORYS, Non-cost barriers to renewables – AEON study – Slovenia, July 2010

RES LEGAL (2011): Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety), *Website on Legal Sources on Renewable Energy*. Available at: <www.res-legal.eu> (last visit on 12 May 2011)

NREAP (2010): National Renewable Energy Action Plan 2010 – 2020 Slovenia, July 2010

SODO (2011): Miklavčič Matjaž, Distribution system operator, interview on 12 May 2011

Association of the Slovenian photovoltaic industry (2011): Gustin Matej, Association of the Slovenian photovoltaic industry, interview on 20 April 2011

BORZEN (2011): Rajer Borut, BORZEN d.o.o. Slovenian market organizer, interview on 12 May 2011

Institut „Jožef Stefan“ (2011): Lah Polona, Institut Jozef Sten, interview on 13 May 2011

Grid development

Summary

In Slovenia the regulatory framework for the grid development is defined in the Energy Act. This law defines that every two years the system network operators have to formulate plans to develop the power grid for at least 10 years. Under the provisions of the same legal act the system network operators are also obliged to ensure the transmission and the distribution of the electricity from RES. For that purpose they are obliged to reinforce and develop the power grid. However the RES producers have no legal means to enforce this right.

The grid development in Slovenia is based on development plans, which are being developed by the distribution system operator together with the distribution companies. Nationwide official studies, except for the National Renewable Action Plan, on this topic do not exist. There are also no formal procedures to prepare them.

Currently the development of the grid with intelligent and active networks has not been introduced yet. However some pilot projects of installing progressive meters for households and preparing different technical and economical analysis have been implemented already.

Relevant legal sources

The *Energy Act* also provides the framework for the grid development in the case of RES. Specific provisions are defined by the *Regulation on general conditions for the supply and consumption of electricity* and by the *General conditions for the supply and consumption of electricity*.

Regulatory framework for grid development

The regulatory framework for developing the power grid is defined by §18 Energy Act. This article obliges the system network operators to formulate every two years plans to develop the power grid, covering at least the subsequent 10 years. These plans also have to be in accordance with the National Energy Programme, which was prepared on the basis of relevant EU directives.

The following articles of the Energy Act are also relevant in this context:

- § 22: the system operator is responsible for maintenance and development of the power grid;
- § 23b: the system operator has the right to independently decide on the funds and assets for the grid development;
- § 87: the Energy Agency of the Republic of Slovenia decides on the eligibility of the costs for the grid development).

RES-E are taken into account in the regular planning how to develop the grids. However, there is no differentiation between different RES sources.

The State provides the framework for the methodology of the plan. The distribution system operator together with the distribution companies drafts and takes the decision on the grid development plans. An independent institute on the basis of the real situation of the grid is preparing the plans. Currently the new grid development plan is in the process of confirmation (SODO 2011).

Obligations, legal responsibilities of the grid operator in relation to the RES-E producer

Under the provisions of the § 64l. Energy Act the transmission and distribution system operators have to ensure the transmission and the distribution of electricity from RES. According to the §§ 64k. and 64m. Energy Act the system network operators are also obliged to reinforce and develop the power grid for that purpose. However, the system network operators are not obliged to reinforce and develop the power grid for electricity produced from RES systems not yet known to the system network operators at the time of planning the network, as outlined on page 24 (SODO 2011).

In practice, the enforcement of the above-mentioned rights is usually difficult. RES producers can hope for reinforcements only by appealing to the Energy Agency in the case of rejection of the connection request to the power grid. Otherwise the RES producer cannot legally demand the system network operator to develop the grid if this is needed for dispatching. The RES producers also do not have any claim for compensation in the case that the system network operator does not fulfil this obligation (Association of the Slovenian photovoltaic industry 2011).

The lack of an obligation to develop the grid could provide a serious block to investments in RES-E generation. For this reason, it may be advisable to introduce such an obligation in order to stimulate further RES-E investment and development. On the other hand, though, there is a high risk of unbalances in such context, meaning that an unbalanced introduction of such an obligation could become very unfavourable for grid operators and have in turn another negative effect. Therefore, the introduction of such an obligation should necessarily be preceded by extensive consultations and should be introduced in parallel to an incentive / penalization system.

Regulatory instruments to encourage grid development

In Slovenia the regulatory instruments to encourage the grid development are limited to the provisions of the Energy Act. However in the view of increasing connections of the RES producers to the power grid, the structure and with that connected development of the power grid would need a change (NREAP 2010). At the moment RES are not foreseen as a regulatory goal in this respect.

Grid development studies and planned improvements

The grid development is basically planned by the development plans prepared by the distribution system operator together with the distribution companies (SODO 2011). However, the question of grid development and planned improvements is also addressed in the National Renewable Energy Action Plan 2010 – 2020 Slovenia. Other official studies do not exist at this time.

Since the power grid in Slovenia has to be changed, the introduction of innovative projects (the term used in the NREAP being "active networks") is planned. These networks will facilitate adaptability, accessibility (enabling connection to the grid for all users, especially for RES producers), reliability of electricity supply and economy. A technical and economic analysis of implementing a system of progressive metering for all consumers within the procedure of introducing active networks has already started. Also some pilot projects of installing progressive meters for households have already begun (NREAP 2010).

Slovenia also has interconnections with the neighbouring countries, especially with Croatia, Austria and Italy. Interconnections with Hungary have also been envisaged but are not realized to that extent yet.

Costs

Accordingly to the "Methodology for charging network fees and the methodology for determining network fees and the criteria for establishing eligible costs for the electricity grid" the system network operators charge the final consumers the network fee for the use of the power grid. This fee also covers costs for grid development of RES-E power plants but not of non-RES-E, as the latter operate under a deep cost approach. RES producers only pay for the connection to the power grid but they do not have to pay for the use of the power grid.

The main practical problem considering the development of the power grid is still the financing issue as the market regulator does not ensure enough financial support for the grid development. There are also some technical issues; the main being the construction and the development of direct current. This would need an improvement (SODO 2011).

Lack of financing is a crucial barrier in many countries. A clear incentive is therefore necessary initialise grid development. It should be therefore considered to change and improve the existing rules on regulation.

Stand Alone	Barriers identified		Solution proposed	Detailed description (Page)
	Cause	Consequence		
	No obligation for grid operator to develop the grid	**Enforcement of grid development very difficult**	The obligation to develop the grid in order to connect a RES-E plant may be introduced.	30
	Market regulator does not ensure enough financial support for grid development	**Development of the grid is not sufficiently funded**	Lack of financing is a crucial barrier in many countries. A clear incentive is therefore necessary initialise grid development. It should be therefore considered to change and improve the existing rules on regulation.	31

Table 5: Development: Summary of identified barriers and proposed solutions to overcome barriers

Literature and sources

AEON (2010): ECORYS, Non-cost barriers to renewables – AEON study – Slovenia, July 2010

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NREAP (2010): National Renewable Energy Action Plan 2010 – 2020 Slovenia, July 2010

SODO (2011): Miklavčič Matjaž, Distribution system operator, interview on 12 May 2011

Market integration

Summary

In Slovenia the wholesale market allows for trading electricity through bilateral contracts via OTC and on the regional electricity exchange. Balancing and intraday markets have not been established yet. The balancing market is planned to start operation by the end of 2011. The wholesale market shows in general high levels of concentration and in particular the energy exchange shows limited but growing liquidity.

The support scheme in Slovenia comprises a FiT for RES-E plants with a maximum capacity of 5 MW and highly efficient CHP plants up to 1 MW. In addition, a market premium option is available for all RES-E producers and highly efficient CHP. The support is guaranteed for 15 years (10 years for wood biomass CHP plants) and is adjusted annually. Only producers under the premium option are balancing responsible.

Relevant Legal Sources

The most relevant legal sources regarding the general market architecture (including liberalisation of the electricity sector) is the Energy Act from 1999, which was last amended in 2009. RES-E regulations and the related support schemes are specified in the following legal documents:

- National Energy Programme (2004)
- Decree on Prices and Premiums for Purchase of Electricity from Qualified Producers (2002, amended 2004, 2006)
- Regulation on Support of RES-E (2009)
- Regulation on the Issue of Declarations of RES-E Production Facilities and Guaranties of Origin for Electricity (2009)
- Regulation on CO2 emission tax.

Market Design

Institutions

The Ministry for Economy is responsible for energy related issues, including legislation for the feed-in tariffs system (Ragwitz et al., 2010). The national regulatory body is the Energy Agency of the Republic of Slovenia, EARS (http://www.agen-rs.si), and it is responsible for granting declarations for RES-E production facilities, guarantees of the origin of electricity and taking decisions on granting RES-E support (EARS, 2011). The Power Market Operator is Borzen d.o.o. (http://www.borzen.si) and is under direct state ownership. Borzen purchases RES-E from eligible producers, organises

equalisation and balancing production groups for producers and sells the electricity to the market (Ragwitz, 2010).

General availability of markets

The liberalisation of the electricity market was stipulated by the Energy Act of 1999.

In the Slovenian wholesale market, most transactions are based on bilateral contracts in the OTC market (EARS, 2011). Furthermore, electricity is traded on the BSP South Pool Energy Exchange, which is since 01.12.2010 in co-ownership of the market operator Borzen and the main transmission network operator ELES. It also operates in the Republic of Serbia and plans to expand its operations to other regions in South Eastern Europe (BSP South Pool, 2011). All legal and natural persons are allowed to participate in the market (including intermediaries) but they have to conclude an accession contract with the market organiser beforehand and pay an entry fee (except members of the balancing scheme) (§11 Rules of engagement of the electricity market, in Official Gazette, 2009). In 2009 the energy exchange counted 17 full members. In July 2009 it also offered the possibility of clearing of the transactions concluded outside the exchange (CEARS, 2010). The price indexes formed at the EX are usually the basis for forming the general wholesale market price (EARS, 2011).

International trade

The Slovenian market is situated between three different regional markets (Market of Central and Eastern Europe based in Germany, the Italian market and the market of South-East Europe) and market transactions include all forms of cross-border trade (EARS, 2011). However, the prices of the Slovenian wholesale market follow roughly the EEX in Germany as it is the only liquid market in the region (CEARS, 2010). Since the beginning of 2011 there is a so called market coupling between Slovenia and Italy, which ensures that bid offers from both countries are treated equally (ELES, 2011).

Intraday market

An intraday market has not yet been established, but is currently being set up in cooperation between Borzen, the market operator, which will also run the market, and ELES, the TSO (Borzen, 2011). A launch date for its operation has not been announced yet.

Balancing market

The management of imbalances is currently the responsibility of the market operator Borzen, but no market for balancing energy exists yet (CEARS, 2010). However, according to Article 24 of the Energy Act a balancing market has to be established. The relevant Rules of Engagement are in the process of coordination between the different stakeholders. The market, which will be centralised and managed by the market operator Borzen is expected to become operative by the end of 2011 (Borzen, 2011).

In 2010 the market operator Borzen introduced new rules for balancing energy prices (Borzen, 2010). The new price index follows the movement of balancing energy prices and thereby tries to ensure that prices for imbalance reflect the true cost resulting from the supply-demand deviations.

Gate closure

For the day-ahead market the gate closure for auction trading on the BSP South Pool Energy Exchange is 9 am, but there is the possibility of continuous trading with block products from 9:00 to 12:00 (BSP South Pool, 2011). However, the latter option not used in practice (Borzen, 2011). Traders may trade bilaterally even after that, but contracts must be reported no later than 14:30 at d-1 (Borzen, 2011a).

Liquidity and concentration

The two largest electricity producers on the transmission network reached a market share of almost 96 % in 2009 (CEARS, 2010). As a consequence of this high market concentration, the market liquidity is not very high. The market operations are perceived as transparent by the market operator (Borzen, 2011). The liquidity on the BSP Energy Exchange is satisfactory and since the market coupling between the Italian-Slovenian border was established in January 2011 the liquidity and number of participants is growing (Borzen, 2011).

To foster normal operation, the market operator can in case of abnormal market conditions either stop trading with a certain standardised product or introduce trading of a new standardised product, but is obliged to inform market participants about these changes 15 days in advance.

Support Scheme Design

General support scheme design

The Slovenian support scheme consists of a fixed FiT and a premium tariff. The premium option is available for all RES-E plants irrespective of their capacity, while the FiT is in place only for RES-E plants up to 5 MW (Toman, 2010). In case of the fixed FiT, the electricity is sold directly to the market operator Borzen. Producers under the premium scheme can sell their electricity on the open market through standard contracts with suppliers or use it for self-consumption.

In the case of plants below 5 MW, the choice between the support schemes has to be made before the plant starts operating. The initial choice is valid for two years, thereafter producers can switch between the FiT and the premium option every three years (Borzen, 2011) The initial choice between support schemes is quite balanced and cannot be linked to a specific technology but rather depends on the preference of the investor (e.g. risk aversion). Since the amendment of the support scheme has only been introduced in November 2009 switching between the schemes is not possible yet.

To be eligible for support, RES-E producers have to obtain a declaration from the national regulator, which is valid for five years and certifies that producers can get Guarantees of Origin. In addition, the regulator makes a decision whether plants are eligible for support (e.g. plants older than 15 years do qualify for Guarantees of Origin but not for support). In general, all RES-E technologies with a maximum plant capacity of 125 MW (CEARS, 2010) are eligible for support. The support for RES-E is provided for 15 years for new plants and also for refurbished power plants with specific requirements. For all cases of news plants and for certain older plants contracts for 15 years are made

between the plant operator and the Support Centre, which is part of Borzen (Ragwitz, 2010). See Chart 5 or the structure of the support scheme.

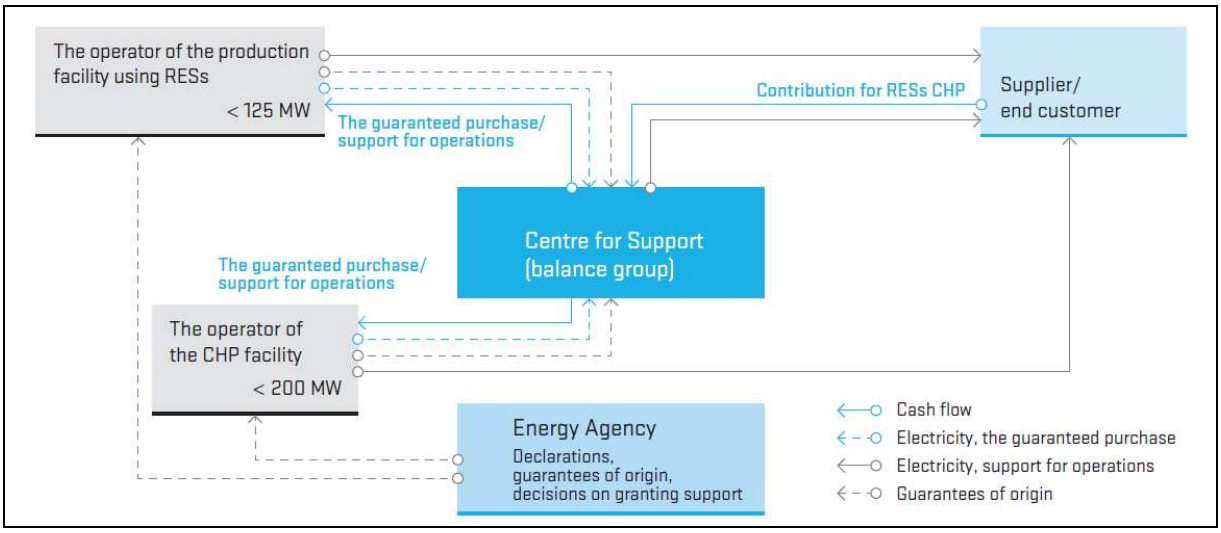

Chart 5: Structure of Support Scheme (Source: CEARS, 2010)

The basis for support levels is the so called "Reference Costs of Electricity" (RCE). In general, the RCE is supposed to represent the overall annual operation costs of RES-E generating plants reduced by all revenues and benefits resulting from its operation (e.g. sale of heat) (Toman, 2010). The formula of the RCE consists of a fixed part (costs of capital, operation and maintenance), which is adjusted at least every five years and a variable part (fuel costs – revenues), which is at least updated annually with reference to forecasted energy market prices (Toman, 2010). For PV, as the only technology, an annual degression of 7% is foreseen (Ragwitz, 2010a).

The costs of the support scheme covered by final customers with an additional payment for every kWh consumed (0.36 €/kWh in 2009) (Rathmann, 2009).

Balancing responsibility

Imbalances of traditional electricity producers are charged monthly on the basis of the electricity price at the energy exchange plus the cost of the TSO resulting from balancing activities. RES-E producers under the FiT are excluded from this legal balancing obligation and Borzen bears the balancing responsibility (Borzen 2011). In contrast, producers under the premium scheme, which sell their energy on the open market, are included in the trader's balance group and the trader is the balance responsible party (Borzen, 2011).

RES-E producers under the FiT scheme do not need to forecast their production hourly and the support is not linked to forecast accuracy by any economic incentives. Only annual forecast are required for RES-E plants, but they have no practical implications regarding the support. However, forecast obligations for RES-E units under the premium scheme can be defined in market contracts with traders, but the producers are compensated by the technology-specific premium levels which take into account the stability of production of the different RES-E technologies (Borzen, 2011)

In summary, the costs of deviations are part of the support and are borne by the market operator and ultimately by the funds for the support system.

Literature and sources

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ELES (2011): *Website of the Slovenian Transmission System Operator* (Public Company Elektro-Slovenija, d.o.o.. Available at <http://www.eles.si/> (last visit on 16.06.2011).

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Ragwitz et al. (2010a): Ragwitz, Mario et al., *Recent experiences with feed-in tariff systems in the EU – A research paper for the International Feed-In Cooperation.*

Rathmann et al. (2009): Rathmann, Max et al., *Renewable Energy Policy - Country Profiles.* Report of the Intelligent Energy Europe project RE-Shaping.

Toman (2010): Toman, Matej, *Key features and recent developments of Feed-In scheme in Slovenia.* Presentation at the 8th Workshop of the IFIC. Berlin.

NREAP Analysis

The table below presents an overview on the identified national barriers of the RES Integration study as well as on the respective NREAP content. Throughout the study, the consortium carefully analysed, if the identified barriers of this study are addressed in the national energy action plan and whether or not the NREAP does foresee a solution approach:

- The column “Barrier identified in RES Integration Study” lists the various barriers, which the present study identified and addressed. The list contains barriers from the section connection, operation as well as development.
- The column “Is the barrier Contested?” would indicate, whether stakeholders in the country under concern would oppose to the identified barrier, namely if they do not see the listed issue as a barrier to the system.
- The column “Section in NREAP” identifies, if and where the respective NREAP is addressing the barrier under concern. The column would list the specific section of the national action plan.
- The column “Summary of foreseen Measure” would contain a short description of the foreseen measure of the NREAP, to overcome the addressed barrier. The column would be empty, if the respective NREAP does not identify the barrier, respectively if the NREAP does not propose a solution to the issue.
- The column “Comments & Evaluation” would contain a short analysis of the proposed NREAP solution and would evaluate, whether the solution is an appropriate and credible option to overcome the existing issue. If the NREAP does not identify the barrier, this section may also contain a short summary of the identified issue.

For a detailed description of the identified barriers in the framework of the RES Integration study, we kindly refer to the sections above, regarding connection, operation, development and market integration of RES-E installations.

Barrier identified in RES Integration Study	Is the barrier contested?	Measures foreseen in NREAP		
		Section in NREAP	Summary of foreseen Measure	Comments & Evaluation
Long, non-transparent and expensive administrative procedures to obtain permits		**4.2.6 c)**	It will be necessary to change the current complicated administrative procedures for the connection of renewable and diffuse sources of energy to the electricity grid through the introduction of simple, clear and safe standardised connection.	Problem acknowledged
All 5 DSOs have different grid codes		**4.2.6 c)**	For maintenance, refurbishing and construction, distribution companies will have to use standardised technical rules and procedures.	Problem acknowledged (and addressed as noted above in the report).
Difficult enforcement of RES investor's rights after connection was refused				Not addressed in NREAP
Unclear law on costs		**4.2.6 i)**	RES investors do not bear the costs of possible reinforcement of the transmission and distribution grid. The costs of all analyses for the issuing of consent to connect to the grid are borne by the system operator.	
Grid reinforcement foreseen every 2 years only: No right to reinforcement for a new (not				Not addressed in NREAP

foreseen) plant				
Priority dispatch in place but not always respected				Not addressed in NREAP
Indirect regulation of curtailment only				Not addressed in NREAP
No obligation for grid operator to develop the grid				Not addressed in NREAP
Market regulator does not ensure enough financial support for grid development		**4.2.7 c)**	The legal framework needs to be changed to ensure a source of funding, since this will allow the SODN the distribution companies to apply in tenders for European funds.	Problem acknowledged

Table 6: Summary of identified barriers and treatment of barriers in NREAP