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

National report: Lithuania

Client: DG Energy

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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:

Vytautas Čekanavičius, BALTPOOL UAB (Electricity Market Operator).

Vidmantas Kniūkšta, Vėjų spektras UAB (Wind farm operator).

Darius Liutkevičius, Valstybinė kainų ir energetikos kontrolės komisija (National Control Commission for Prices and Energy).

Ramūnas Ponelis, LITGRID AB (Lithuanian TSO).

Saulius Vytas Pikšrys, Lietuvos vėjo elektrinių asociacija (Lithuanian Wind Power Association).

Vilija Railaite, LITGRID AB (Lithuanian TSO).

Executive summary

Grid connection	
Effect on integration of RES-E	Negative
Obligation to reinforce if necessary	Yes
Distribution of costs	Deep (divided)
Relevant grid level	Transmission grid/Distribution grid
Main barriers to integration	Complicated connection procedure Legislation not clear High costs

Grid operation	
Effect on Integration of RES-E	Positive
Purchase obligation	Yes
Occurrence of grid curtailment	Rare
Main barriers to integration	No barriers detected

Grid development	
Effect on Integration of RES-E	Neutral
Regulatory instruments	Sufficient
Nationwide grid development studies	Existing
Main barriers to integration	Grid development as a strategic nationwide political issue – RES do not constitute a goal

Market design	
Functioning markets	Bilateral market and day-ahead-market
Intraday market and gate closure	No Intra-day market, gate closure 45 min before delivery
Main issue	Integration into other Baltic markets and Nord Pool

Support scheme	
Support scheme	Feed-in tariff
Market integration and/or risk sharing elements	None
Balancing responsibility for RES producers	None, RES-E balancing provided by TSO

Table 1: Overview on grid and market integration Lithuania

The connection procedure for RES-E plants is generally considered to be complicated, time-consuming and costly. This had already been the case before the new legislation came into effect, but it is expected to become even less clear due to the introduction of the new "Law of the Republic of Lithuania on Renewable Energy", especially right after its introduction. The law was expected to enter into force on 1.1.2012; instead it partly came into effect on 24.05.2011. Some other articles will not be introduced before 31.12.2011. The new regulations are expected to solve some of the problems reported by interviewed stakeholders, for example: too high connection costs, no differentiation between big and small installations in the connection procedure, and speculation with grid capacity. How these new solutions will affect grid connection cannot yet be assessed.

As regards grid operation, the transmission grid operator is obliged to purchase all electricity produced from renewable energy sources. Moreover, RES-E has priority in the transmission and distribution of electricity. The regulation on curtailment will not enter into force before the end of this year. The draft articles of the new Law on Renewable Energy specify that curtailment has to be carried out in a non-discriminatory way; yet, no compensation is foreseen for RES-E plant operators that are subject to curtailment measures.

Grid development is one of the biggest issues in Lithuanian energy policy, yet not specific to RES. The country is exclusively connected with the two other Baltic States, as well as with Belarus and Russia. The construction of interconnections with Central Europe and Scandinavia is considered a main goal in the national energy strategy. Connecting the country to the European Continent and the North European Network is classified as very important for the security of energy supply in Lithuania. The development of the grid connecting the Western coastal region, where the wind power plants are situated, and the rest of the country is one of the strategic projects of the transmission grid operator. The integration of RES does not play an important role in grid development.

The Lithuanian electricity market is under development, recent changes focused on increasing competition and moving towards integration with other markets. Its progress in the energy sector has been triggered in recent years. There is a short gate-closure time, but no intraday market for the time being. Current cooperation and future integration with the Nord Pool market provides an interesting perspective for the further market development, in terms of an increasing market size, the participation in a well-established, functioning market and the introduction of an intraday market. The main support for RES-E in Lithuania is a Feed-in tariff (FiT) system introduced in 2002. Other support mechanisms are loans and subsidies for specific projects. There are no additional mechanisms to support market integration.

One of the biggest issues considering the development and integration of RES-E are the priorities of energy policy. The National Energy Strategy classifies energy independence as the most important goal to achieve until 2020. Lithuania is severely dependent on energy imports. Since the closure of nuclear power plant Ignalina, Lithuania has been importing more than 80% of energy resources, e.g. natural gas, from one single supplier: Russia. 100% of Lithuania's natural gas is imported from this single supplier. Moreover, 70% of its heat and the largest share of electricity are generated from these gas imports. This situation has provided a fertile ground not only for energy insecurity but also for economic and political vulnerability (National Energy Strategy 2010).

Future energy independence is very high on the political agenda and was compared to the level of national independence of 1990 by the Minister of Energy (National Energy Strategy 2010). As three solutions for this issue, the National Energy Strategy names the construction of interconnections with the Continental and Northern European Networks, the construction of new nuclear power plant, the diversification of gas imports and the deployment of renewable energy sources (National Energy Strategy 2010).

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Renewable electricity deployment

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

Lithuania's energy sector is characterised by an extreme dependence on imports of fossil fuels from a single supplier: Russia. So far, renewable energy has not played a big role in electricity generation, since until 2009 electricity used to be generated by a nuclear power plant, Ignalina, which guaranteed sufficient electricity supply. In 1990, the share of renewable energy accounted for 2.5% of national electricity generation. This share had risen to 4.6% by 2008 (Eurostat 2011).

Current generation mix and net generating capacity

Chart 1 shows a graphical overview of Lithuania's electricity generation mix in 2010.

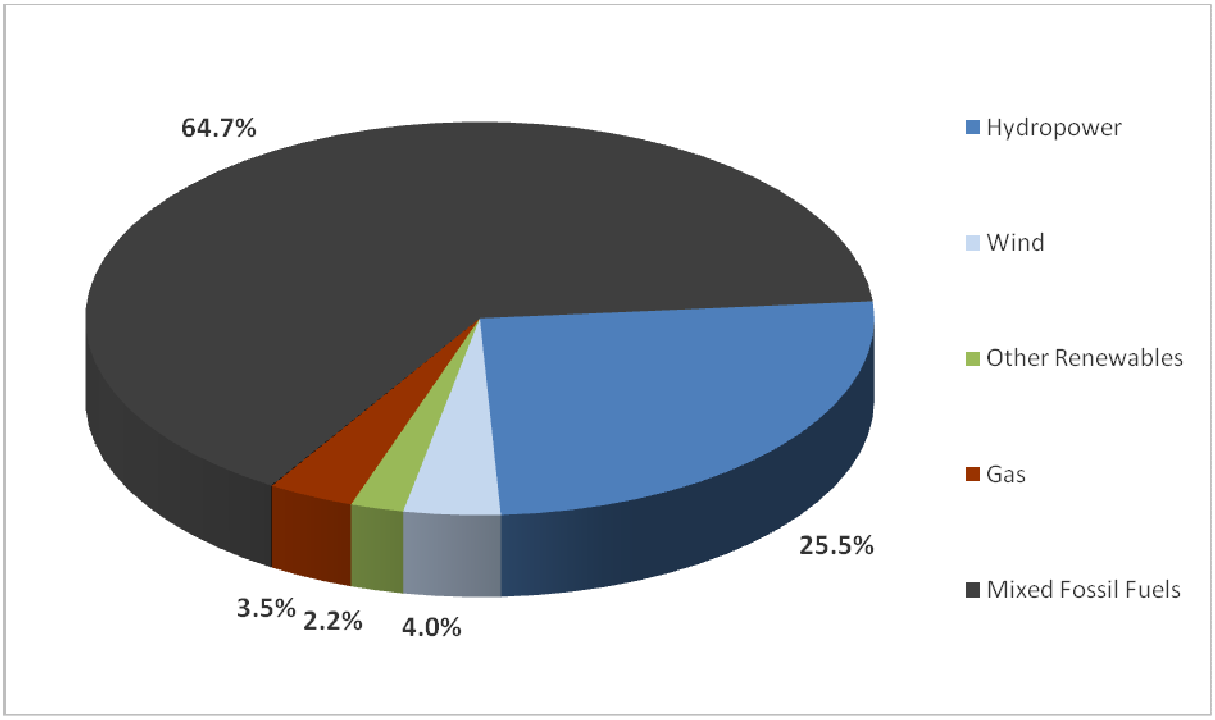

Chart 1: Generation Mix - 2010 (%), Source: own elaboration of Entso-e online database of Detailed Monthly Production. Sources not explicitly mentioned are included either in other renewable or other fossil fuels.

Power generation in Lithuania is dominated by fossil fuels (over 60%). The most important electricity generation source has been nuclear power. The nuclear power plant Ignalina had to close partly in 2004 and entirely in 2009. Since then, the country has been almost entirely dependent on imports of natural gas, which is widely used for both heating and electricity generation (National Energy Strategy 2010).

Hydro-power makes up more than 25% of Lithuania's electricity generation, but most of it generated in pumped storage power plant (LITGRID 2011). . Therefore there is a relatively large amount of flexible generation capacity that can help balancing variable renewables.

The net generating capacity is provided in Chart 2.

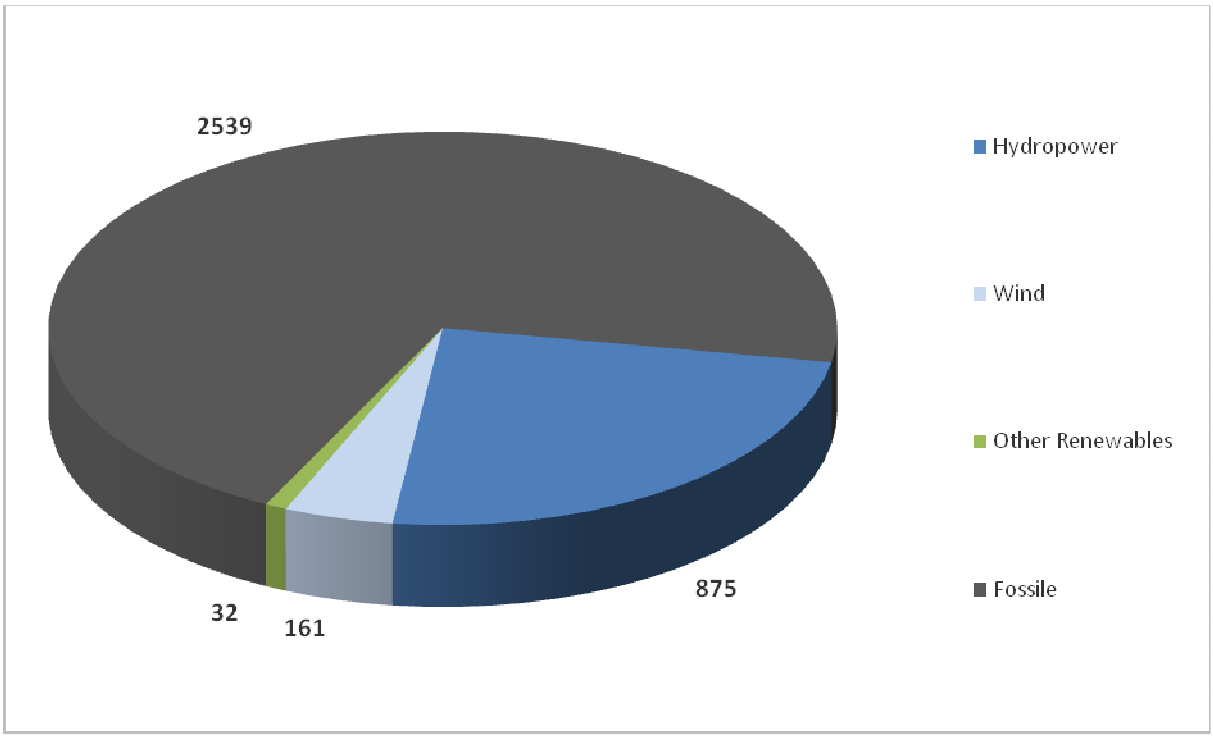

Chart 2: Net generating capacity - 2010 (MW), Source: own elaboration of Entso-e online database of Net Generating Capacity.

Electricity consumption

In 2010, Lithuania consumed 10,258 GWh (ENTSO-E 2011), i.e. approx. 3.1 MWh per inhabitant, which is far below the EU average of 6.2 MWh (ENTSO-E 2011, Eurostat 2011). In terms of eelectricity intensity of the economy Lithuania performed well above the EU average, consuming 379.9 MWh / M€ GDP, against a EU average of 257.7 (ENTSO-E 2011, Eurostat 2011).

Considering the development of electricity consumption in time (EEA 2010), Lithuania's average annual percentage change in electricity consumption is -2.0 and is thus the lowest among the EU countries.

RES-E share

Chart 3 provides an indication of Lithuania'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 figures as planned by the government.

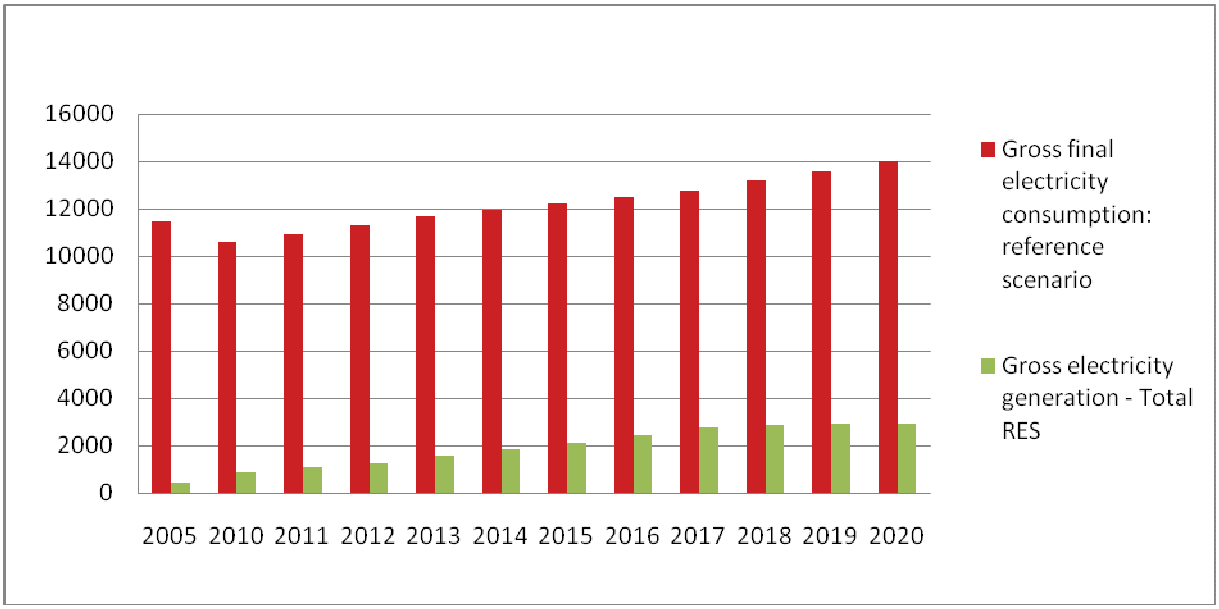

Chart 3: Electricity consumption and RES-E generation (GWh). Source: own elaboration of Lithuania's NREAP

According to the Lithuanian NREAP, overall electricity consumption is expected to grow from 10,618 GWh in 2010 to 14,002 GWh in 2020. The share of RES-E will grow from 8% in 2010 to 21% in 2020. In absolute terms, this corresponds to a growth of RES-E generation from 876 GWh in 2010 to 2,958 GWh in 2020, i.e. to a total growth of 237.67% in a period of ten years. This compares with growth rates of 64% in the period 2003-2008 and of more than 28% in the period 1998-2008 (Eurostat 2011).

The evolution of renewable electricity generation is further broken down in Chart 4, which outlines the generation shares of wind, solar, hydro-power and other RES-E to 2020. This graph is particularly interesting for the aim of this study, as variable sources (wind and solar) will require a grid infrastructure allowing for a high input variability. The higher the share of variable sources the more relevant the issue of grid adaptation. Hydropower, on the other hand, is a fairly controllable RES-E, which is well suited to balance the network fluctuations caused by wind and solar energy, thus the larger the share of this energy source, the larger the extent to which fluctuations can be mitigated.

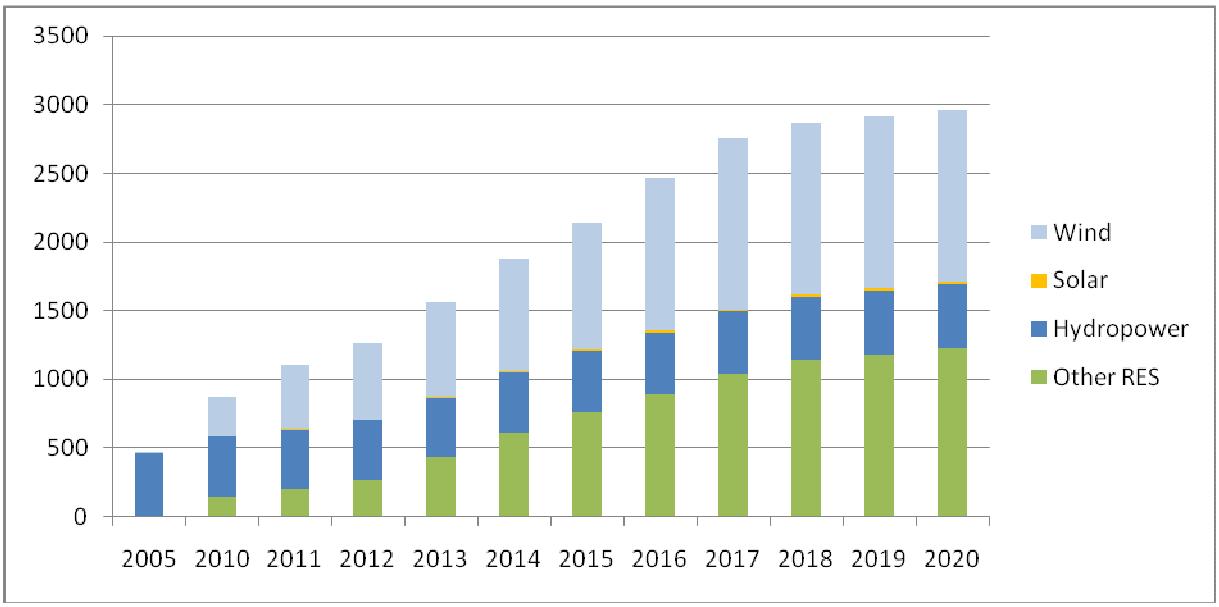

Chart 4: RES-E generation (GWh). Source: own elaboration of Lithuania's NREAP

The largest part of planned growth is expected from biomass and wind power. This will require growing efforts for the market and higher grid integration of RES-E, both in terms of grid development and creating additional storage and balancing power capacity.

Natural resources and geographical structure

Following the context description, this section outlines some elements of the natural renewable resources of the country, and their geographical distribution. This is not meant as in-depth analysis, but rather as a rapid background for the analysis and recommendations in the following chapters.

Wind

As shown in Figure 1, the best on-shore wind resources in Lithuania are in the Western part of the country, particularly in the coastal areas. Furthermore, there is a relatively large off-shore potential in the Baltic Sea. Unfortunately, the power grid in this area is quite weak for historical reasons, since Lithuania was connected to the rest of the Soviet Union in the East and had to export the electricity generated by its nuclear power plant. The grid in the Western part of the country was not anticipated to transfer huge amount of electricity. It was primarily used for distributing electric energy among the local area customers. Thus, the integration of further large resources requires a significant development of the grid, both at the local level and in terms of long-distance transmission capacity.

Solar

The map shown in Figure 2 represents the yearly sum of irradiation in Lithuania. Radiation is quite low due to the country's position in the North. The Lithuanian National Energy Strategy does not consider the use of photovoltaic technology in future power generation. However the new Law of the

Republic of Lithuania on Renewable Energy foresees the promotion for total 10 MW of electricity produced in photovoltaic plants.

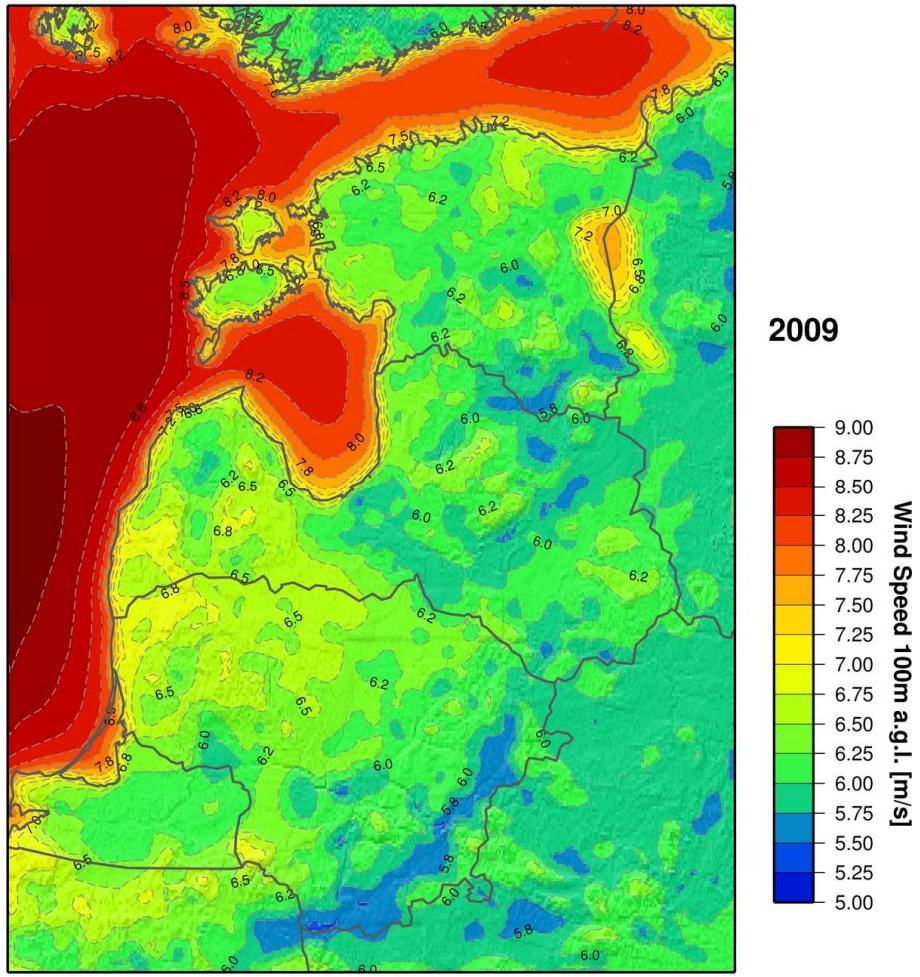

Figure 1: Mean annual wind in Lithuania at standard height of 100m above ground level (Source: anemos 2009)

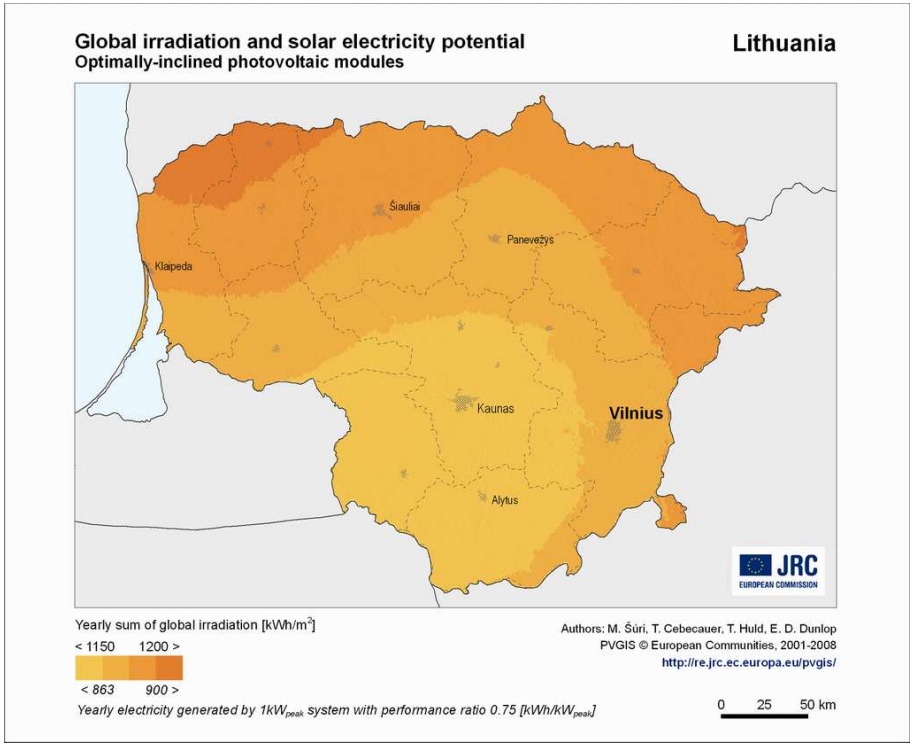

Figure 2: Yearly sum of global irradiation on horizontal and optimally inclined surface, 8-years average of the period 2001-2008 [kWh/m2]. (Source: EC JRC 2007)

Grid operators & dominant generators

Dominant generators

Lietuvos Energija is the main power company in Lithuania. It owns the largest power plants in the country. Its precursor, the Lithuanian Power Company, was a state-owned enterprise that owned and operated all electricity and heat generation plants in Lithuania apart from Ignalina Nuclear Power Plant. The company was privatised in 1997. 86.5% of the shares went to the government, 8.5% to its workers, and 5% to the Swedish company Vattenfall.

Transmission System Operators

LITGRID is the Lithuanian electricity transmission system operator managing electricity flows in Lithuania and maintaining stable operation of the national electricity system. LITGRID is also in charge of the integration and development of the electricity market of Lithuania as well as the operation and development of the electricity transmission grid. (LITGRID 2011a)

Distribution System Operators

AB LESTO (LESTO) is the biggest Lithuanian distribution network operator (a few others are only small local DSOs). The Company was established through a merger of two former distribution network companies: *Rytų Skirstomieji Tinklai* (RST) and *Vakarų skirstomieji tinklai* VST (LESTO 2011).

Interconnections, import/export

Due to the closure of the Ignalina nuclear power plant by the end of 2004 and 2009, Lithuania is highly dependent on imports of electricity from its neighbouring countries. Lithuania is not yet connected to Western Europe and all interconnections are limited to Latvia, Belarus and Russia. As shown in the table below, Lithuania is a net importer of electricity. In 2009, it imported 5,992 GWh net, i.e. more than 58% of its overall consumption.

GWh (2010)	LV	BY	RU	Total	% of consumption
Export	234	402	1549	2185	21.30%
Import	3055	4488	634	8177	79.71%
Net	**-2821**	**-4086**	**915**	**-5992**	**-58.41%**
Total flows	**3289**	**4890**	**2183**	**10362**	**101.01%**

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

Literature and other sources

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Grid Connection

Summary

The connection procedure for RES-E plants is generally considered to be complicated, time-consuming and costly. This had already been the case before the new legislation came into effect, but it is expected to become even less clear due to the introduction of the new "Law of the Republic of Lithuania on Renewable Energy", especially right after its introduction. The law was expected to enter into force on 1.1.2012; instead it partly came into effect on 24.05.2011. Some other articles will not be introduced before 31.12.2011.

The new regulations are expected to solve some of the problems reported by interviewed stakeholders, for example: too high connection costs, no differentiation between big and small installations in the connection procedure, and speculation with grid capacity. How these new solutions will affect grid connection cannot yet be assessed.

Relevant legal sources

The most relevant legal source with regard to the grid connection procedure is the new "Law of the Republic of Lithuania on Renewable Energy" (hereafter: Law on Renewable Energy). At first, the law was expected to enter into force on 1 January 2012. Finally, the Law on Renewable Energy was introduced in part on 24 May 2011; some other parts will not enter into force before 31 December 2011.

The procedure for the adoption of the law was not transparent and so is the law itself. The description of connection to and use of the grid is not clear. The new law mentions documents and orders, which do not yet exist. For example, according to art. 14 par. 8, an RES producer has to apply to the grid operator for initial connection conditions to be published in order to be connected to the grid. The conditions have to comply with the Procedure on Network Use, which has not yet been drafted.

An introduction of a new law often leads to uncertainty among the interested parties. Some time after coming into effect, most ambiguities are solved through a daily practise. If the problems continue, the legislator may consider reformulating or modifying the relevant law accordingly.

Other legal sources relevant for the connection procedure:

- Rules for the Issuance of Permits for Activities in the Electricity Sector approved by Resolution No 1474 of the Government of the Republic of Lithuania of 5 December 2001 (Valstybės Žinios (Official Gazette), 2001, No 104-3713; 2004, No 9-228; 2005, No 73-2651; 2006, No 100-3862; 2009, No 49-1958; 2010, No 82-4329);

- Procedure for the Promotion of Generation and Purchase of Electricity Generated from Renewable Energy Sources approved by Resolution No 1474 of the Government of the Republic of Lithuania of 5 December 2001 (Valstybės Žinios (Official Gazette), 2001, No 104-3713; 2004, No 9-228; 2005, No 73-2651; 2006, No 100-3862; 2009, No 49-1958; 2010, No 82-4329);
- Description of the Procedure and Conditions for the Connection of Energy Facilities (Networks, Installations, Systems) of Electricity Consumers and Producers to Operating Facilities of Energy Companies (Networks, Installations, Systems) approved by Order No 1-246 of the Energy Minister of the Republic of Lithuania of 9 December 2009 (Valstybės Žinios (Official Gazette), 2009, Nr. 149-6678) [hereafter: Description of the Procedure and Conditions for the Connection];
- Technical Rules for the Connection of Wind Power Plants to the Lithuanian Electricity System approved by Order No 4-102 of the Minister of Economy of the Republic of Lithuania (Valstybės Žinios (Official Gazette), 2004, No 57-2007);
- Guidelines R 44–03 for Environmental Impact Assessment of Planned Economic Activities (Wind Power Plants) approved by Order No 406 of the Minister of Environment of Republic of Lithuania of 31 July 2003 (Valstybės Žinios (Official Gazette), 2003, No 60-578; 2010, No 142-7313);
- Rules for the Issuance of Permits for Activities in the Electricity Sector approved by Order No 380 of the Minister of Economy of the Republic of Lithuania of 18 December 2001 (Valstybės Žinios (Official Gazette), 2001, No 110-4010; 2009, No 63-2522; 2010, Nr. 51-2535).

Connection procedures, deadlines, and information management

The connection procedure of RES plants is defined in the Law on Renewable Energy.

The table below illustrates the general procedure for the connection to the grid. The procedure does not apply to projects that take part in the auction for the financial support for their electricity produced from RES (feed-in tariff) (LITGRID 2011).

Connection procedure:

APPLICATION FOR INITIAL CONNECTION CONDIDITIONS	**The investor submits an application requesting specifications on preliminary requirements for connection.**
APPLICATION FOR SIGNING A LETTER OF INTENT	**The investor submits to the grid operator evidences on the compliance of the installation with municipal construction obligations. In addition, both parties will have to sign a Letter of Intent, committing them to construct and to connect an installation. The Letter sets out the capacity, the energy source that will be used in the plant as well as the respective deadlines for the project. Power plants whose capacity does not exceed 350 kW are exempt from signing the Letter of Intent.**

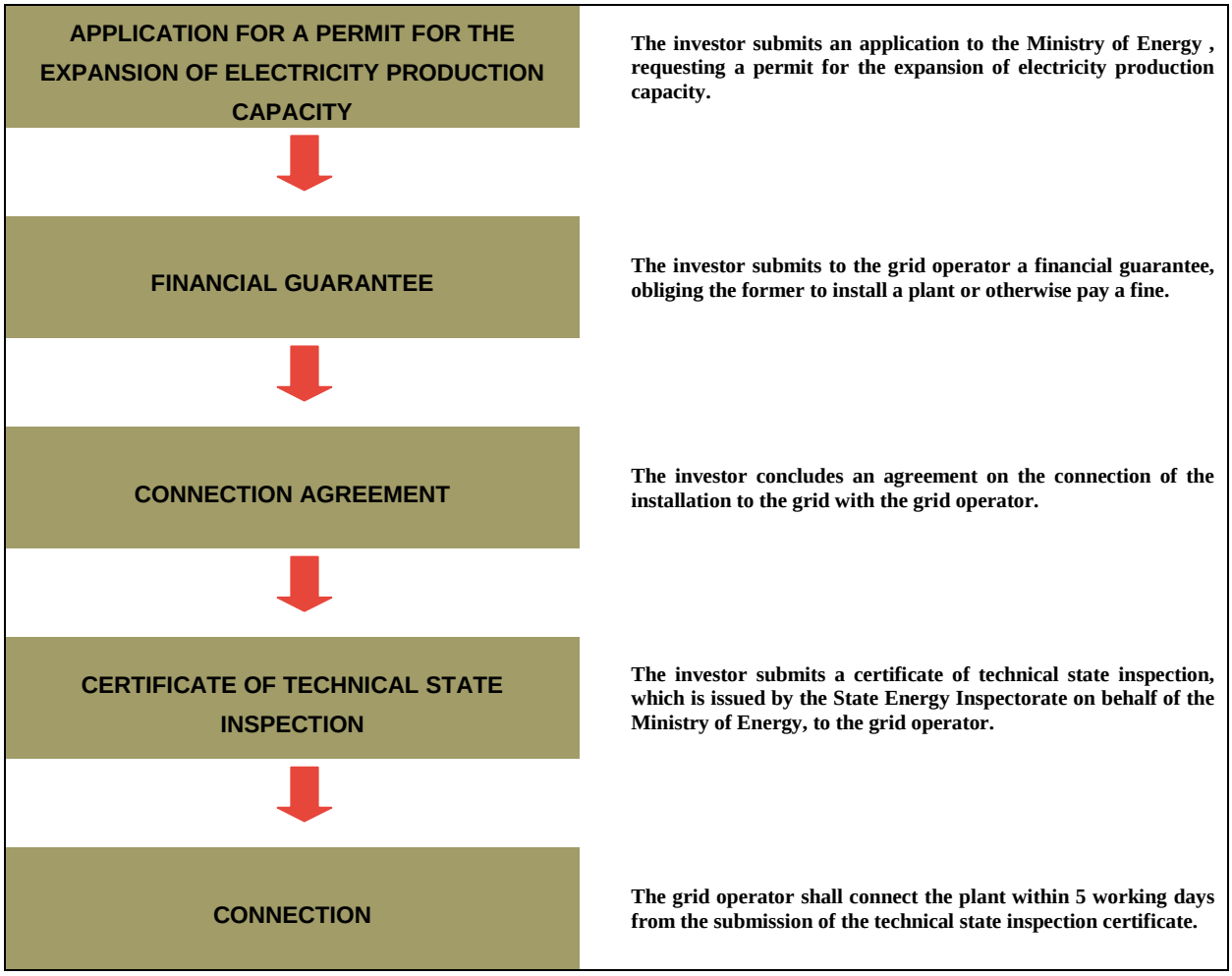

Diagram 1: Connection procedure (Source: Law on Renewable Energy).

According to the National Control Commission for Prices and Energy, the current procedure for the connection of plants to the grids is quite complex. There are a lot of inconsistencies and complaints due to the vague definitions in the applicable legislation (VKEKK 2011). This situation is expected to become even more severe after the new Law on Energies from Renewable Sources has entered into force, especially in the transition period (VKEKK 2011).

The barrier could be mitigated by a thorough analysis of existing processes in order to identify and improve existing inefficiencies. At the same time, as described above it should be first waited whether or not this problem will remain.

Before the introduction of the new law there was no differentiation in the connection procedure according to the size of an RES-E plant or the voltage of the grid the plant was supposed to be connected to. Since 24 May 2011 the procedure has been simplified. Operators of plants with a capacity of up to 30 kW do not have to pay for their connection to the grid (see cost part).

According to art. 4 par. 16 Law on Renewable Energy, plants with a capacity of up to 350 kW are to be connected faster and under simplified conditions.

According to art. 22 par. 2 and 3 of the Law on Renewable Energy, offshore wind-power parks require a permit for the development and maintenance of power plants in the territorial sea, the exclusive economic zone in the Baltic Sea and (or) the coastal strip, which can be obtained through a tendering process.

Upon receipt of such permit, a producer acquires the exclusive right to carry out research in the defined territory, which is necessary to obtain a permit for the development of an offshore wind farm. This exclusive right lasts for 4 years. If the producer does not receive a permit to build the power plant within this 4-year period, or if he informs the Ministry of Energy about his refusal to build the power plant, the permit to use the territorial sea, the exclusive economic zone in the Baltic Sea and (or) the coastal strip for power plant development and maintenance will be withdrawn (art. 22 par. 7 of the Law on Renewable Energy).

Deadlines

Before the new Law on Renewable Energy entered into force, the deadlines for connection to the grid were specified in a connection service agreement between the grid operator and the RES-E producer (par. 10 of the Description of the Procedure and Conditions for the Connection of Energy Facilities (Networks, Installations, Systems) of Electricity Consumers and Producers to Operating Facilities of Energy Companies (Networks, Installations, Systems).

In accordance with art. 14 par. 1 of the Law on Renewable Energy, the TSO has the obligation to connect RES power plants no later than 18 months after the agreement for connection services was signed. In case the construction period of the installation exceeds the above-mentioned 18 months, the TSO is obliged to establish connection until completion of the installation.

In case the grid operator has to optimise, boost or expand the grid in order to connect a plant, the RES-E plant must be connected to the electricity networks within a reasonable time, agreed by the parties, taking into account network upgrade or expansion needs. However, optimisation must be deemed reasonably necessary for the connection of the RES plant (art. 14 par. 2 of the Law on Renewable Energy). In this regard it must be noted again that the new law entered into force only a few weeks ago; thus, it remains to be seen how the law will actually be applied. The author, however, would like to point out that the phrase “reasonable time” lacks a clear definition. It would be wise to combine the qualitative criteria ("reasonable") with defined deadlines. Such a feature has been recently introduced in the German system.

The deadlines for connection given above may be extended for objective reasons, which do not depend on the network operator. In any case, an additional period of 6 months should not be exceeded (art. 14 par. 3 of the Law on Renewable Energy).

According to art. 16 par. 14 Law on Renewable Energy, plants with a capacity of up to 350 kW (under the condition that there is efficient capacity at the nearest connection point of the distribution grid) shall be connected promptly. Again it has to be noted that the word “promptly” lacks a definition as to what has to be considered as prompt.

Information management of TSO/ DSO

Grid operators, after receiving an application from a producer for initial connection conditions, must provide all information on the steps to be carried out in order for a plant to be connected to the grid, as well as the time frame for necessary grid expansion works. Upon the request of a producer, the grid operator shall submit a comprehensive cost estimate for the grid connection of the power plant, an exact schedule for the submission of the application for connection, and a schedule for the connection itself. Moreover, the grid operator and the producer shall permanently exchange all necessary technical as well as other information relevant for the producer's connection to the grid (art. 14 par. 8 of the Law on Renewable Energy).

Interviewed stakeholders complained about the availability of information on available grid capacity. They stated that even though such information was publicly available, i.e. on the TSO's website, there was no comprehensive overview on the actual available capacity. The published information for example does not include the connection processes, which are already in progress, thus showing these capacities as still available (Vėjų spektras 2011).

It should be considered to re-state the list of obligations of the system operators and to state more explicitly what information grid operators have to give to plant operators.

Obligation, legal responsibilities and enforcement of legal rights

The TSO is obliged to connect RES power plants. RES producers have priority right of connection to the operator's grid at a connection point which has the required voltage level and is closest to the producer's plant. This general rule applies unless there is a technically or economically more viable solution that is more appropriate for the connection of the producer (art. 14 par. 1 of the Law on Renewable Energy).

The RES plant connection point is selected by the network operator to whose grid the RES producer wants to be connected, according to the producer's request and upon the evaluation of technical and economic aspects of connection (art. 14 par. 4 of the Law on Renewable Energy).

Connection obligation

According to art. 14 par. 1 and 2 of the Law on Renewable Energy, RES producers have priority right of connection to the operator's grid. Grid operators are obliged to connect plants even if connection is only possible by optimising, boosting or expanding the grid.

If a RES-E plant fulfils all the technical requirements, the grid operator has no right to refuse to connect it to the grid (Vėjų spektras 2011).

According to many RES producers, most problems relate to the technical conditions. When the technical requirements are fulfilled, the time required to connect a RES plant to the grid is quite short (this applies to small RES plants). For large RES plants some problems arise due to the fact that the

institutions that issue the different documents (e.g. planning conditions, permits etc.) do not co-ordinate their activities (Vėjų spektras 2011). These co-ordination problems are supposed to be solved by the new Law on Renewable Energy: The competences are legally distributed among the respective institutions.

According to art. 15 of the Law on Electricity, an RES-E plant may only be connected to the transmission grid if the responsible distribution system operator refuses to connect the plant for technical or operational reasons.

According to par. 29 of the Description of the Procedure and Conditions for the Connection, the conclusion of the connection agreement is a precondition for connection. The stakeholders outlined that this precondition does not constitute any barrier (LITGRID 2011).

Reinforcement obligation

Before the introduction of the new Law on Renewable Energy there was a legal uncertainty as to the obligation of grid operators to reinforce the grid for the connection of a RES-E plant.

While the TSO argued that network operators were obliged to reinforce the grid if this was necessary for the connection of a RES-E plant (LITGRID 2011); the NCC and RES-E producers contested this obligation. According to them, a RES-E plant could only be connected if grid capacity was still available. In case of grid shortages at a particular site, the grid operator had no obligation to connect an RES plant exactly at this location, except if the RES plant operator agreed to bear the reinforcement costs (LITGRID 2011; VKEKK 2011; Vėjų spektras 2011).

This exception has hardly ever been applied, since the costs for reinforcement were too high to be borne by a single plant operator (Vėjų spektras 2011).

The new Law on Renewable Energy has introduced some relevant changes. According to art. 14 par. 2 of the Law on Renewable Energy, the grid operator is obliged to connect RES-E plants even if connection is only possible by optimising, boosting or expanding the grid.

Moreover, when a RES-E producer and the grid operator conclude a connection agreement, the latter shall immediately take all necessary and reasonable measures to optimise, extend and (or) reconstruct the grid and increase grid capacity, in order to ensure the safe and reliable access, the transmission and the distribution of electricity generated from renewable energy sources (art 18 par. 1 of the Law on Renewable Energy).

Enforcement of RES producer's legal rights

According to the new Law on Renewable Energy, any disputes concerning the connection procedure are to be investigated by the National Control Commission for Prices and Energy in accordance with the procedure and conditions set out in the Law on Energy.

In addition, RES producers have the right to enforce their legal rights (including claims for compensation for the damages suffered) in court. Regarding the legal means available to the plant operator, the author would like to point out that the effectiveness of these means will highly depend on the length of the procedure as well as on the costs involved. Consequently, a court procedure can only be considered an option if the plant operator has a chance to receive a judgement within reasonable time and for reasonable costs.

Costs of grid connection

Legislation does not set a limit to the costs of connection (NREAP 2010).

Before the introduction of the new Law on Renewable Energy, RES-E producers had to bear 60% of the connection costs. The rest was paid by the grid operators, which in turn could pass on these costs to the final electricity consumers through the fees for public service obligation (NREAP 2010; par. 12 of the Procedure for the Promotion of Generation and Purchase of Electricity Generated from Renewable Energy Sources).

The Law on Renewable Energy lowered the percentage of the costs to be carried by the RES-E producer. Since 24 May 2011, the producer has to bear:

- If the installation has a capacity above 350 kW: 40% of the connection costs
- If the installation has a capacity between 30kW and 350 kW: 20% of the connection costs
- If the installation has a capacity of 30 kW or less, connection is fully financed by the grid operator (art. 21 par. 2, 3 of the Law on Renewable Energy).

According to art. 21 par. 4 of the Law on Renewable Energy, the connection costs are defined as the actual costs for the grid connection works. The costs for a necessary reinforcement or development of the grid are also included in the connection costs (NREAP 2010). The connection cost scheme outlined above has to be considered a deep cost approach. This practice may constitute a barrier for the development of RES as the costs for grid reinforcement may be very high.

The distribution of costs is one of the key barriers for the deployment and for the integration of RES. For that reason, the rules regulation the distribution of costs should be scrutinized and possibly refined. It would go above the scope of this study to present a detailed solution that takes all national specifications into account. In fact such a solution could be organized as a process by the responsible ministry or the national regulator. The process leader would have the task to initiate a dialogue that involves all national stakeholders. The involved stakeholder groups should identify and discuss options how to clarify and probably rules on the distribution of costs. Future changes of energy generation capacities and subsequent need for grid development should be taken into account as well as the advantages and risks of shallow and deep cost approaches for deployment and integration. It might be also worthwhile to tie this discussion to ongoing initiatives at European level, such as the High Level Group responsible for development of the Baltic Energy Market Interconnection Plan.

If a RES-E producer chooses another connection site than the one proposed by the grid operator, the additional costs related to connection has to be borne by the producer (art. 21 par. 6 of the Law on Renewable Energy).

In contrast to this, it is the grid operator who has to bear these additional costs if he requests a more expensive grid connection alternative (art. 21 par. 7 of the Law on Renewable Energy).

The producer shall reimburse to the network operator not more than 10 percent of the costs incurred for the optimisation, the development and (or) the reconstruction of the network, including costs for the acquisition of equipment and facilities necessary for the safe and reliable operation of the grid (art. 21 par. 8 of the Law on Renewable Energy).

Other barriers

Speculation

Prior to the introduction of the new law, speculation with capacity was identified as one of the most severe problems. There have been situations where investors reserved capacity for the connection of a plant to the grid but did not intend to actually install a plant. The spare capacity could then be sold to other interested investors. Under these circumstances grid operators had to reserve capacity and sometimes even had to reinforce the grid, even though they could not be sure that the planned installation was finally constructed. This also constituted a barrier for real investors that wanted to install a plant and connect it to the grid, since the capacity was reserved for virtual plants and therefore not available for other investors. It was difficult to know who was a real power plant developer and who was not. Reserving capacity was free of charge and there were no financial sanctions for unfinished projects (LITGRID 2011; LVEJA 2011).

The Lithuanian government tried to solve this problem by introducing a financial guarantee. An investor wishing to reserve grid capacity for the connection of his plant has to oblige himself towards a grid operator to install a plant and to connect it to the grid by submitting a financial guarantee of 50 LTL/kW (around 14 €/kW), i.e. he obliges himself to pay a fine if the investment is not successful due to his fault (art. 15 of the Law on Renewable Energy). Since this solution came into effect as late as on 24 May 2011, it is not yet possible to assess its impact.

The introduction of financial guarantee as an answer to the speculation problem is one of the possible solutions. At the same time, this solution may constitute a barrier to further development of RES-E. The project developer has to make additional expenses a long time before the investment pays off. Moreover, these additional costs at the beginning of the project can lead to higher costs of the overall RES project. The balancing of these costs can make additional funding necessary, thus, the costs for the general public could increase. Moreover, high advance payments can be realized rather by large companies that can afford high investments and do not need quick return of investments. As a consequence, financial guarantee may advantage actors with high financial resources while it can pose a barrier to smaller actors at the market. One other possible solution is to introduce for the grid

connection process a set of intermediate steps, each of them ending with a realistic and appropriate milestone that the project developer has to reach within a defined period of time (e.g. first step submission of building permissions, second step financial guarantees and so on until the grid connection process is completed). After having achieved the first steps, the project developer may reserve a certain amount of capacity. If a project developer fails to reach the next milestone in the given time, the reservation expires and the developer has to restart with the first process step. However, in case of delays that do not lay in the responsibility of the project developer, for example waiting time for administrative decisions, time to realise the milestones should be extended. The restructuring of the process would prevent projects from being idle and would thus support a quick implementation of projects. The suggested process would provide grid operators with a clearer understanding which projects will be commissioned and an overview when projects will be ready. Such knowledge would help them in assessing how much capacity will be connected in a conceivable period of time and to accommodate its own planning. As a consequence, the process would be less stressful for grid and plant operators.

Not sufficient grid development

The grids are not sufficiently developed, especially in the Western part of the country, where most wind power plants are installed. According to the transmission grid operator wind power plants should be distributed more deeply in the central part of the country, where there are still free grid capacities to transport the generated electricity The right distribution of RES through the whole power system in Lithuania would lower the grid development cost, meaning a lower burden on all electricity consumers (LITGRID 2011).

Development of the grid in the western areas could be a wise solution to this problem, however it may be difficult to apply in case long authorising procedures, e.g. for obtaining building permits, were needed. Apart from that the construction of new infrastructure can be very costly. If the financial problem constitutes a severe barrier in the further development of the grid infrastructure, the EU Cohesion Funds may become useful.

NIMBY towards wind installations

Some interviewed stakeholders complained about the protests against wind power installations (NIMBY) (VKEKK 2011). As for NIMBY behaviour, the German government has recently introduced several legal changes in order to mitigate this barrier, which may also serve as model in the Lithuanian context. Among others, participation and transparency during the grid development process has been enhanced by introducing compensations for municipalities, more participation for citizens and increasing campaigning. The outcome of the new initiatives is not yet evaluable. However, it may worthwhile to follow up the development, and, in case it turns out to be effective to adapt it accordingly.

Heterogeneous connection conditions

The conditions for grid connection are not uniform and differ according to the local authority in charge of the area in which an RES-E plant is to be developed (AEON 2010).

Barriers identified			Solution proposed	Detailed description (Page)
Stand Alone	Cause	Consequence		
	Unclear, non-transparent new law	**Unclear definitions in the new law**	It could be advisable to wait and monitor if this problem prevail. If so the definitions should be redefined.	17-19
	Procedure for the adoption of the new law not transparent	**More complexity expected in the future, for the transition period to the new law**	It should be waited until the transition period of the law implementation is over. If after some time the procedures still seem to be too complex it could be advisable to modify the law.	17-19
	Poor status of the infrastructure in some areas, the ones with the most wind	**Until introduction of guarantees for reserving capacity: speculation and virtual saturation. Possibly solved**	The grid infrastructure should be developed. This process may however be very complex and take a lot of time.	25
Complex connection procedure			The process should be analysed in order to find and improve the inefficiencies.	19
Vague definition of deadlines ("reasonable time", "promptly")			It could be advisable to define the deadlines.	20
Partial availability of information on available grid capacity			The obligation of information sharing between grid operator and RES-E plant operator should be re-defined.	21
Demanding technical requirements			In the process of defining the technical requirements all stakeholders should be involved.	21
Insufficient grid development			The grid infrastructure should be developed. This process may however be very complex and take a lot of time.	25

Deep cost approach – divided			The rules regulating the distribution of costs should be examined and if necessary redefined.	23
Public opposition			Several solutions have been developed as for example information campaigns, more participation of local groups in the grid development process or the compensation for the municipalities.	25

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

Literature and other sources

AEON (2010): ECORYS, eclareon, *Assessment of non-cost Barriers to Renewable Energy Growth in EU Member States* (Lithuania). Available at: <http://ec.europa.eu/energy/renewables/studies/renewables_en.htm> (last visit on 29 May 2011).

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VKEKK (2011): Liutkevičius, Darius, *Valstybinė kainų ir energetikos kontrolės komisija* (National Control Commission for Prices and Energy). Interview on 2 May 2011.

Grid Operation

Summary

In Lithuania, the transmission grid operator is obliged to purchase all electricity produced from renewable energy sources. Moreover, RES-E has priority in the transmission and distribution of electricity.

The regulation on curtailment will not enter into force before the end of this year. The draft articles of the new Law on Renewable Energy specify that curtailment has to be carried out in a non-discriminatory way; yet, no compensation is foreseen for RES-E plant operators that are subject to curtailment measures.

Relevant legal sources

The most relevant legal source with regard to the use of the grid of RES-E plants is the new Law of the Republic of Lithuania on Renewable Energy (Valstybės Žinios (Official Gazette), 2011, No. 62-2936).

Other legal sources relevant for grid operation:

- Procedure for the Promotion of Generation and Purchase of Electricity Generated from Renewable Energy Sources approved by Resolution No 1474 of the Government of the Republic of Lithuania of 5 December 2001 (Valstybės Žinios (Official Gazette), 2001, No 104-3713; 2004, No 9-228; 2005, No 73-2651; 2006, No 100-3862; 2009, No 49-1958; 2010, No 82-4329);
- Resolution No 7 of the National Control Commission for Prices and Energy of 11 February 2002 on Prices of Public Service Obligations in the Electricity Sector (Valstybės žinios (Official Gazette) No 16-648, 2002);
- Description of the Procedure for the Provision of Services Meeting Public Interests approved by Order No. 1-215 of the Minister of Energy of the Republic of Lithuania of 24 November 2009 (Valstybės Žinios (Official Gazette), 2009, No. 140-6159; 2011, No. 14-647);
- Technical Rules for the Connection of Wind Power Plants to the Lithuanian Electricity System approved by Order No 4-102 of the Minister of Economy of the Republic of Lithuania (Valstybes Žinios (Official Gazette), 2004, No 57-2007).

Obligations, legal responsibilities and enforcement of legal rights

Purchase obligation

Before the new Law on Renewable Energy entered into force, electricity generated from RES was purchased at the rates approved by NCC, which differed according to the type of renewable energy source. The amount of the supported quantity of installed power from RES and the limit of the purchase obligation were specified in the Description of the Procedure for the Provision of Services Meeting Public Interests and differed for every renewable energy source (LITGRID 2011).

The new Law on Renewable Energy brought some changes related to this. Thus, according to art. 20 par. 1 of the Law on Renewable Energy, all electricity produced by RES power plants whose total installed capacity does not exceed 30 kW shall be purchased at the fixed feed-in tariff set by the government. For RES-E plants with a total installed capacity above 30 kW, fixed feed-in tariffs and the government's growth target for supported electricity generated from RES shall be allocated in an auction (art. 20 par. 3 of the Law on Renewable Energy).

The party obliged to purchase electricity from RES is the transmission grid operator or the distribution grid operator (par. 6, 7, 9 of the Description of the Procedure for the Provision of Services Meeting Public Interests).

Dispatching priority

A dispatching priority for renewable energy has already been introduced (LITGRID 2011).

This rule is complemented by the new Law on Renewable Energy. Art. 17 par. 1, 2, which, however, will enter into force no sooner than on 31 December 2011, states that a grid operator has to accept all electricity generated from RES and transmit and distribute it as a priority.

Priority or guaranteed access

According to art. 14 par. 1, 2, Art 15 of the Law on Renewable Energy, RES-E producers have a right to priority connection of their plants to the grid. Grid operators are obliged to connect systems even if connection is only possible by optimising, boosting or expanding the grid.

After the connection of a RES power plant to the operator’s grid, a purchase agreement is concluded between the RES producer and the grid operator, whereby the grid operator agrees to accept the generated electricity, except when this would somehow damage the grid. In such a case the grid operator can temporarily disconnect a RES plant (Vėjų spektras 2011).

Moreover, as already mentioned above, the new Law on Renewable Energy will provide that the grid operator has to accept all electricity generated from RES and transmit and distribute it at a priority.

Obligations of the RES producer to operate in line with network requirements

According to the TSO, there is currently no obligation to provide any ancillary services for RES power plants. Technically, they should have remote voltage, active and passive power factor corrector (LITGRID 2011). The NCC also confirmed that RES power plants are required to have installed remote control or disconnection mechanisms in order to enable the grid operator to reduce their output if necessary (VKEKK 2011).

Par. 17 of the „Technical Rules regulating wind power plants' connection to the Lithuanian energy system" states that it must be possible to change the output of each wind power plant from the operational dispatch control station.

According to RES-E producers, technical requirements for connection to the grid are provided in the technical conditions for the connection of RES plants. Network operators have set a number of unnecessary requirements for RES producers who wish to be connected, arguing that these requirements are necessary to ensure the security and stability of the network (Vėjų spektras 2011). For example: In case of a wind park consisting of 4 turbines of 2.0 MW each and one turbine of 330 kW, the high power turbines (2.0 MW) are required to install additional network support equipment low voltage ride through. However, the same equipment may also be required for the small wind turbine (330 kW), although it accounts for only 4% of the total capacity of the wind park. In countries where wind power infrastructure is highly developed, small wind power plants are exempt from this requirement, as they are too small to affect the network parameters. In this respect it can be observed that Lithuanian grid operators often adopt good practices from other countries (like Germany) and apply them in a more restrictive manner, i.e. without any exceptions for small power plants. For this reason, good practices are misused and small power plants have to face unnecessary requirements (Vėjų spektras 2011).

In this regard, it seems necessary to ensure that all stakeholders are represented in the definition process of technical standards. It remains to be seen whether the development of the Pilot Grid Code at European level will help mitigating this problem. Another alternative would be to set up a technical clearing house that would give recommendations in case of conflicts as it has been proposed in the national PV LEGAL report for Germany (PV LEGAL 2011).

From late 2011, the network requirements for wind power plants with a capacity above 350 kW and hydro-power plants with a capacity over 5 MW will be regulated by the new Law on Renewable Energy. Art. 19 par. 3 and 4 obliges RES-E plant operators, on the grid operator's request, to provide the plants with technical and maintenance systems enabling grid operators to remotely reduce or increase the output at any time. However, remote output regulation is permitted only in case of threatening overload of the grid due to force majeure and in order to prevent or mitigate a power system emergency or network emergency.

Grid curtailment

According to the TSO, the currently applied curtailment procedure is not legally regulated. If there are problems in the grid, the grid operator can reduce the feed-in capacity of wind parks (LITGRID 2011). Disconnection is possible only in the case of an emergency or a deviation of the generated electricity from the defined grid parameters. According to several RES producers, there are no abuses on the side of the grid operator with regard to curtailment, because the RES plant operators have the right to claim wrongful curtailment and damages in court (Vėjų spektras 2011).

The author would like to highlight that due to its strong dependence from energy imports from other countries, Lithuania is highly interested in minimising these imports through domestic energy generation. As a consequence, a growing share of RES is aimed for and curtailment occurs only rarely.

According to the TSO, power plant owners are currently informed about the curtailment in advance (LITGRID 2011). Moreover, information on the plants to be disconnected and the time of disconnection can be found on the website of the TSO (VKEKK 2011).

According to the TSO, compensation is subject to agreement with the producer (LITGRID 2011). There are no regulations on special compensation payments for curtailment (VKEKK 2011; Vėjų spektras 2011). However, RES producers may claim damages under general civil law in case of violation of civil law obligations.

Legal regulation of the curtailment process will be introduced on 31 December 2011. On this date art 17 of the new Law on Renewable Energy will enter in force, introducing specific curtailment rules with regard to RES-E producers. According to these provisions, curtailment will be allowed only in case of power system emergencies or for other technical reasons, but in any case curtailment shall be carried out on a non-discriminatory basis. If a grid operator takes measures to substantially limit the use of renewable energy resources in order to ensure the stability of the grid, the responsible network operator shall immediately inform the competent authority of the relevant measures, the extent of and the reasons for curtailment and indicate the corrective measures to be taken to prevent unnecessary restrictions (art. 17 par. 3, 4 of the Law on Renewable Energy).

According to art. 17 par. 3 of this law, damages incurred to a producer due to curtailment will not be compensated for, unless the curtailment was caused by the network operator's fault or other legal grounds for damages are present.

Curtailment of electricity production hardly ever happens in Lithuania. Although the grid operators have the technical possibilities to disconnect RES power plants or to reduce their production, in practice they use this possibility reasonably, only in case of emergency, deterioration or maintenance (Vėjų spektras 2011). According to the interviewed stakeholders, curtailment is a temporary measure (LITGRID 2011; VKEKK 2011; Vėjų spektras 2011).

Other barriers

Government growth targets for RES-E

Many stakeholders have complained about the government's quantitative growth targets for the development of electricity from renewable energy sources, which were introduced by the new Law on Renewable Energy (AEON 2010).

The following targets are listed in the law:

- wind energy: 500 MW (small wind power plants with a capacity of less than 30 kW are not included in this total amount),
- solar installations: 10 MW (small solar power plants with a capacity of less than 30 kW are not included in this total amount),
- hydro energy stations: 141 MW,
- bio fuel installations: 355 MW.

According to the new Law on Renewable Energy, these capacity targets should be reached until 2020. If these figures are reached, the government will consider defining new capacity targets for the above-mentioned RES technologies (art. 13 par. 3, 4 of the Law on Renewable Energy).

An adequate and perhaps more ambitious RES target should be defined. In this process all relevant stakeholders should be involved. For that reason the stakeholders should meet and develop a common and most feasible target for RES development.

Barriers identified			Solution proposed	Detailed description (Page)
Stand Alone	Cause	Consequence		
	Unclear, non-transparent new law	**Unclear definitions in the new law**	It could be advisable to wait and monitor if this problem prevail. If so the definitions should be redefined.	17, 19
	Procedure for the adoption of the new law not transparent	**More complexity expected in the future, for the transition period to the new law**	It should be waited until the transition period of the law implementation is over. If after some time the procedures still seem to be too complex it could be advisable to modify the law.	17-19
Demanding requirements for ancillary services			The development of the Pilot Grid Code at European level might help mitigating this problem.	33
Disagreement about the national targets for RES-E development			A more ambitious target for RES-E development should be developed.	35

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

Literature and sources

AEON (2010): ECORYS, eclareon, *Assessment of non-cost Barriers to Renewable Energy Growth in EU Member States* (Lithuania). Available at: <http://ec.europa.eu/energy/renewables/studies/renewables_en.htm> (last visit on 29 May 2011).

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PV LEGAL (2011): Persem, Mélanie, Thomas, Chrometzka, Brohm, Rainer, Moch, Frederik, Brennig, Christian, Hielscher, Thomas, Bundesverband Solarwirtschaft e.V. (German Solarindustry Association), *Reduction of administrative barriers for photvoltaic systems in Germany – Recommendations of how to reduce obstacles at a National Level when Planning and Realising Photovoltaic Systems*. Available at: <http://www.pvlegal.eu/> (last visit on 24 August 2011).

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VKEKK (2011): Liutkevičius, Darius, *Valstybinė kainų ir energetikos kontrolės komisija* (National Control Commission for Prices and Energy). Interview on 2 May 2011.

Grid development

Summary

Grid development is one of the biggest issues in Lithuanian energy policy, yet not specific to RES. The country is exclusively connected with the two other Baltic States, as well as with Belarus and Russia. The construction of interconnections with Central Europe and Scandinavia is considered a main goal in the national energy strategy. Connecting the country to the European Continent and the North European Network is classified as very important for the security of energy supply in Lithuania. The development of the grid connecting the Western coastal region, where the wind power plants are situated, and the rest of the country is one of the strategic projects of the transmission grid operator. The integration of RES does not play an important role in grid development.

Relevant legal sources

The most relevant legal sources regulating grid development with regard to RES-E plants are the new Law of the Republic of Lithuania on Renewable Energy (Valstybės Žinios (Official Gazette), 2011, No. 62-2936) and a Law of the Republic of Lithuania on Electricity (Valstybės Žinios (Official Gazette), 2000, No 66-1984; 2004, No 107-3964; 2008, No 77-1002; 2010, No 117-5967).

Other legal sources relevant for grid operation:

- Law of the Republic of Lithuania on Energy (Valstybės Žinios (Official Gazette), 2002, No 56-2224; 2010, No 67-3337);
- Description of the Procedure and Conditions for the Connection of Energy Facilities (Networks, Installations, Systems) of Electricity Consumers and Producers to Operating Facilities of Energy Companies (Networks, Installations, Systems) approved by Order No 1-246 of the Minister of Energy of the Republic of Lithuania of 9 December 2009 (Valstybės Žinios (Official Gazette), 2009, No 149-6678).

Regulatory framework for grid development

The grid operators are, according to the current legislation, obliged to develop their grids in order to secure energy supply and environmental protection, which includes the connection of RES-E plants (art. 15 and 19 of the Law on Electricity; art. 14 par. 2 of the Law on Renewable Energy).

Grid operators have to consult the National Control Commission for Prices and Energy on their investments in grid development. However, the Commission can only accept or not accept the proposed development plan and is not allowed to give recommendations on how and to what extent the grid is to be developed. Moreover, the Ministry of Energy may formulate political objectives

relating to grid development, like for example, interconnections with Sweden or Poland (VKEKK 2011; Vėjų spektras 2011).

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

The Law on Electricity obliges the grid operators to maintain and develop their grids taking into account the requirements for security of supply, quality, efficiency, consumption, management and environmental protection (art. 15 and 19 of the Law on Electricity). This obligation is not specific to RES.

However, the new Law on Renewable Energy brought some relevant changes. It provides that grid operators are obliged to connect RES-E systems even if connection is only possible by optimising, boosting or expanding the grid (art. 14 par. 2 of the Law on Renewable Energy). Thus, when a RES-E producer and grid operator conclude an agreement on the connection to the network services, the grid operator, having considered the current technical condition of the grid, shall immediately take all necessary and reasonable measures to optimise, extend and (or) reconstruct the grid and increase the grid capacity in order to ensure the safe and reliable access, the transmission and the distribution of electricity generated from renewable energy sources (art. 18 par. 1 of the Law on Renewable Energy).

Regulatory instruments to encourage grid development

According to the Lithuanian TSO there are no regulatory instruments to encourage grid development (LITGRID 2011).

Grid development studies and planned improvements

There is a national energy strategy for the whole of Lithuania. In addition, the TSO outlined that there are complementary grid development studies from other government bodies. Summaries of these studies can be found on the website of the TSO (www.litgrid.eu) (LITGRID 2011).

The following studies relate to grid development and renewable energy:

- National Energy (Energy Independence) Strategy;
- National Strategy for the Development of Renewable Energy Sources;
- Plan of Measures for the Implementation of the National Strategy for the Development of Renewable Energy Sources;
- State audit report on the potential of renewable energy use in Lithuania (VKEKK 2011).

Apart from these studies, the Lithuanian Energy Institute prepared a study, *Wind power development feasibility analysis*, in 2009.

The major challenge for the Lithuanian transmission grid is the construction of new interconnections between Lithuania and Poland, and Lithuania and Sweden (BRG 2009).

Interconnection with the European Continental Network (ECN)

Lithuania, as all three Baltic States, is part of the IPS/UPS – synchronised transmission grid of some CIS countries (including Russia, Ukraine, Belarus etc.). Since the country is a member of the European Union and thus politically belongs to the structures of Western Europe, it does not want to be part of the IPS/UPS. The goal of the Lithuanian government is to synchronise itself with the European Continental Network (ECN) (National Energy Strategy 2010). The synchronous operation of Lithuanian, Latvian and Estonian electricity transmission systems and the European Continental Network is the key strategic aim of Lithuanian energy policy in order to increase security of supply.

In January 2010, it has been agreed to conduct a feasibility study on interconnection in order to synchronise the Baltic States with the ECN (LITGRID 2011b).

The TEN-E financial support committee agreed during a meeting held in Brussels in September 2010, to financially support the feasibility study on Interconnection Variants for the Integration of the Baltic States to the EU Internal Electricity Market. € 950,000 were allocated for its financing. It is expected that the study will be finished in 2012-2013 (LITGRID 2011b).

For the time being, there are two interconnection projects already in progress. The first one is the NordBalt project, which aims at establishing a connection between Lithuania and Sweden. The interconnection is scheduled to be launched into operation in 2016 (LITGRID 2011b).

The second one is the LitPol Link, which will connect Lithuania with Poland and at the same time with the Western part of Europe. It is scheduled that 500 MW Poland-Lithuania power interconnection will be launched into operation in 2015. By 2020, the operation of the second 500 MW line will be started (LITGRID 2011b).

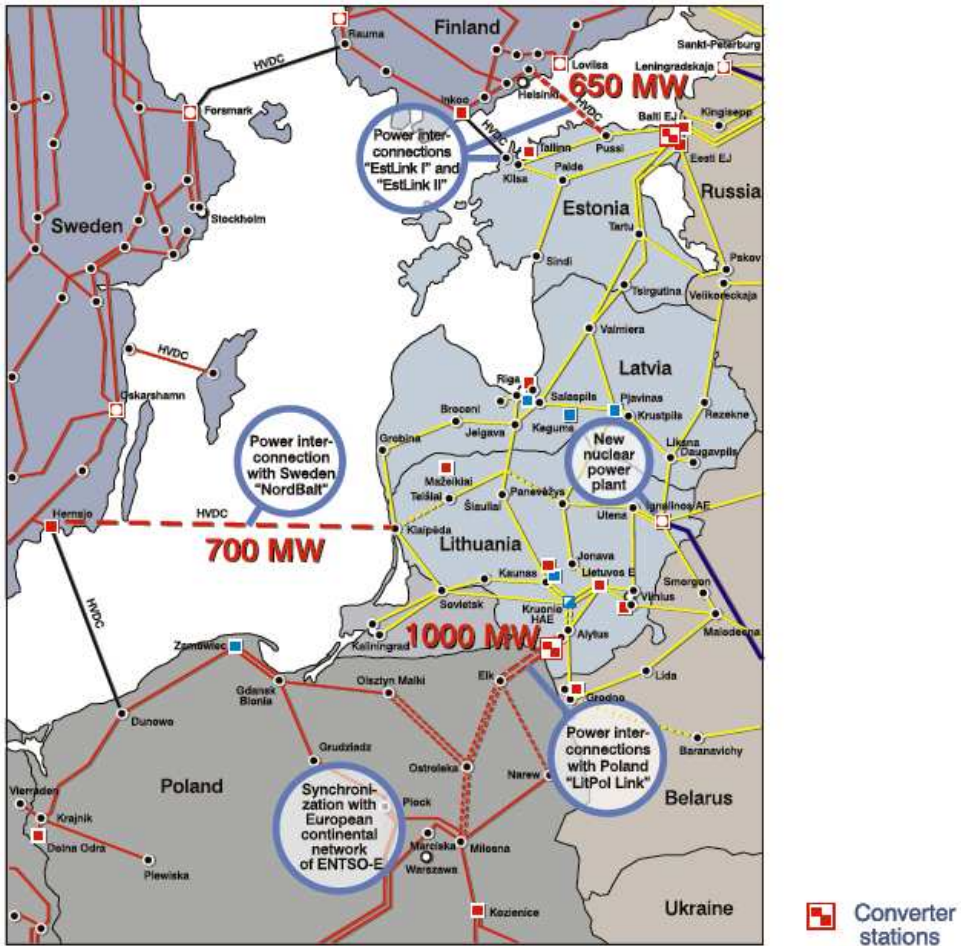

Figure 3: Planned interconnections (Source: National Energy Strategy – Road 2010)

Internal grid development

To synchronise the Lithuanian power system with the European continental networks, it is necessary to reinforce the internal Lithuanian electricity transmission grid. Numerous projects are already taking place. As showed in figure 4, one of the planned developments is the stronger connection of the Western part of the country, where the wind parks are situated (LITGRID 2011b).

Figure 4: grid reinforcement projects (Source: LITGRID 2011b).

Other

In its "Wind power development feasibility analysis" prepared in 2009, the Lithuanian Energy Institute mentions topics such as intelligent networks and storage facilities. However, these topics are only mentioned as abstract objectives for the future and are not analysed in detail. Moreover, NCC stated that the development of the smart grid would be too expensive for Lithuania. Lithuania should thus search for possibilities to install common smart grids with the neighbouring countries if technically possible (VKEKK 2011).

Costs

According to NCC, the costs for the development of the grid are borne by the final electricity consumers, as they pay electricity charges in which the price for public service obligation (RE) is included (VKEKK 2011).

Barriers identified			Solution proposed	Detailed description (Page)
Stand Alone	Cause	Consequence		
	Unclear, non-transparent new law	**Unclear definitions in the new law**	It could be advisable to wait and monitor if this problem prevail. If so the definitions should be redefined.	17, 19
	Procedure for the adoption of the new law not transparent	**More complexity expected in the future, for the transition period to the new law**	It should be waited until the transition period of the law implementation is over. If after some time the procedures still seem to be too complex it could be advisable to modify the law.	17-19
Insufficient grid development			The grid infrastructure should be developed. This process may however be very complex and take a lot of time.	25
Deep cost approach – divided			The rules regulating the distribution of costs should be examined and if necessary redefined.	23
Public opposition			Several solutions have been developed as for example information campaigns, more participation of local groups in the grid development process or the compensation for the municipalities.	25
Disagreement about the national targets for RES-E development			A more ambitious target for RES-E development should be developed.	35

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

Literature and sources

BRG (2009): Baltic Regional Group, *Baltic Regional Group Annual Report 2009*. Available at: <https://www.entsoe.eu/fileadmin/user_upload/_library/publications/baltic/annual_report/100713_BRG_Annual_Report_2009_final.pdf> (last visit on 31 Mai 2011).

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Market integration

Summary

The Lithuanian electricity market is under development, recent changes focused on increasing competition and moving towards integration with other markets. Its progress in the energy sector has been triggered by the following issues in recent years:

- Ignalina Nuclear Power Plant shut down (responsible for 75-88% of Lithuania's electricity output). As a result Lithuania became an importing rather than an exporting country.
- Following EU Directives, AB Lietuvos Energija was restructured by separating TSO and Market Operator activities into separate companies.
- Regulated tariffs are removed for large consumers, around 35% of Lithuania's consumption.
- Start-up of Power Exchange (Baltpool) on January 1st, 2010.

There is a short gate-closure time, but no intraday market for the time being.

Current cooperation and future integration with the Nord Pool market provides an interesting perspective for the further market development, in terms of an increasing market size, the participation in a well-established, functioning market and the introduction of an intraday market.

The main support for RES-E in Lithuania is a Feed-in tariff (FiT) system introduced in 2002. Other support mechanisms are loans and subsidies for specific projects. There are no additional mechanisms to support market integration.

Relevant Legal Sources

The basic principles of energy development and management, energy and energy resources efficiency, conditions and requirements for the generation and purchase are established by the Law on Energy that came into force in 2002[1], amended several times (among others to foster RES) and last updated in 2010 (Lithuania, 2002a).

There is no exclusive law for the promotion of RES-E, since the Law on Energy from 2002 already included several measures to promote RES (following the Directive of the European Parliament), including a feed-in tariff system[2].

[1] Sectorial requirements were set in the separate Laws (Electricity Law (2004) , Heat Law (2007), Biofuel Law (2007), and Law on Nuclear Power Plant (2007).
[2] Resolution No 7 of State Price and Energy Control Commission of 11 February 2002 (Valstybės žinios, No 16-648, 2002)

In order to increase support for RES and to achieve its target of 23% from RES by 2020[3], in June 2010 a National Strategy for the development RES was approved[4]. In its content, it disaggregates targets by areas, and established development of RES projects as a strategic issue.

Market Design

General availability of markets

Upon accession from Lithuania to the European Union in 2002, its electricity framework was harmonised with the 2nd EU Electricity package (through the new Law on Electricity).

However market liberalisation was not totally accomplished and only a few customers opted to buy electricity from independent suppliers (Varul, 2010). Therefore further changes were needed and implemented in 2010. Those improvements entered into force on 1st January 2010, and are part of the "Development Plan of the Lithuanian Electricity Market". These new regulations aim at improving full competition.

On January 2010, the electricity power exchange Baltpool became operational (Baltpool, 2011). Furthermore, due to the new legislative framework, the companies operating in the market are allowed to participate in the wholesale electricity market. Only direct participants in the market are allowed to trade (Lithuania, 2009). Additionally, participants must have a contract with a balance energy supplier for trading of balance electricity (Varul, 2010).

Wholesale electricity trading in Lithuania can be done in the following ways:

- Bilateral contracts
- Baltpool (day-ahead market)

In 2010, the Baltpool traded up to 70% of electricity consumed in Lithuania (Kubilius, 2010).

In order to enable the future integration into the Nord Pool market, the conditions for trading and clearing at the Baltpool should be compliant with the "Rulebook for Nord Pool Spot's Physical Markets" (CESI, 2009). Moreover, the balancing model framework follows the Nordic model, again providing the basis for the envisaged integration of both systems (CPI, 2011).

Gate closure

There is only a day-ahead wholesale market, which allows market participants to trade in the power exchange. Gate closure for the day-ahead market is 11 am day-ahead (EET). The gate closure for the balancing market is 45 min before physical delivery (Railaitė, 2011).

[3] National strategy for RES development
[4] Valstyb•s Žinios (Official Gazette), 2010, No 73-3725.

Intraday market

There is no intraday market in Lithuania.

As mentioned before, in a first stage the Baltpool shall cover only the day-ahead market and, thereafter, on the basis of the acquired experience and feedback from the day-ahead market, further markets could be introduced in the power exchange (intraday market and financial markets, e.g. futures) (CESI, 2009).

The three Baltic countries established a joint work project. According to the Baltic Energy Market Interconnection Plan (BEMIP) Lithuania Latvia and Estonia signed a proposal to merge into a single common Baltic electricity market and integrate into NordPool Spot in 2011-2013 (BEMIP, 2009). Currently, the Estonian electricity power exchange is already operated by Nord Pool (Nordpool, 2010). Lithuania and Latvia are still waiting for the legislation approval. While market integration of Lithuania is expected to happen in the beginning of 2012 there is still no firm date for Latvia (ACER, 2011).

Balancing

Real time balancing and regulation auction take place in the Lithuanian market. The market is opened to any participant with a supply license or generation permit with an additional agreement signed with the TSO. The TSO ultimately assumes the responsibility for electricity balancing and long-term planning of power system's capacity balance.

Every party is balancing responsible and is required to have a unique balance supplier (ERGEG, 2009). Thus a supply agreement is needed for every party to cover the unbalances they may cause. The balance contract can be established either with other market actors or the TSO. (CESI, 2009).

The main requirements for regulation auction (UTCE tertiary reserve) are a minimum bid volume of 5 MW (Railaitė, 2011). Those producers with an installed capacity higher than 5 MW must present regulation power bids for TSO for regulation power auction. The regulation power auction takes place during the operation hour (CESI, 2009).

There is no specific regulation to enable RES-E to participate in the balancing market.

Support Scheme Design

General support scheme design

The key support instrument for RES-E generation is a Feed-in tariff with purchase obligation at the national level approved in 2002 (Lithuania, 2002). The FiT system is financed by the consumers through the electricity prices. Besides the FIT system, Lithuania's RES support system count on diverse subsidies and loans granted by the Lithuanian Environmental Investment Fund (LEIF). Additionally, electricity generated from RES is exempted of excise duty from 2010 (EREC, 2009)

The FIT system obliges energy suppliers to purchase energy from RES at guaranteed price (Lithuania, 2001). Purchasing prices and the conditions of application thereof is established by the National Control Commission for Prices and Energy (hereinafter NCCPE). Electricity production with the use of renewable energy sources is a service meeting public interests. Newly commissioned plants benefit from the FIT for 12 years after the plant commissioning (Lithuania, 2011).

Furthermore, Lithuania has introduced an annual maximum quota of RES to be purchased at the guaranteed price for the period 2004-2010, differentiated by RES technologies (Lithuania, 2009a).

Mechanisms to promote market integration

There are no special mechanisms to foster market integration from RES-E within the FiT system. The only alternative to participate in the market would be to leave the feed-in scheme, which would entail a price disadvantage. So far there is no information from RES-E producers that have left the FiT system to participate directly in the market.

Balancing responsibility

There is no balancing responsibility for RES-E under the feed-in scheme. Rather, the TSO is responsible for balancing the generation of RES-E (Railaitė, 2011).

In terms of forecasting of RES, it is also the TSO that makes the forecasts in order to fulfil its national balancing function.

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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
Unclear, non-transparent new law	**Yes**		Not mentioned in NREAP	
Unclear definitions in the new law			Not mentioned in NREAP	
Procedure for the adoption of the new law not transparent	**Yes**		Not mentioned in NREAP	
More complexity expected in the future, for the transition period to the new law	**Yes**		Not mentioned in NREAP	
Poor status of the infrastructure in some areas, the ones with the most wind			Not mentioned in NREAP	
Insufficient grid development	**Yes**		Not mentioned in NREAP	
Complex connection procedure			Not mentioned in NREAP	
Vague definition of deadlines ("reasonable time", "promptly")			Not mentioned in NREAP	

Partial availability of information on available grid capacity	**Yes**		Not mentioned in NREAP	
Demanding technical requirements			Not mentioned in NREAP	
Deep cost approach – divided			Not mentioned in NREAP	
Public opposition			Not mentioned in NREAP	
Demanding requirements for ancillary services	**Yes**		Not mentioned in NREAP	
Disagreement about the national targets for RES-E development			Not mentioned in NREAP	

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