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Legal conditions for grid access

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Report

APPENDIX II Report on legal conditions for grid access

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Integration of renewable electricity into the grid

WP 4.1 of the GEOELEC-project aims to identify regulatory barriers for geothermal electricity. This part of the report wants to introduce the reader into the legal conditions for grid access of renewable electricity. In contrast to the "Technical report on grid access" (WP 2.4) we are especially focusing on the existing European regulations and legal barriers for grid access whereas in WP 2.4 the focus was on the process of grid integration from a technical point of view. Besides that, questions concerning the costs of grid access, the process of grid access and the demand of electricity in general and geothermal electricity in special were addressed.

This report shall first give the reader an overview of the European regulations concerning the grid access of geothermal/renewable electricity. In a second step it shall show legal, organizational and systemic barriers for grid integration on a European level and finally the report shall take a look at the situation in the member states of the European Union.

To better understand the reasons and circumstances of regulations concerning the grid integration of renewable power sources (RES) the main challenges of RES integration are explained in the following. Challenge in this situation mainly means the adaptions that have to be done in the existing electricity grid. The current grid is grown since the beginning of the electrification and is therefore based on large, controllable, centralized, fossil and nuclear power plants which were/are situated close to consumption. To allow the integration of a growing RES-capacity the whole electricity system has to be redesigned and adapted to handle three main challenges.

a. Geographical distribution:

The geographical distribution of production and consumption of electricity changes with the introduction of RES. Fossil and nuclear power plants, industry and settlements have developed dependent on each other, at a national level. RES are local, this means that electricity production and consumption should be close together, which makes an enforcement of the electricity grid necessary to adapt to a local production and more decentralized production.

b. Distributed generation:

Small scale installations of RES like geothermal low temperature power plants (CHP) and other RES (often small scale) are called distributed generation (DG). These generation capacities are mostly connected to the distribution grid. This DG causes a challenge for the distribution networks. Traditionally the power was transported vertically from the transmission level over several voltage levels to the distribution networks. The grid infrastructure was built for this directed power flows. DG and other RES, which are connected to the middle voltage level (e.g. geothermal power plants), cause challenges through bidirectional power flows. Therefore system operators have to adapt their infrastructure (Timpe, Bauknecht, Koch, & Lynch, 2010).

c. Variability and intermittency:

RES depend on the availability of their natural sources. While geothermal power is continuously available, wind and solar power plants for example can only produce when their natural sources are available. They are at the same time variable and intermittent and therefore not flexible usable (Timpe, Bauknecht, Koch, & Lynch, 2010).

These challenges can be solved through technical, organizational and legal measures. But these adaptions of the current system are not only costly but in some cases also attract the resistance of the public in the often discussed 'Not-in-my-backyard-problem'. These issues won't be addressed in this report but nevertheless

Some RES technologies, i.e. Geothermal electricity, are dispatchable. This means they are capable of responding to command from system operators to ramp output up and down demand, and thereby can provide valuable flexibility to the electricity system.

The main principles are the following:

1) A regional approach (a level between nationally centralised and individually decentralised systems) should be considered for designing the electricity system and manage the grid

2) Being sizable and controllable, flexible RES technologies (like geothermal, biomass and hydropower) could reduce the need of installed capacity of gas fired backup systems

3) It is expected to decrease the total costs for the society: no need of large storage capacities and large infrastructure. Flexible RES technologies deal with both transmission

grid issues (balance of supply/demand and frequency control at various time scales, congestion of transmission grid line) and distribution grid (voltage control issues).

Error! Reference source not found. shall give an overview over challenges and measures of he integration of RES.

Table 1: Challenges of renewable electricity integration and related measures (Based on: Timpe, Bauknecht, Koch, & Lynch, 2010)

<table>
<tr><th>Challenges / Measures</th><th>Geographical distribution</th><th>Distributed generation</th><th>Variability and Intermittency</th></tr>
<tr><td>Expansion of the transmission network</td><td>Adapt grid structure to connect new generation and demand</td><td>Generation in the distribution grid reduces the demand for transmission capacity</td><td>Adapt grid structure to enable improved balancing between intermittent generation e.g. leveling-out wind generation in different areas; renewable base load; flexible resources such as geothermal</td></tr>
<tr><td>Expansion of the distribution network</td><td></td><td>Increase network capacity to accommodate DG</td><td rowspan="6">Variability and intermittency have to be counterbalanced by increased flexibility in the system
Flexible renewable and conventional power plants compete here with electricity storages and demand-side-management</td></tr>
<tr><td>Intelligent (distribution) networks</td><td></td><td>Increases capacity of existing network to accommodate DG</td></tr>
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Flexible RES power plants can help to reduce network bottlenecks</td></tr>
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<tr><td>Flexibility on the demand side</td></tr>
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</table>

Generally speaking one can say that barriers for the grid integration of renewables arise through problems with the grown structures of the electricity system. The grown electricity grid has to be adapted to the new challenges of a renewable electricity system. Renewable

energy sources like hydro power plants e.g. have been used even before fossil and nuclear power plants and are well integrated into the electricity grid.

1. European legislation for the grid integration of geothermal electricity

In the center of European legislation concerning the grid integration of geothermal electricity are three legislative initiatives.

- Directive 2009/28/EC
  - "This Directive establishes a common framework for the promotion of energy from renewable sources." (European Parliament and the Council of the European Union, 2009)
- Directive 2012/27/EU
  - "This Directive establishes a common framework for the promotion of energy efficiency."
- The third European energy package with directive 2009/72/EC
  - "This Directive establishes common rules for the generation, transmission, distribution and supply of electricity, together with consumer protection provisions, with a view to improving and integrating competitive electricity markets in the Community." (European Parliament and the Council of the European Union, 2009)

A directive only sets the objective of a certain legislative initiative, but leaves the actual implementation to the national legislation. This gives the Member States freedom to adapt their legal system to the new objectives. (Publication office of the European Union, 2010).

1.1 Directive 2009/28/EC

Directive 2009/28/EC is called the renewable energy directive. It is the first time, that there is a comprehensive legislative initiative which regulates the future development of renewable energies. Before that there were only directives for renewable electricity and biofuels (Lehnert & Vollprecht, 2009). The main success for renewable energies in this directive is that with Article 3 it is the first time that there are mandatory goals for renewable energies in the final EU energy consumption (European Parliament and the Council of the European Union, 2009).The overall goal is to reach a 20 % share of renewable energy in the energy consumption of the European Union in 2020.

The legal security for renewable electricity sources has made a step forward with that directive. Article 16.2 e.g. gives a priority or guaranteed access to the grid for renewable

electricity power plants. While in the former directive for renewable electricity production (2001) countries only could introduce such a priority or guaranteed access the directive 2009/28/EC makes it mandatory (Lehnert & Vollprecht, 2009).

The directive has no direct sanctions against a Member State, which doesn't reach its goals or doesn't adapt its legal system to certain provisions like the priority grid access. But the EU Commission has the right to open infringement proceedings like stated in Article 226 EG (Lehnert & Vollprecht, 2009).

1.2 Directive 2012/27/EU

In Article 15.5 of the Energy Efficiency Directive adopted in 2012, it is mentioned that now there is also "priority access or dispatch for high efficiency cogeneration". So not only renewables have priority for grid access but also some conventional CHP.

Moreover, this article specifies that this "shall in any case ensure that priority access or dispatch for energy from variable renewable energy sources is not hampered"1. Such a loose and biased provision could hamper other non-variable RES including geothermal:

· The use of "variable" strongly undermines the legal consistency of the article as it is in striking contrast with the initial "Without prejudice to Article 16(2) of Directive 2009/28/EC". In fact, Article 16 (2) of Directive 2009/28/EC (hereinafter referred to as RES Directive) provides for "either priority access or guaranteed access to the grid -system of electricity produced from renewable energy sources " (therefore without the adjective "variable");

· The term "variable renewable energy sources" only refers to wind, solar and wave, and may in turn exclude and heavily hamper other renewables such as biomass, hydro, geothermal; this is again in contrast with objective of the RES Directive, notably with its Article 16 (2).

· There is no EU-wide legal definition of "variable renewable energy sources" and this may bring about a loop hole at EU level as well as at national level.

1.3 Third European energy package

The third European energy package consists of three regulations and two directives, of which directive 2009/28/EC has the most impact on the electricity market. The overall goal

[1] It should be noted that some linguistic versions of the directive vary. Indeed, while some versions state that Member States "shall in any case ensure that priority access or dispatch for energy from renewable energy sources is not hampered", others – including the English version - refer to "variable renewable energy sources" only. In this respect, the implementation at national level will better define the concrete implications of this provision and should be closely monitored.

of the third energy package is to complete the liberalization of the grid-based energy markets (natural gas, electricity) and to reduce monopolistic structures and market imperfections in the European member states. The European Commission sees the free energy trade, the free choice of supplier and the access to existing grids mainly hampered by vertical integrated incumbents. That's why the European Union created this energy package to address four key features (Linklaters, 2009):

- Unbundling of energy supply and production from network operations
- Ensuring fair competition between EU companies and third country companies
- Strengthens of the power of national regulators
- Creation of a European energy agency

For the electricity grid the request for unbundling has the most influence. In Article 9.1 of directive 2009/72/EC it is stated that a company who is active in the business of electricity production or supply shall not have any control over transmission system operators (European Parliament and the Council of the European Union, 2009). While distribution systems weren't touched by the third energy package, Owners of transmissions systems were given three unbundling options (Linklaters, 2009):

- Ownership unbundling (OU).

OU means that transmission system operators are not majority controlled or owned by energy production or supply companies.

- Independent System Operator (ISO).

This option allows production or supply companies to keep their ownership on transmission grids. But the operation of these grids has to be handed over to an independent company.

- Independent Transmission Operator (ITO).

This option leaves ownership of the transmission networks with the supply companies, but requires that they abide by certain rules to ensure that the production/supply and transmission network operations are conducted independently.

Through these measures the European Union assures that electricity producers also from renewable energy sources have an indiscriminate access to the electricity network. For the development of the electricity grid the third European energy package strengthened the national and European regulation, created a network of transmission system operators (ENTSO-E) and gave this network the duty to create a yearly 10-year network development plan (Binda, et al., 2012).

2. Legal barriers to grid integration of renewables in Europe

In the following we want to give a general overview of the situation in Europe in the different grid integration phases. A map will present for each phase the overall situation in Europe. Additionally a table will show for each country the main barriers. Afterwards the legal barriers are discussed that have been identified for each phase of integration. Although it can be assumed that legal measures would be helpful in overcoming the barriers for grid integration most of the barriers detected are non-legal-barriers.

The integration of renewable electricity can be divided into three main phases that shall be examined in the following (Binda, et al., 2012):

- grid connection
  … means the physical connection of a power plant to the electricity grid and the process of implementation
- grid operation
  … means the operation of the electricity grid with a growing share of renewable electricity
- grid development
  … means the adaption of the grid to geographical distribution, distributed generation, volatility and intermittency of renewable power plants

1.4 Grid connection

Grid connection of RES is the first contact between the grid operator and the power plant operator. Here the strongest and most of the barriers occur. This can be explained by three reasons (Binda, et al., 2012):

- Grid connection is the first contact point between grid operator and power plant operator
- Only in a few countries larger experience with grid operation and development for renewables exists so the barriers could not be visible yet. This puts a strong emphasis on the gird connection phase
- Grid connection is a very cost intensive process, which leads to tension between the two concerned parties

Figure 1 gives a good overview over the situation in Europe concerning the barriers to grid connection of RES.

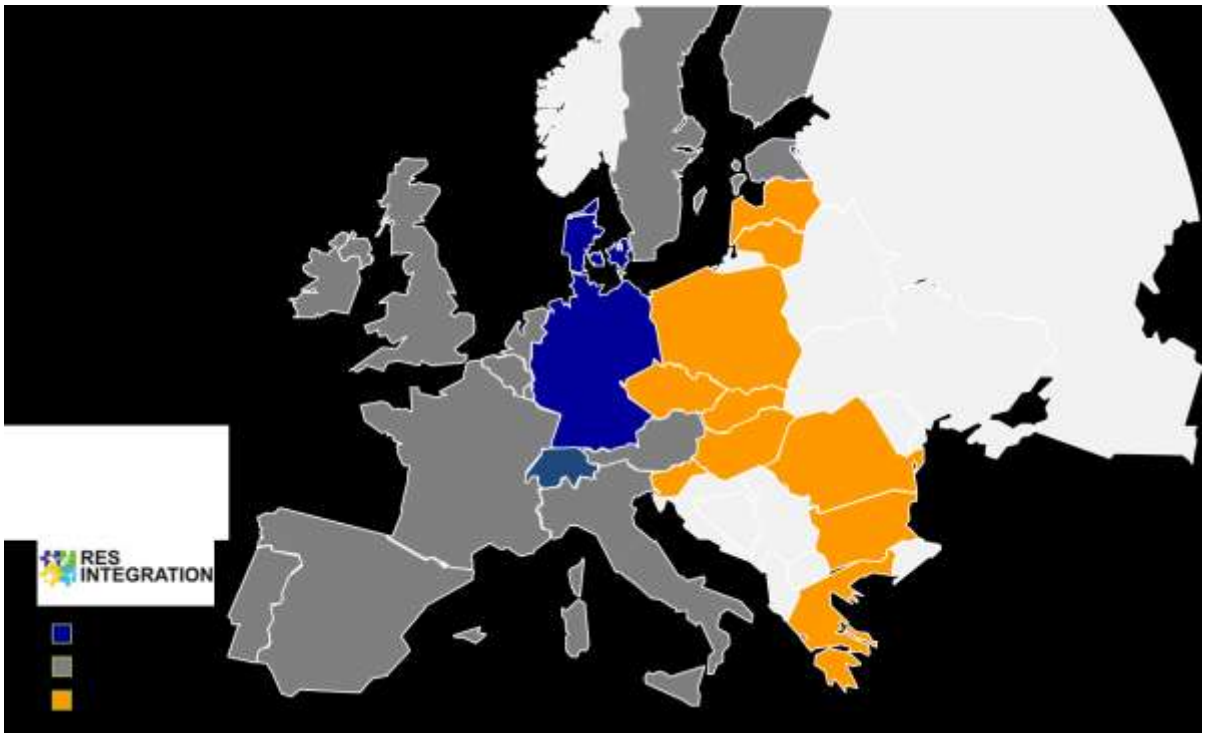

Figure 1: Assessment of connection Process in European member states (Binda, et al., 2012)

Only Denmark and Germany provide positive conditions for grid connection, whereas most of the eastern and south eastern countries provide negative conditions. The main barrier which has been detected in 17 countries was the long lead time in the grid connection process. All Member States have at least one barrier that hampers the grid connection of RES.

In

Table 2 the main problems in the single countries are listed. It should be mentioned that the situation shown in Figure 1 is not necessarily connected to the number of detected barriers in the single countries but to their severity (Binda, et al., 2012).

Table 2: Main barriers identified in each member state in the grid connection phase (Binda, et al., 2012)

Member states	Main barriers to integration in the grid connection phase
Austria	Distribution of costs Information policy regarding costs
Belgium	Missing obligation to connect RES-E installations, except in the framework of the "inform & Fit" procedure Connection can be denied due to insufficient capacities, no obligation to immediately reinforce grid to allow connection
Bulgaria	TSO does not connect new RES plants Capacity limits for RES Advance payments
Cyprus	Bureaucracy Length of grid connection procedure
Czech Republic	Connection moratorium Supposed lack of grid capacity Speculation
Denmark	No barriers detected
Estonia	Lack of sufficient grid capacity Speculation
Finland	Lack of grid capacity Distribution of costs Speculative grid applications
France	Cost of grid connection
Germany	Communication between stakeholders Lack of transparency Definition of technical and legal requirements
Great Britain	Planning consent Issues linked to the charging regime
Greece	Inefficient administrative procedures Insufficient special planning
Hungary	Status of the grid Capacity saturation and speculation
Ireland	Potential delays for grid connection due to the group processing approach Potentially higher shallow costs than in other Member states

Italy	Administrative barriers Overload of connection requests Virtual saturation
Latvia	Lack of sufficient grid capacity Speculation
Lithuania	Complicated connection procedure Legislation not clear High costs
Luxembourg	Definition of connection costs
Malta	Inefficient administrative procedures Insufficient special planning Competing public interests
Netherlands	Lack of sufficient grid capacity
Poland	Lack of sufficient grid capacity Complicated and not-transparent grid connection process Unclear regulations concerning the distribution costs
Portugal	Complicated and slow licensing procedure related to the Environmental Impact assessment
Romania	Virtual saturation Access to credit Information management
Slovakia	Delays during the connection process Speculation
Slovenia	Administrative procedures Long lead times Enforcement of RES'-procedures rights
Spain	Delays introduced by administrative procedures Heterogeneity of DSO technical requirements
Sweden	Cost bearing and sharing

A Long lead time is one barrier which can be addressed with legal measures. Although long lead times are mostly connected to process aspects, they can also be related to legal issues, for example the erroneous or unbalanced allocation of deadlines in the legal framework. One solution could be to set mandatory deadlines for the grid connection of renewable power plants. But experience show that the determination of these deadlines is quite complicated. To big time frames or loopholes can undermine these deadlines and make them insufficient. Here qualitative criteria in laws could help to strengthen such deadlines (Binda, et al., 2012).

Another solution could be to reduce the legal means of appeal to one single level of jurisdiction. Here one need to have in mind, that such a step could reduce the reputation of RES in the public and the public would probably find ways to express their dissatisfaction through other channels.

Another barrier with legal roots is the lack of grid capacity. This barrier refers to the issue that RES-capacity can't be connected to the gird because of insufficient transmission capacity. The pace of RES-capacity increase is simply too fast for grid expansion. This can be attributed to insufficient procedures and planning, which finally leads to the insight that legal framework of grid expansion has not been sufficiently adapted to the transformation of the electricity system (Binda, et al., 2012).

Communication problems can also be seen as a barrier which is connected to legal issues. Communication problems and conflicts between grid operators and power plants developers can heavily delay the overall process of grid connection. One solution to these problems would be to go to court and settle the problem. In several member countries for example the grid operator is legally obliged to reinforce the grid if necessary. This right could be legally enforced by power plant developers. But power plant developers often decide not to go to court because of possible negative consequences and their weak position towards grid operators. This weak position arises through several points:

- Long duration of judicial processes
- Strong position of grid operator and the fear to affect the long term relationship negatively
- Lack of trust in legal system. Power plant developers don't think that a court has the necessary technical knowledge to give an appropriate judgment.

One solution could be to create a neutral body which has the necessary technical knowledge and can exclusively deal with disputes between grid operator and power plant developer. If general disputes have to be solved RES-associations could take legal actions on behalf of plant developers (Binda, et al., 2012).

The costs for grid connection are obviously another barrier related to legal issues. The main issue here is the distribution of connection costs between grid operator and power plant developer. While in most European countries there are no problems reported, in 9 countries power plants developers have to take the biggest part of the total grid connection costs

(reinforce, extension, connection). Solutions could be to change the current systems or to clarify and enforce existing laws. This has been reported as a problem in 3 countries (Binda, et al., 2012).

1.5 Grid operation

After the connection to the grid, the operation of the grid with an increasing share of renewable capacity means the next step towards a grid integration of renewable electricity. As Figure 2 shows, the conditions for grid operation are quite good in the most parts of Europe.

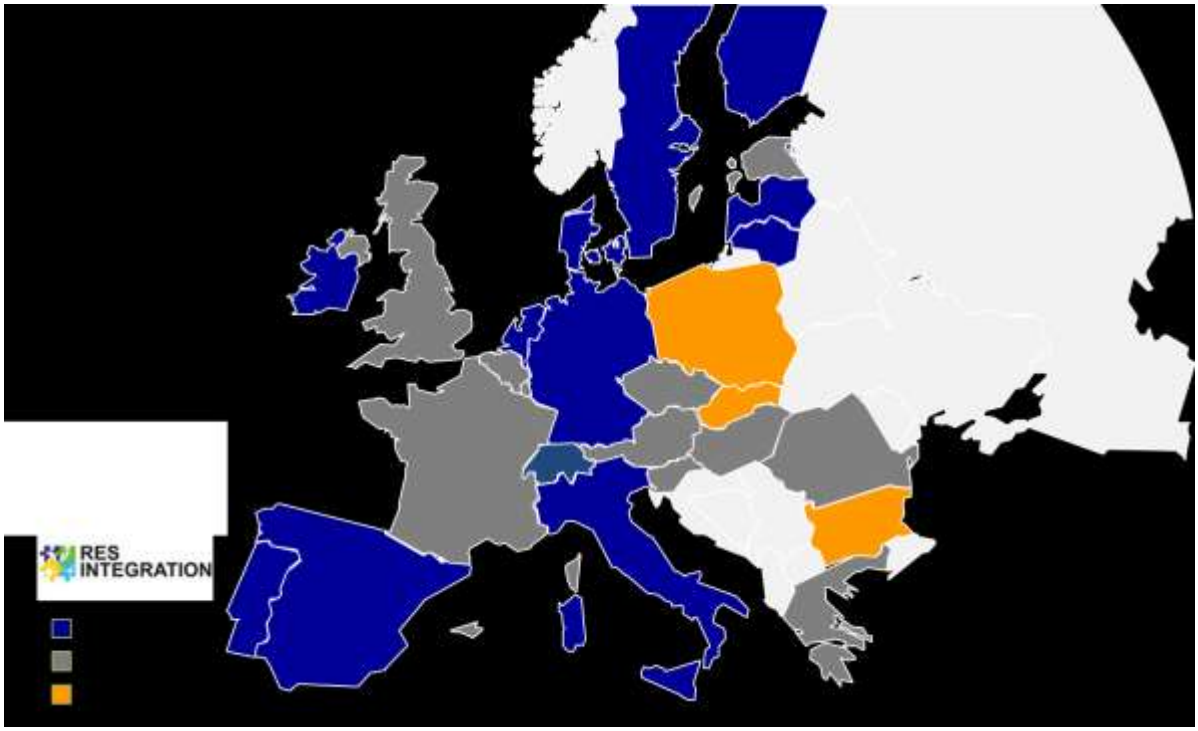

Figure 2: Assessment of grid operation in European member states (Binda, et al., 2012)

Compared to grid connection there are only few barriers to a secure grid operation (N-1 condition) of RES. This can be explained through a low share of renewable electricity sources in Europe. Especially volatile RES like wind and solar power cause problems for the grid operation. But currently only six Member States have in fact a volatile RES-E (renewable electricity) shares higher than 5 %. It is expected that this topic gains importance in future. On the other side practical examples show that a secure grid operation with a high share of RES-E is possible. Three of six countries (Denmark, Germany, Portugal) with a volatile RES-E share bigger than 5 %, show positive conditions for the grid operation of RES-E. This shows that the barriers are at least manageable. Instead geothermal power with its base load

character could have positive effects on the grid operation. Though its flexible and controllable character it rather supports the grid than it puts more burdens on it (Binda, et al., 2012).

Nevertheless barriers for grid operation were detected in several Member States. Table 3 shows these barriers for each Member State. It has to be mentioned, that not the number of barriers but rather their severity were a reason for the statements given in Figure 2.

Table 3: Main barriers identified in each member state in the grid operation phase (Binda, et al., 2012)

Member states	Main barriers to integration in the grid operation phase
Austria	Ineffective purchase obligation System fee for large RES-E plants
Belgium	No proper regulation for congestion management (curtailment) yet, especially on regional level
Bulgaria	TSO does not comply with dispatching priorities Curtailment regulation and procedure
Cyprus	No regulation for curtailment isolated systems
Czech Republic	Planned amendment could abolish the priority for RES and the purchase obligation
Denmark	No barriers detected
Estonia	No barriers detected
Finland	No barriers detected
France	Curtailment regulation and procedure
Germany	Grid curtailment
Great Britain	None for now, possibly ones with the increase of RES-E
Greece	RES-plants are sometimes cut off, when new plants are connected to the grid
Hungary	Lack of reserve capacity Instability of priority access due to support scheme revision
Ireland	Challenges to apply the concept of priority dispatching under the Irish circumstances (40 % RES-E target)
Italy	Frequency of curtailment in areas with large RES-E potential
Latvia	No barriers detected
Lithuania	No barriers detected
Luxembourg	No barriers detected

Malta	Grid not connected to the EU grid
Netherlands	Mismatch in lead times of newly developed power versus corresponding gird reinforcement/expansion
Poland	Lack of investment security Lack of sufficient grid capacity
Portugal	Strict parameters of frequency and limited availability in the distribution network
Romania	None, yet possible with variable RES-E growth
Slovakia	Massive lowering of feed-in tariffs
Slovenia	None, give the low share of variable RES-E
Spain	No significant barriers detected
Sweden	No barriers detected

Grid curtailment is the main barrier for renewables concerning the operation of the electricity grid. Grid curtailment itself means the adaption of electricity feed-in because of grid issues. As electricity can't be stored in the network grid curtailment can for example become necessary when an unexpected high feed-in of RES-E meets with a low demand. Then an overloading of the grid has to be prevented by grid curtailment. Another reason for grid curtailment could be a geographical distribution of electricity production and demand. If the transport capacity is not sufficient, grid curtailment becomes necessary

The first barrier relates to the lack of legal coverage of grid curtailment. While some member states have strict rules for such a case, others have a complete legal gap in this case. This topic should be given a legal background so that disputes between grid and power plant operators are avoided. A legal framework for all Member States should cover the following points (Binda, et al., 2012):

- The procedure to be followed in case of curtailment
- The responsible bodies
- The priority for RES-E technologies
- The rights and duties of all affected stakeholders (producers, regulators, TSO/DSO, market operator)
- The compensation system

One of these disputes could be the remuneration in case of grid curtailment. Curtailed power plants should be compensated for their losses. But not all the European countries have regulations for this in place or the calculation systems are complicated and therefore still a barrier. A compensation system for grid curtailment should also take into account that besides volatile RES-E feed-in other factors like the status of the grid infrastructure could be reasons for grid curtailment (Binda, et al., 2012).

Currently in some Member States curtailment isn't a barrier but it's expected to become one with a growing share of volatile RES-E feed in (Heilemann, 2012).

1.6 Grid development

The adaption of the electricity grid on the distribution as well as on the transmission level to the requirements of a renewable electricity system is one of the key preconditions for further integration of RES-E. In many Member States the insufficient capacity of the electricity grid is already today seen as a decisive barrier for the integration of RES-E. Grid development in this report focuses on the regulatory framework for the adaption of the electricity gird to a growing share of RES-E, to avoid grid curtailment or limitations in grid access. Figure 3 gives an idea about the current situation and frame conditions of grid development in Europe.

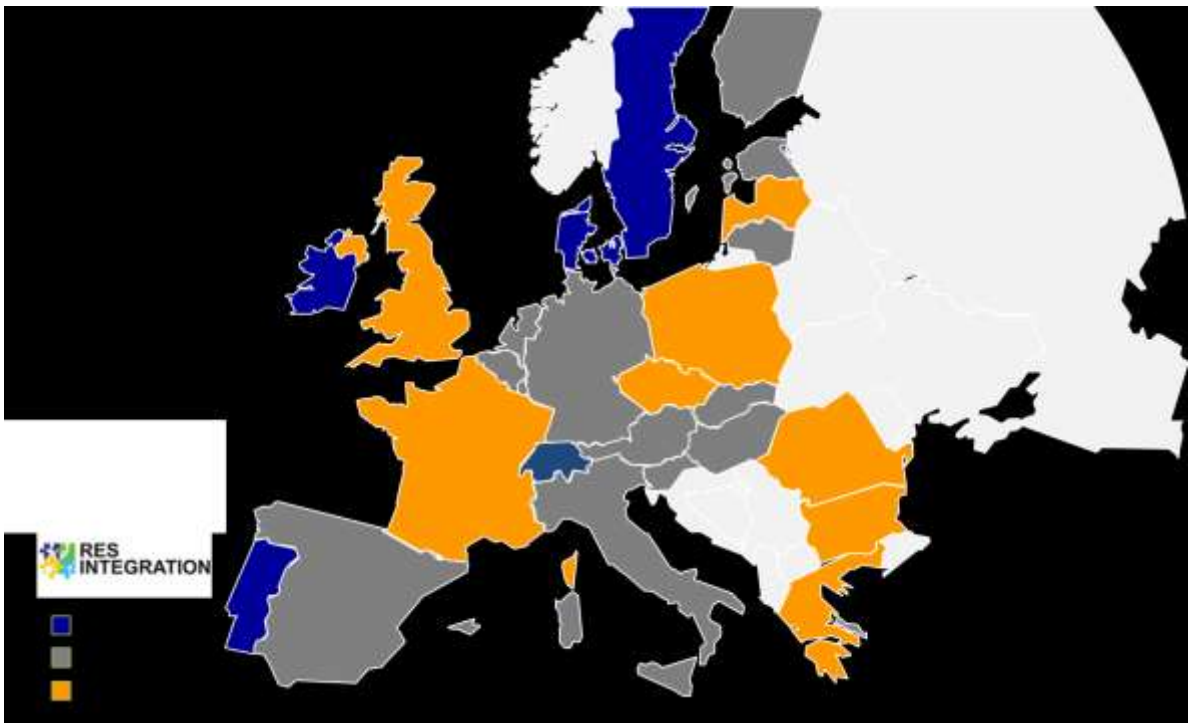

Figure 3: Assessment of grid development process in European Member States (Binda, et al., 2012)

The overall situation in Europe doesn't look very favorable for the grid development. While only four countries have positive framework conditions most of Europe will have to adapt their current regulations for grid development to the future tasks of the electricity grid. Table 4 shows the barriers for grid development in the single Member States. Again the amount of barriers in Table 4 isn't essential for the statement of Figure 3, but rather the severity of the barriers in each country.

Table 4: Main barriers identified in each member states in the grid development phase (Binda, et al., 2012)

Member states	Main barriers to the grid integration in the grid development phase
Austria	Lack of incentives for grid operator NIMBY Long lasting procedures
Belgium	Distribution of costs, especially after the decision of the Constitutional Court in May 2011
Bulgaria	No grid development plan TSO fails to expand transmission grid
Cyprus	None, given the low share of RES-E
Czech Republic	Close linkage between TSO and dominant DSO Lack of incentives for grid operator

Denmark	Deadline for obtain permission for grid development not sufficiently specified
Estonia	Lack of incentives for grid operator Distribution of costs
Finland	Lack of regulatory instruments Speculative grid applications Lack of resource for regulator
France	No grid development plan Remaining time for grid development Incumbent position of main generator Limited power of regulator
Germany	Public opposition Complicated permission procedures Lacking financial incentives
Great Britain	Planning consent Issues connected to the charging regime Backup availability
Greece	Investors excluded from decision making process RES-Procedure Rights are not clearly defined
Hungary	Lack of reserve capacity
Ireland	No right of RES-producers to demand grid extension, if required for dispatching
Italy	Administrative barriers to grid development
Latvia	Lack of incentives for grid operator Distribution of costs Communication between stakeholders
Lithuania	Grid development as a strategic nationwide political issue - RES do not constitute a goal
Luxembourg	Grid development studies are generally not published
Malta	Short-term planning Planning permits and financing
Netherlands	Time required for grid development RES are not specific objective for grid development
Poland	Complicated legislative procedures for the development
Portugal	Small stakeholder participation besides consultations. The RES-E producer bears the costs if an expansion is anticipated
Romania	Public opposition Lack of funds
Slovakia	Lack of incentives for grid operator Distribution of costs

Slovenia	Planning every 2 years
Spain	Lack of proper incentives for DSOs and RES developers Remuneration of distribution level grid development costs
Sweden	Long lead time for permit/concession for transmission lines

One of the main barriers for future integration of RES-E is insufficient consideration in the planning of the future grid structure. In 11 of 27 Member States RES-E isn't sufficiently considered in grid development. This barrier is currently almost invisible but future power plant developers could face an electricity grid which is not able to accommodate renewable power plants. Legal solutions are difficult to find here, but governments should be aware of this barrier, if they want to transform their electricity system towards sustainable electricity production (Binda, et al., 2012).

Another detected barrier is the missing obligation for grid operators to reinforce the electricity grid. In almost one third of the European member states this barrier exists. If the grid operator can't be legally forced to reinforce the grid this could prevent further connection and installation of renewable power plants. Often the cause of such a situation is that legal obligations are either silent or unclear. This leads to juridical processes, which reduce the investment security for renewable developers. An easy solution would be to establish a legal obligation for grid enforcement. On the other hand a solution has to be found where this happens in an economical way (Binda, et al., 2012).

A further barrier can be seen in missing incentives for grid development. Although grid reinforcement is a necessary task for future integration of RES-E, grid operators are not always willing to do such costly investments. This can be explained through the monopoly structure of the electricity grid and the incentive regulation, which shall guarantee an efficient network operation. The regulated network tariffs are the key incentive for network operators to invest in their assets. But there seems to be a mismatch between grid expansion and cost reduction. This lack of incentives is a serious barrier in nine of the European member states. Currently regulation systems haven't been adapted to the need for grid expansion through RES-E. A future regulation should therefore be transparent, reliable and attractive enough in terms of return (Binda, et al., 2012).

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