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GreenNet-Incentives

Promoting grid-related incentives for large-scale RES-E integration into the different European electricity systems

Appendix to Deliverable D8

Regulatory framework for RES-E system integration in Europe – Description and analysis of different European practices

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Introduction

The core objective of the project **GreenNet-Incentives** is to promote grid-related incentives for large-scale RES-E integration into different European electricity systems, to identify existing non-technical barriers for RES-E grid integration, and to actively involve key European market actors (grid companies, RES-E generators, regulators, decision makers) in the discussion process towards “green” electricity grids.
The major products of this project will comprise tailor-made recommendations and actions plans for several key market actors to establish a common European vision on the implementation of grid-related policies favouring “green” electricity networks.

In this review of European grid regulation models different implemented regulatory mechanisms are described with respect to their implication on RES-E grid connection and overall system integration. A critical discussion evaluates the impact of these mechanisms on promoting respectively hindering the future deployment of RES-E in respective countries.

Operation of electricity grids constitutes a natural monopoly. To prevent monopolists from extracting excessive rents, which would lead to welfare losses, and from discriminating competitors of former affiliated generators and retailers this segment of the electricity value chain is subject to regulation. Hence (national) regulatory authorities develop mechanisms to derive a tariff structure for the provision of services as grid access, metering, electricity transmission and distribution, which limits companies’ profits to an accepted return on equity.
Core elements of regulatory mechanisms are the provisions concerning the accountability of (new) investments (for cost-based approaches as well as for incentive-schemes in terms of a “starting point”): Regulatory authorities try to identify a necessary stock of assets as basis for the calculation of a respective return on equity. Infrastructure investments may alter this acknowledged stock corresponding to predefined rules; they may or may not be “passed through” into higher tariffs.
Therefore, regulatory mechanisms in general and especially the treatment of investment costs strongly impact the deployment of RES-E and the success of respective national support schemes, as respective grid and system integration is generally connected with upfront costs for the grid operator in terms of expenses for grid connection and grid reinforcement.

ETSO, the association of Europe's transmission system operators, states its view on the integration of wind energy in the European electricity system in a position document of 2006 [1]. The association is concerned about the fact that “the regulatory frameworks favouring renewable energy sources are significantly different among European countries. Some regulations may even induce technical and economical decisions that might be not the most effective.”

As electricity networks are characterised by capital intensive infrastructure with long lifetimes of assets it appears even more important to

- identify and promote the best practice of grid regulation w.r.t. RES-E
- proactively influence investment decisions towards efficient outcomes
- set up stable framework conditions to enable long term investments

– in line with national and European policies of Renewables deployment.

The EU internal-market-directive [2] states in chapter 2: *Member States shall implement appropriate measures to achieve the objectives of social and economic cohesion, environmental protection, which may include energy efficiency/demand-side management measures and means to combat climate change, and security of supply. Such measures may include, in particular, the provision of adequate economic incentives, using, where appropriate, all existing national and Community tools, for the maintenance and construction of the necessary network infrastructure, including interconnection capacity.*
Also the directive on security of supply [3] obliges member states to provide *investment signals for both the transmission and distribution system network operators to develop their networks in order to meet foreseeable demand from the market* and encourages them to additionally facilitate *new generation capacity and the entry of new generation companies to the market.*

Summing up, incentivising investments into electricity infrastructure facilitating system integration of renewables is clearly in line with European energy policy.

The aim of this review is to provide an overview over the applied regulatory framework for integration of electricity from renewable energy sources in different European electricity systems and markets.

It can be stated, that – although RES-E deployment in Europe is driven by a common European energy policy and respective legislation – national provisions for electricity grid regulation with respect to RES-E integration differ widely.

This overview shall help identify best implemented practice of grid regulation models concerning favourable and efficient conditions for RES-E deployment in the form of economic incentives for grid operators to support integration of rapidly increasing shares of RES-E generation.

A Structure of the Overview

A.1 Country Specific Market Design for RES-E

This section comprises a brief overview over the currently implemented promotion scheme for RES-E in selected countries.
At least following topics are covered:
The **type of promotion scheme** (feed-in-tariff/quota system), the **period of support**, and the commercial **distribution of RES-E** to customers partly predefines boundary conditions of the regulatory framework (e.g. balancing).
The responsibility for balancing RES-E feed-in according to the respective national market rules (and support schemes) is connected with significant costs and challenges for generators. **Balancing responsibility** also implies additional financial risks and transaction costs for the obliged party.
Finally the method of **financing** the necessary transfers to RES-E producers is explained.

A.2 Specification of Regulatory Regime in place

The currently implemented regulatory regime is explained and analysed with respect to its impact on RES-E system integration. Following topics are of primary interest:

- Grid access (priority grid access for RES-E)
- Tendering of grid connection work
- Cost allocation of RES-E system integration
- Formal description of DNO/TSO regulation (cost based, rate of return, price cap, revenue cap)
- Asset Base Determination
- Exemptions for RES
- Micro Scale Connection
- Role of TSO/DSO regarding RES-E integration

A.3 Overview of disaggregated grid related charges

This section provides information on actual grid related charges on load as well as on generation. Current values for one time as well as regular (capacity as well as energy related charges) are indicated.
Cross references to impacts of these charges especially on RES-E generation are given.
Differentiations in charges incorporating potential locational incentives are indicated as well.

A.4 Summary of barriers and incentives for connection of RES-E, Conclusions

Major barriers and incentives for the connection of additional RES-E generation are discussed here. From the point of view of a grid operator possible solutions to overcome identified barriers are proposed.
Finally, conclusions are drawn on the background of the findings.

A.5 Country Specific Definitions

Distribution Grid (Voltage Level)
Transmission Grid
Distributed Generation
Micro Generation

A.6 Country Specific list of references

Regulatory documents, decrees ...
(references, web addresses)

B AUSTRIA

B.1 Country Specific Market Design for RES-E

B.1.1 RES-E Promotion Scheme

Technology specific feed-in-tariffs are granted over a period of 10 years, plus additional 2 years at reduced tariffs (75%, 50%) [4].

An institution for the administration of feed in and remuneration of supported RES-E is installed by law with following main responsibilities:

1) single buyer for acknowledged RES-E in the support scheme
2) day-ahead assignment of obligatory schedules to suppliers in proportion to end user consumption based on forecasts of injection
3) Balancing Responsible Party (Programme Responsible Party)

Acknowledged RES-E generators profit from purchase and remuneration of feed-in [6], which is limited in terms of a technology specific cap of funding and technical constraints of grid connection.

B.1.2 Balancing Responsibility

Balancing responsibility for RES-E generation within the Austrian support scheme lies with the single buyer and costs resulting from settlement of balancing energy are borne by customers.
Cost of balancing wind power are stated by the Austrian regulatory authority to be in the range of 12 €/MWh [5].
RES-E feed in outside the support scheme takes place in the common market framework for electricity, this means generators have to negotiate bearing of balancing costs with the respective balancing responsible party they are associated with. As schedules for electricity currently have to be declared on a day-ahead basis respectively a 3-days ahead basis before weekends, high volumes of balancing energy are demanded.

B.1.3 Financing:

Financing of the subsidy scheme is provided via a fixed tariff [11] for attributed RES-E by suppliers (to be passed on to end users) and via a fixed yearly charge on grid usage paid by end users depending on the voltage level [6].

B.2 Specification of Regulatory Regime in place

B.2.1 Grid Access for RES-E

According to the Renewable Energies Act RES-E [6] the network operators are obliged to provide grid access in a non-discriminatory way. This regulation does not constitute a positive discrimination to conventional generation but is just compatible with general European requirements concerning the electricity market.
No regulations for priority grid access, as mentioned as possible provisions in the European RES-E directive [8], are in place with this respect.

B.2.2 Tendering of grid connection work

The right of issuing a call for tender for the grid connection work is not mentioned in respective regulations. But as work on own account has to be accounted for, this option seems to be open in principle.

B.2.3 Cost allocation for RES-E system integration

System integration costs have to be borne by RES-E generators (within the subsidy scheme) as far as grid connection (grid access), system operation (capacity costs of secondary control) and metering are concerned according to Austrian regulation (see section B.3.1):

But, as claimed by renewable energy associations, the practice of grid connection cost charging for wind power plants ignores both the European as well as national provisions [6] with this respect as lump sum payments to the grid operator (e.g. 50.000 € - 100.000 € per MW), constituting *deep connection charges* (including also reinforcement costs) are charged at least from wind power plant operators [9]:

- *Standard rules relating to the bearing of costs of technical adaptations* are neither *set up* nor *published*.
- There are no requirements put into force to provide *comprehensive and detailed estimates of costs associated with the connection*.
- Generally, grid reinforcement costs in connection with additional grid access shall be charged to load only. As for wind power, these costs are charged to generators also.

The European RES-E directive [8] mentions the options for member states to implement provisions requiring the socialisation of RES-E system integration costs and allowing RES-E producers to issue a call for tender for the connection work. These options are not put into force in Austria.

Only **balancing costs** costs of the single buyer are being socialised via surcharges to the electricity prices and grid usage tariffs for load.

B.2.4 Competent Authority to Judge Design and Cost of Connection

E-control, the Austrian regulatory authority for electricity has to approve general conditions of grid operators, which lay out details of application for grid access: Applicants *shall* receive response from the grid operator within 14 days. Rejections have to be based on substantiated legal principles. The regulator has to decide on their legitimacy.
Connections shall be realised at a technically feasible point in the existing grid, taking into account economic considerations of the applicant.

B.2.5 DNO/TSO regulation

For DNOs, in January 2006 a cost based regulatory regime for the determination of monopoly profits has been replaced by an incentive scheme [11] which is determined through decoupling costs of grid operation from revenues. In principle, a cap on allowed costs has been introduced for the first regulatory period from 2006 – 2009. A tariff scheme has been determined taking account of a general increase of productivity (frontier shift = 1,95%), a sectoral price index, specific efficiency-dependent tariff degressions and variations of transported and delivered energy (50% of relative increase is passed through to overall costs). according to following mechanism:

$$K_{t+1} = K_t*(1-X_{gen})*(1-X_{ind})*(1+\Delta NPI_t) \qquad \text{Formula B-1}$$

where

K	network cost
X_{gen}	general productivity increase (1,95 % / a)
X_{ind}	individual productivity increase (resulting from a benchmarking process)
NPI	price index of network operators

For TSOs a cost-plus regulation is in effect with yearly financial audits and tariff adaptations.

B.2.6 Asset Base Determination

As a starting point of the incentive regulation scheme, which is decoupling costs from calculated tariffs, capital costs are related to original investment costs (asset base).
Determination of capital cost has been based on historical developments of interest rates.

B.2.7 Exemption for RES

There are no exemptions for RES-E in place concerning cost pass through in the installed incentive-regulation scheme. Therefore extra costs for RES-E grid integration on the grid operators' side directly negatively impact their profit margin.

No research or innovation related incentive mechanisms are in place to compensate grid operators for extra efforts with this respect.

B.2.8 Role of TSO/DSO regarding RES-E integration

Historically, the Austrian TSOs operated a special balancing group, which acted as a single buyer of supported RES-E. The responsibility for forecasting feed in and attributing schedules to suppliers lied within this balancing group.
DSOs are accepting applications for grid access from RES-E producers and have to decide approval and propose a specific charge for the technical installations to connect a new plant to the existing grid.

B.2.9 Regulatory Authority

Two regulatory bodies exist in the field of electricity regulation.
Energie-Control Kommission has to approve general terms and conditions for grid access, determines use of system tariffs and other tariffs and has to approve legal compliance of agreements with end users.
Energie-Control GmbH as the actual regulatory authority has to provide framework conditions for efficient operation of Energie-Control Kommission in the field of elaborating market rules, grid codes etc. It also acts as competition watchdog in the electricity market (non-discrimination, unbundling, public price comparisons).

B.3 Overview of disaggregated grid related charges

B.3.1 One-Time-Charges and yearly fixed charges (non-output-related charges)

- Grid Access Charge ("Netzzutrittsentgelt") [11]: **G**(enerator), **L**(oad)
  No incentives for Connection of RES-E plants
  Charge should be based on strictly attributable expenditures for installations providing access to the grid or an upgrade in power.
  In case of efforts on own account of the grid user the grid access charge should be reduced accordingly.
  According to the general Austrian Electricity Act [11] grid operators are obliged to connect producers in a non-discriminatory way.

- Reinforcement Charge ("Netzbereitstellungsentgelt") [11]: **L**
  The Grid Reinforcement Charge comprises a lump sum singular charge for prefinanced grid installation, therefore it can be described as a "deep load connection charge".
  (0 – 265 € per kW)

- Metering Charge ("Entgelt für Messleistungen") [12]: **G**, **L**
  (e.g.: 28,8 € per year in total for households, 900 € per year for medium voltage level)

- Lump sum payment per metering point for RES-E funding ("Zählpunktpauschale") [6]: **L**
  (e.g.: 15 € per year in total for households, 15.000 € per year for high voltage grid)

B.3.2 Use of System Charges (Energy/Power related charges)

- Use of System-Charge ("Netznutzungsentgelt") [13]: **L**
  charge for installation and maintenance of the grid incl. System operation (reactive power provision, voltage stabilisation, ...)
  Capacity Charge [€/kW]
  (e.g.: 6 - 20 € per kW per year for households,)
  Energy Charge (€/kWh)
  dependent on Peak/Offpeak/Summer/Winter-Consumption
  (e.g.: 20,8 – 57,5 €/MWh for households)

- Losses-Charge ("Netzverlustentgelt") [13]: **L**
  (e.g.: 2,4 – 6,6 €/MWh for households)

- System Operation Charge ("Systemdienstleistungsentgelt"): **G**
  for secondary control provision
  applicable for plants (plant agglomerations) with a rated power > 1 MW
  (e.g.: 0,639 – 1,135 €/MWh)

B.4 Summary of barriers and incentives for connection of RES-E

Non uniformly determined charges for grid connection (deep connection charges) constitute a major barrier or at least a major cost component for the integration of RES-E plants into the existing grid.
The decree on grid charges [10] defines a one-time payment for grid users, which compensates expenditures of the grid operator for the initial connection or modification (installed power) on the basis of reasonable market prices. Grid connection refers to the physical connection of the installation of the grid user with the electricity grid – and not to reinforcement measures in the existing grid, which are compensated via a specific reinforcement charge on load.

In contradiction to this, lump sum payments for grid extension and grid reinforcement, e.g. investments into a transformer station in the high voltage grid (110/380kV), are charged from RES-E producers.

B.5 Conclusions

Uniform rules for charging integration of RES-E into the Austrian electricity system have so far not been put into effect, as far as grid reinforcement costs are concerned and transparency concerning grid connection licensing and charging can still be raised.
From the gird operators' point of view there are no incentives in place to remove existing bottlenecks for additional RES-E integration. The incentive regulation in place does not endogenously reward investments facilitating additional RES-E deployment and securing quality of supply on behalf of network operators.

Balancing responsibility lies within the single buyer of RES-E covered by the promotion scheme in place. This allocation does not provide any incentives for generators to efficiently place their production on electricity markets.

So far, no locational signals are implemented in the Austrian framework of electricity grid charges for generators. In order to transform variable side effects of new installations on the grid infrastructure, marginal costs of expected regional deployment of generation capacity may be attributed partly to generators (G-charge), partly to load (L), following a comprehensive planning attempt taking into account energy policy targets, RES potentials and energy infrastructure development.

Publishing grid access contracts might increase transparency in the licensing process for new installations.

B.6 Country Specific Definitions

Transmission Grid: Voltage Level >= 110 kV

Grid Voltage Level 1:
High Voltage (380 kV, 220 kV)

Grid Voltage Level 2:
Transformer Station (380/110 kV or 220/110 kV)

Grid Voltage Level 3:
High Voltage (110 kV))

Grid Voltage Level 4:
Transformer Station High/Medium Voltage (110/20kV or 110/10 kV)

Grid Voltage Level 5:
Medium Voltage (20 kV, 10kV)

Grid Voltage Level 6:
Transformer Station Medium/Low Voltage (20/0,4 kV, 10/0,4 kV)

Grid Voltage Level 7:
Low Voltage (0,4 kV)

B.7 Country Specific list of references

References AUSTRIA:
Most recent documents concerning electricity regulation can be found at the website of the Austrian regulatory authority for electricity, E-Control.

www.econtrol.at

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C CZECH REPUBLIC

C.1 Country Specific Market Design for RES-E

C.1.1 RES-E Promotion Scheme

RES-E promotion scheme is based on New Renewable Energy Law (180/2005 Coll.) applied since 2006 and set of implementing legislative Decrees.

The RES-E promotion scheme is based on combined feed-in tariff / green bonus (a feed-in premium on top of the market price) scheme with optional choice from the two options. The level of feed-in tariffs / green bonus is technology specific and is granted over a "lifetime" of RES-E installation which is for small hydro 30 years and rest of RES-E installations 20 years [16]. The stability of support is also guaranteed by guaranteed increase of feed-in tariff by 2-4% (except electricity from biomass).

The level of feed-in tariffs/green bonuses is presented in the following table:

Table C.1*: Level of feed-in tariffs / green bonuses for RES-E installations in the Czech Republic for installations put into operation in 2008*

Technology	category	start of operation	2008			
			feed-in tariff		green bonus	
			CZK/kWh	c€/kWh	CZK/kWh	c€/kWh
Wind energy	all	2008 and later	2.46	9.46	1.87	7.19
Small hydro (< 10 MWe)	all	2005 and reconstructions	2.22	8.54	1.02	3.92
	new locations	2008	2.6	10.00	1.4	5.38
Biomass combustion	category O1 (energy crops)	2008 and later	4.21	16.19	2.93	11.27
	category O2 (straw, forestry / gardening waste, etc.)	2008 and later	3.27	12.58	1.99	7.65
	category O3 (wood processing waste, shawings, sawdust etc..)	2008 and later	2.52	9.69	1.24	4.77
Biomass co-firing with fossil fuels	category S1 (energy crops)	all	-	-	1.39	5.35
	category S2 (forestry / gardening waste, straw, etc..) - 2008 and later		-	-	0.79	3.04
	category S3 (wood processing waste, shawings, sawdust etc..)		-	-	0.24	0.92
Sewage and landfill gas combustion	all	2006 and later	2.33	8.96	1.03	3.96
Biogas combustion (biogas from biogas stations)	utilising specified biomass	2008 and later	3.9	15.00	2.62	10.08
	utilising other biomass	2008 and later	3.3	12.69	2.02	7.77
Geothermal electricity	all	2006 and later	4.5	17.31	3.37	12.96
Solar electricity	all	2008 an later	13.46	51.77	12.65	48.65
Exchange rate CZK/EUR					26	

The increased costs for network operators who provide payment of increased feed-in tariffs / green bonuses to RES-E producers are projected into end user price of electricity in the form of country-wide average additional charge included in regulated part of price of electricity. In 2006 the projected cost of RES-E support into end user prices of electricity was 0,028 CZK (approx. 0,1 €c per kWh).

C.1.2 Balancing Responsibility

Balancing responsibility for RES-E generation lies with the regional network operators and costs resulting from settlement of balancing energy are borne by customers. Operators of the regional grid systems and the operator of the transmission system shall be obliged to purchase all electricity from renewable sources eligible for support and to conclude a supply contract, if a producer has offered electricity from renewable sources, under the terms and conditions given by the Renewable Energy Law and related Decrees. This obligation includes also assumption of responsibility for deviation pursuant to special regulation.

RES-E feed in outside the support scheme takes place in the common market framework for electricity, this means generators have to negotiate bearing of balancing costs with the respective balancing responsible party they are associated with. As schedules for electricity currently have to be declared on a day-ahead basis respectively a 3-days ahead basis before weekends, high volumes of balancing energy are demanded.

C.1.3 Financing

Fixed feed-in tariffs/ green bonuses are paid to RES-E producer by distribution system operators. The DSOs then project their increased costs to end user prices of electricity. The charge for renewable energy support is an average fixed fee per kWh and is specified by Energy Regulatory Office each year based on increased costs of DSOs in the previous year. In 2006 the projected cost of RES-E support into end user prices of electricity was 0,028 CZK (approx. 0,1 €c per kWh).

C.2 Specification of Regulatory Regime in place

C.2.1 Grid Access for RES-E

According to the Energy Act 485/2000 Coll. (as amended), the network operators are obliged to provide priority grid access RES-E installations in a non-discriminatory way on following conditions:

- Application has to be submitted
- Installation has to meet technical conditions specified in Distribution / Transmission Network Code
- Variations in production given by character of RES-E installations cannot be taken as reason for refusal of connection to the grid

According to the Energy Act 485/2000 Coll. (as amended), the network operators are obliged to give priority to RES-E in distribution / transmission (does not apply to transboundary transmission).

C.2.2 Tendering of grid connection work

The European RES-E directive [8] mentions the options for member states to implement provisions requiring the socialisation of RES-E system integration costs and allowing RES-E producers to issue a call for tender for the connection work. These options are not put into force in the Czech Republic.

The right of issuing a call for tender for the grid connection work is not mentioned in respective regulations. But as work on own account has to be accounted for, this option seems to be open in principle.

C.2.3 Cost allocation for RES-E system integration

The Czech Republic applies the deep connection charges approach. According to Energy Act (§ 23), the generator is obliged to:

a) Secure at its own expense the connection of its equipment to the transmission system or the distribution system;
b) Enable, and pay for, the installation of a metering device by the operator of the transmission system or the respective distribution system to which the generating plant is connected; …

In practice, system integration costs are shared between RES-E generators and grid operators, therefore the Czech system is somewhere between shallow and deep cost allocation model. The shared system integration costs cover connecting line + necessary adaptation of network.

The conditions for connecting a new customer/generator to the distribution or transmission system, including the method for calculating the applicant's share of the costs incurred in the connection and in bringing the required power, are described in Energy Regulatory Office (ERO) Decree No. 51/2006 Coll.

The technical conditions for connection are stipulated in the rules of the transmission/distribution system operation (the Grid Code). The Grid Code is prepared by the relevant network operator and approved by the Energy Regulatory Office.

Specification of type and configuration of measuring equipment and share of costs related to connection to distribution network and reservation of capacity are included in the connection contract.

Costs for transformation to level of connection (switchboards, transformer, etc.) are by 100% borne by operator of RES-E installation

Connection costs at the voltage level of connection (connecting line) are shared between operator of RES-E installation and DSO. Share of connection costs should cover only eligible costs of DSO for connection and necessary modification of network.

Details on calculation of the share of generator and TSO/DSO on covering eligible costs are given in Decree 51/2006 Coll. The eligible costs are defined as follows:

1. Costs of TSO or DSO incurred by connection, providing required connection capacity or an increase of connection capacity for power generator on low-voltage, medium-voltage, high-voltage, and very-high voltage levels should be necessary and really spent eligible costs connected with buying, construction or adjustment of TS or DS incurred by the requirement of applicant in connection with site and way of connection. Buying, construction or adjustment of TS or DS should be done in necessary volume relevant to the connected capacity required by the applicant.
2. The eligible costs also include design documentation costs, geodetic survey, real burden and other directly related investment costs and charges related to construction, adjustment or buying TS or DS.
3. Costs above eligible costs of DSO are by 100% borne by RES-E generator.

The share of the generator on the covering eligible costs is set as follows:

a) On the level of TSO and DSO in case on very high, medium and high voltage in CZK/MWh
b) On the level of DSO in case of low voltage in CZK per each Ampere of reserved capacity.
c) In case of connection of generator to the TSO the generator has fully cover connection costs to the TSO.

Real connection costs are calculated using data in the following table:

Table C.2*: Costs shares for most common variants of connection:*

network	Type of connection	Cost share (CZK / MW)	Cost share (EUR / MW)
transmission network	excl. connecting line	500 000	20 000
110 kV distribution network	standard (incl. connecting line)	1 200 000	48 000
	non-standard (excl. connecting line)	150 000	6 000
22 (35) kV distribution network	standard (incl. connecting line)	640 000	25 600
	non-standard (excl. connecting line)	150 000	6 000

As could be seen in the table above, the system provides option for RES-E operator to install the connecting line himself and pay lower share of connection costs or get the line installed by DSO and pay higher share of connection costs. DSOs, however, generally prefer the second option which is general practice in the Czech Republic. In case of connection to transmission network, the costs of connecting line are 100% borne by RES-E installation operator.

C.2.4 Competent Authority to Judge Design and Cost of Connection

The configuration of connection and connection point are set by network operator (taking into account network conditions, capacity and configuration of consumer connection). The technical conditions for connection are stipulated in the rules of the transmission/distribution system operation (the Grid Code). All of these documents are available on the respective companies' websites.

The Grid Code, which includes general conditions of grid operators, which lay out details of application for grid access, is prepared by the relevant network operator and approved by the Energy Regulatory Office. Rejections have to be based on substantiated legal principles. The regulator has to decide on their legitimacy.
The key technical conditions for grid connection are:

- Configuration of connection and connection point - set by network operator (taking into account network conditions, capacity and configuration of consumer connection)
- No backward influence on the network (voltage changes, flicker, higher harmonic frequencies, influence on ripple control signal etc.)
- Detailed technical conditions for electricity sources connected in parallel to distribution network are set by Annex 4 of Distribution network code (administrative procedure, requirements for information / data, configuration of connection, configuration, setup of electricity meters, switching and control equipment, setup and coordination of protection equipment, requirements for reactive power control, cos φ, voltage and other operational parameters, conditions for testing and continuous operation etc.)

C.2.5 DSO/TSO regulation

One transmission system operator is active in the Czech Republic; the TSO is responsible for electricity transmission at the level of the transmission system (400 kV, 220 kV and selected 110 kV lines), for the development of the transmission system, and for providing the system services that help to ensure safe and reliable operation. At lower voltage levels (110 kV and lower), electricity distribution is provided by three regional distribution system operators (DSO) with more than 90,000 customers, whose facilities are connected directly to the distribution system. Besides these regional distributors there are approx. 300 operators of other distribution systems, connected only to DSOs, who distributed electricity within areas specified in their electricity distribution licences.

To calculate average charges for electricity transmission and distribution the Energy Regulatory Office uses the incentive-based revenue cap regulatory method for the second regulatory period (1 January 2005 – 31 December 2009). This method consists in the regulator setting the cap on allowed revenues regulated companies may achieve irrespective of costs. By this separation of revenues from costs, regulated companies are motivated to reduce costs and improve efficiency. The revenue cap method will be applied throughout the second regulatory period, i.e. from 1 January 2005 to 31 December 2009.

The electricity price to eligible (final) customers, including households, is composed of regulated and unregulated items. The regulated items, which are set by the Energy

Regulatory Office every year, include all charges for the monopoly activities related to electricity transport from the generator over the transmission and distribution systems to the final consumers, i.e. transmission and distribution services, system services, and contribution to support for renewable resources and combined heat and power generation, and, effective since the beginning of 2006, secondary resources. They also include the charges for the market operator's service of imbalance clearing. Electricity generation and imports and commercial activities related to electricity supply to final customers are not regulated and are fully subject to market mechanisms.

C.2.6 Exemption for RES

There are no exemptions for RES-E in place concerning cost pass through in the installed incentive-regulation scheme. Therefore extra costs for RES-E grid integration on the grid operators' side directly negatively impact their profit margin.

No research or innovation related incentive mechanisms are in place to compensate grid operators for extra efforts with this respect.

C.2.7 Micro Scale Connection:

There is no specific regulation for the connection of micro scale generators in the Czech Republic.

C.2.8 Role of TSO/DSO regarding RES-E integration

DSOs are accepting applications for grid access from RES-E producers and decide on approval or specify connecting conditions based on the Network Code. DSOs also charge the RES-E producers for their share technical installations to connect a new plant to the existing grid (according to Decree 51/2006 Coll.) and sign a contract on provision of support for RES-electricity that is fed into their grid.

C.2.9 Regulatory Authority

There is single regulatory authority – Energy Regulatory Office (ERO). ERO´s main tasks are:

- Support of economic competition;
- Support of the use of renewable and secondary energy sources;
- Protection of consumers´ interests in the areas of energy sector where competition is not feasible.

ERO approves general terms and conditions for grid access, determines use of system tariffs and other tariffs and has to approve legal compliance of agreements with end users.

C.3 Overview of disaggregated grid related charges

C.3.1 One-Time-Charges and yearly fixed charges (non-output-related charges)

- The charge for connection of RES-E installation into grid is specified in Decree 51/2006 Coll. And is in detail provided in the table in chapter C.2.3. The charge varies between 6-20 EUR / kW (excluding connection line or 20 – 48 EUR /kW (incl. connecting line) depending on voltage level.

- There are no other one-time or fixed non-output related charges for RES-E sources.

C.3.2 Use of System Charges (Energy/Power related charges)

The RES-E generators do not have to pay UoS charges.

The UoS charges are included in regulated part of the end user price of electricity are presented in the relevant the Energy Regulatory Office's Price Decision published at the end of each year and valid for next calendar year.

- Charge for electricity distribution - to consumers connected to low voltage network - capacity based monthly fixed charges for distribution based on the rated current of the main circuit breaker upstream from the electricity meter, (in CZK) – specified according to type of customer and tariff, peak/off peak consumption (when relevant) – detailed levels of charges are specified in the Energy Regulatory Office's Price Decision No. 10/2007

- Charge for system services
  (147,81 CZK /MWh = approx. 5,92 EUR / MWh)

- Charge for transmission services
  (41,25 CZK /MWh = approx. 1,65 EUR / MWh)

- Charge for meeting the extra costs incurred in support of electricity from renewable sources, combined heat & power, and secondary resources
  (40,75 CZK /MWh = approx. 1,63 EUR / MWh)
- Charge for activities of the electricity market operator
  (4,75 CZK /MWh = approx. 0,19 EUR / MWh)

- Price of energy supplied by a supplier of last resort to final customers is composed of a standing charge, a charge for the supplied quantity of energy at the high rate, and a charge of the supplied quantity of energy at the low rate – detailed levels of charges are specified in the Energy Regulatory Office's Price Decision No. 9/2007

C.4 Summary of barriers and incentives for connection of RES-E

- The support scheme for RES-E is already well functioning and motivating investors to develop RES-E installations.
- Guaranteed access to grid is another important factor supporting RES-E
- The Grid connection regulation is in place, but sometimes slightly in favour of DSOs who have deciding power on technical possibility of connection.
- The charges for grid connection (deep charges with share of DSO) are levelized and could disincentive RES-E investors in certain locations close to the grid. The DSOs also prefer an option to build connecting line (and receive higher connection charge) rather than let the RES-E operator to build his own connecting line. The above, however, cannot be considered as a significant barriers to RES-E development, no significant delays in RES-E development process
- Both DSO and investors are still learning use the system in efficient way
- Some areas (especially suitable for wind and solar PV installations) have limited capacity of grid or already reserved capacity, however, in general, network capacity is currently not a serious problem.
- There are more serious issues at the transmission network level related to backup capacities and transboundary transmission of electricity through Czech transmission grid related to wind energy installations in Germany

C.5 Country Specific Definitions

Transmission Grid: Voltage Level >= 220 kV (220 kV, 400 kV)

Grid Voltage Level 1:
Extra High Voltage (400 kV, 220 kV)

Distribution Grid: Voltage Level >= 110 kV (110 kV, 35 kV, 22 kV, 10 kV, 0,4 kV)

Grid Voltage Level 2:
Extra High Voltage (110 kV)

Grid Voltage Level 3:
High Voltage (35 kV, 22 kV, 10 kV)

Grid Voltage Level 4:
Low Voltage (0,4 kV)

C.6 Country Specific list of references

References CZECH REPUBLIC:
Most recent documents concerning electricity regulation can be found at the website of the Energy Regulatory Office.
http://www.eru.cz/index_aj.html

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[21]	The Energy Regulatory Office's Price Decision No. 9/2007 of 26 November 2007, laying down the prices of electricity and related services http://www.eru.cz/pdf/cen_roz_aj_2007_9.pdf
[22]	The Energy Regulatory Office's Price Decision No. 7/2007 of 20 November 2007, laying down support for electricity generation from renewable energy sources, combined heat & power, and secondary energy sources http://www.eru.cz/pdf/cen_roz_aj_2007_7.pdf
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[24]	Directive 2003/54/EC of the European Parliament and of the Council, 2003 "Internal market in electricity" http://eur-lex.europa.eu
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D CROATIA

D.1 Country Specific Market Design for RES-E

D.1.1 RES-E Promotion Scheme

The present Croatian energy law has been supplemented by five regulations. They entered into force as from July 1st 2007. The technology specific feed-in tariffs for electricity from RES are set according to the energy source it is generated from and installed capacity (below and over 1 MW). Green electricity producers which have signed a contract with the market regulator are eligible for these tariffs for 12 years since completion of construction. Existing projects are eligible to receive the tariff for 12 years minus years of operation so far [27].

D.1.2 Balancing Responsibility

Green electricity producers shall not pay for non-permitted deviations. It is further determined that costs incurred by the network operator because of this deviations shall be covered from amount collected by suppliers from all electricity consumers [31].

D.1.3 Financing

Tariff System for the Production of Electricity from Renewable Energy Sources and Cogeneration (OG 33/2007) [27] is dealing with subsidies for electricity from RES and cogeneration units. It is defining the amount of the subsidy and how it has to be accounted, raised and allocated. From 1st of July 07 all end consumers of electricity and eligible customers by their suppliers, through money order of HEP-Operator distribucijskog sustava d.o.o., will pay additional 0,89 lipa[1] (0,12 €) per kWh for promotion of RES +VAT. For households that means additional 1,5 up to 3 HRK (0,2-0,4 €) on the monthly payments for electricity. It will grow up to 2 lipe (0,3 c€) till 2010. The collected fees are used by HROTE [33] for the payments to the eligible producers, for balancing costs and costs of operation of HROTE in compliance with the [35].

D.2 Specification of Regulatory Regime in place

D.2.1 Grid Access for RES-E

The status of eligible producer secures the purchasing of the total electricity produced (Article 8 of the Electricity Market Act), i.e. the Transmission System Operator or the Distribution System Operator is obliged to ensure purchasing of the total electricity produced from eligible producers as provided for in the prescribed conditions. Rules on costs and fees for connection to the grid and reinforcements are published in the Ordinance on the Amount of the Fee for the Connection to the Power Line and for the Increase in Terminal Load (OG 28/06) [32] and the Decision

[1] 1 € is approx. 7,2773 HRK, 100 lipa = 1HRK.

on the Amount of the Fee for the Connection to the Power Line and for the Increase in Terminal Load (OG 52/06) [35].

D.2.2 Tendering of grid connection work

The right of issuing a call for tender for the grid connection work is not mentioned in respective regulations. But as work on own account has to be accounted for, this option seems to be open in principle. [39]

D.2.3 Cost allocation for RES-E system integration

For all producers (RES and CHP) included the Ordinance on the Amount of the Fee for the Connection to the Power Line and for the Increase in Terminal Load states deep connection costs. The costs are borne by the producer and include real costs for building the connection and costs for technical conditions, safety equipment etc. For low and middle voltage the producer pays all costs, for high voltage connection costs are paid partly by the producer partly by the TSO. [32]

D.2.4 Competent Authority to Judge Design and Cost of Connection

Preliminary electro energetic approval (PEES) from TSO is needed to get Location Permit for the project (after which comes the Building Permit). The prerequisite for PEES is grid connection study, for which TSO gives Terms of Reference. Study must be done by experienced independent institution (usually an institute or a faculty) and is subject to revision of TSO. Amendment to Grid Code for wind farms is currently open for public commentary and it should be put to force in near future. It is not determined who is competent to judge design and cost of connection, as all questions regarding grid connection are completely in hands of the TSO. [39]

D.2.5 DNO/TSO regulation

The methodology for grid charges of the end user is common price and nominal connection power or real costs for connecting to the grid.

For low voltage level the common price is used.
– $\mathbf{c_{NN1}}$, for up to 30 kW of nominal grid connection power $\mathbf{N_{NN1} = c_{NN1} \cdot P}$
$\mathbf{N_{NN1}}$ – price for end user connection at the low voltage level up to 30 kW [HRK],
$\mathbf{c_{NN1}}$ – common price for nominal connection power up to 30 kW in a low voltage level defined by the government of Republic Croatia [HRK/kW]
P – nominal connection power of the new end user, approved by the electro energy consensus. [kW]

– $\mathbf{c_{NN2}}$, for more than 30 kW of nominal grid connection power. $\mathbf{N_{NN2} = c_{NN1} \cdot 30 + c_{NN2} \cdot (P - 30)}$
$\mathbf{N_{NN2}}$ – price for end user connection at the low voltage level more than 30 kW [HRK]
$\mathbf{c_{NN2}}$ – common price for nominal connection power more than 30 kW in a low voltage level defined by the government of Republic Croatia [HRK/kW].

If DSO decides, that there is no need for grid connection nominal power of existing or future end users and no benefit for new operating or development of the low and middle voltage grid, the end user completely finances the work on the grid otherwise

the costs are divided between DSO and end user according to his part of the connection power in the transformator installed power of the transformer station 10(20)/0,4 kV reduced for the 20% of the operation reserve.

For middle voltage level the common price is used and calculated according:
NSN = cSN . P
$\mathbf{N_{SN}}$ – price for end user connection at the middle voltage level [HRK,
$\mathbf{c_{SN}}$ – common price for a middle voltage level defined by the government of Republic Croatia [HRK/kW]
P – nominal connection power of the new end user or value of increased nominal connection power, approved by the electro energy consensus [kW].
If real costs of connection exceed the price calculated by the equation above for more than 20 %, the price for connection is calculated according to the real costs of the connection.
If for connection of end user on middle voltage level, there is a need to reinforce the grid, the costs of connection are calculated according to the formula above or real costs are used. Real costs of connection include costs of connection and end user's part of grid reinforcement costs. The end user's part is calculated according to the three different cases.

For high voltage level (from 110 kV) the common price is used and calculated according: $\mathbf{N_{VN} = c_{VN} . P}$ $\mathbf{N_{VN}}$ – price for end user connection at the high voltage level [HRK],
$\mathbf{C_{VN}}$ – common price for a high voltage level defined by the government of Republic Croatia [HRK/kW]
P – nominal connection power of the new end user or value of increased nominal connection power, approved by the electro energy consensus [kW].
If real costs of connection exceed the price calculated by the equation above for more than 20 %, the price for connection is calculated according to the real costs of the connection. If for connection of end user on high voltage level, there is a need to reinforce the gird, the costs of connection are calculated according to the formula above or real costs. Real costs of connection include costs of connection and end user's part of grid reinforcement costs. The end user's part is calculated according to the two different cases. [31]

D.2.6 Asset Base Determination

Market operator sends proposal to the Ministry in charge for changing the feed-in tariffs, when there is not enough money to cover all the needs. Until the average generation price of electricity is assessed the average production price is 0,2625 kn/kWh(0,04€/kWh). The common price for electricity for covering costs for eligible producers was in transition era (till 31. of January 2008) 10 % of the average generation electricity price.
Feed-in prices are based on eligible costs of operation, maintenance, investment or reconstruction of power plant, environmental protection including reasonable payback period for investment into energy objects and grid. They have to be non discriminative and evident. [30] The amounts of the feed-in tariff for each designated renewable energy source are to be updated for retail consumer prices index for the current year [35].

D.2.7 Exemption for RES

An eligible producer, apart from hydropower plants larger than 10 MW, can acquire the right to the incentive price prescribed by the Tariff System for the Production of Electricity from Renewable Energy Sources and Cogeneration. The given amounts of feed-in tariff are to be multiplied by correction factor that depends on the share of domestic component of the project. The variation is between 100% for more than 70% share of domestic component to 93% for less than 45% share of domestic component. The share of domestic component is determined by the Ministry. Apart of the gains from the feed-in tariff, the same Ordinance prescribes fee for the producer to be paid to the local community for all plants that have installed capacity larger than 1 MW in amount of 0.01 HRK/kWh (the amount is to be corrected for retail consumer prices index for the current year) [35] There are no exemptions for RES-E in place concerning cost pass through. Therefore extra costs for RES-E grid integration directly negatively impact on investors investment costs. No research or innovation related incentive mechanisms are in place to compensate grid operators for extra efforts with this respect. [30]

D.2.8 Micro Scale Connection:

No specific regulation for the connection of micro scale generators (smaller than 50 kWe) in Croatia exists.

D.2.9 Role of TSO/DSO regarding RES-E integration

The Electricity Market Act regulates the obligation to take the total electricity produced from eligible producers (Article 8), the obligation to submit data from the operator of the the transmission system in order to guarantee the origin of electricity, and the obligation to create a minimum share of electricity produced from renewable energy sources and cogeneration, (Article 30). [35]

D.2.10 Regulatory Authority

The Ministry of Economy, with its Energy and Mining Division, is the ministry in charge of energy policy. The Ministry of Economy submits to the Government energy needs and policy proposals, drafts secondary legislation and/or regulations in collaboration with the Croatian Energy Regulatory Council, in order to establish general principles on the basis of which the Croatian Energy Regulatory Council acts [37].
The Energy Department carries out activities relating to energy balance of the Republic of Croatia, analyses the energy flows, the situation in the world energy sources market, considers the energy source price issues, carries out activities relating to building of energy facilities, harmonizes the connection of energy systems of the Republic of Croatia with the systems of other countries, coordinates the energy system development with the development plans of the Republic of Croatia, proposes measures for efficient organization of energy activities, participates in drafting laws and regulations relating to energy sector, oversees and reviews economic measures affecting the status of legal persons in the energy sector, participates in drawing up and procedure of enactment of tariff systems and general conditions for particular energy sources and customer categories, Within the Energy Department following divisions are established; Energy Systems Division and Renewable Energy Resources and Energy Efficiency Division [39].

Croatian Energy Regulatory Agency [36] (HERA) is an autonomous, independent and non-profit public institution which regulates energy activities in the Republic of Croatia. HERA's obligations, authorities and responsibilities are based on the Act on the Regulation of Energy Activities, the Energy Act and other acts regulating specific energy activities.

D.3 Overview of disaggregated grid related charges

Regulated price for captive consumers has also:

- Part of price for energy activities that uses captive consumers
- RES-E and CHP charge
- Charge for regulator of energy activities
- Charge for market operator HROTE
- Additional costs if they are specifically fixed for specific technology
- Possible other charges fixed with law.

Market price has:

- Market price for electricity
- Grid charge for the use of grid
- RES-E and CHP charge
- Charge for regulator of energy activities
- Charge for market operator HROTE
- Possible other charges fixed with law.
- Additional costs if they are specifically fixed for specific technology

Objective, clear and non-discriminatory methodology for assessing the grid connection cost or for increasing the nominal connected power of end users as well as producers, and divides according to the benefits of the grid users, is fixed with the Order from the Croatian Energy Regulatory Agency.
Grid connection costs consist of costs for elaborating technical conditions and physical connection to the grid. The grid charge represents part of the RES-E investor in financing the connection point and part for elaborating technical conditions in the grid. [30]
Grid Access Charge: no incentives for Connection of RES-E plants. Charge should be based on strictly attributable expenditures for installations providing access to the grid. According to Electricity Act [29] grid operators are obliged to connect producers in a non-discriminatory way.

D.4 Summary of barriers and incentives for connection of RES-E, Conclusions

The main barriers for RES-E production are the high investment costs as well as lack of RES-E power plants in regional spatial planning. Namely, location permit is mandatory item for gaining eligible producer status for RES-E feed-in tariff and absence of location in spatial planning is significantly prolonging already complicated permit procedure of 10 steps. Another barrier is that at least 60% of the RES-E project has to originate from national sources in order to gain full feed-in tariff. Otherwise, the feed-in tariff could be lowered by 7% [39]. Given the interest by both domestic and foreign companies, investment environment is positive while the eligible producer status procedure is still to be improved in sense of transparency and duration. So far, none of the renewable energy plants have gained the status. Three existing RES-E plants (2 wind power plants and 1 landfill gas plants) are having a

special agreement for electricity sales. Nevertheless, the improvements are expected to occur in the near future. Current RES-E legislation demonstrates problems in implementation but the responsible bodies are already engaged in improving it. The major barrier is the procedure for obtaining the eligible producer status by a committee dedicated to determine the share of domestic component in the project. In addition, the same conditions and procedure are valid for different plant sizes i.e. a 10 MW and 100 kW plants [35]. Low level of awareness is crucial social barrier at all levels of society and possible stakeholders. Croatia has strong NGOs that are advocating the RES utilization on the one side and monitoring and reacting on the Governmental activities in the energy field. There is a low level of public awareness regarding the RES and its benefits. NGOs are pro-RES utilization at a declarative level with often “not in my backyard” attitude when an actual implementation and/or construction of RES is about to occur. In that respect, there are still informational barriers to overcome but, this time, with a wider information campaign. RES policy is well developed at the highest levels while local and regional levels are mostly not able to follow the stated policies at local level. Recently, local authorities are establishing regional developing agencies and regional energy agencies in order to facilitate utilization of EU programs. Regarding project preparation procedure, the newly adopted RES-E legal system is still under examination. So far, even projects in highly developed stage (i.e. operating wind farms) were unable to gain eligible producer status and enjoy the feed-in tariff system. The Ministry has foreseen some 6 months to 1 year procedure but it is still early to say if this period was realistic. The main problem occurs in the grid connection and examination of domestic component in the project. It is fair to state that complicated and long procedure for licenses issuing is one of the most common barriers to any kind of project, including RES, in Croatia. The Croatian Government has introduced an action plan - Hitrorez - to reduce the administrative barriers in general and this would affect the RES administration procedures, too. As before mentioned, there is a clearly described procedure how to obtain eligible RES-E producer status with several issues with lack of transparency but the Ministry is working on its removal. In that sense, procurement process still has the adjective of being uncertain [34].

D.5 Country Specific Definitions

Distribution Grid (Voltage Level) 400/230V: objects creating distribution grid and needed for distribution of electricity on high, middle and low voltage level. It is the grid from transmission grid to the end user.

Transmission Grid 400/220/110 kV: objects creating transmission grid and needed for transmission of electricity on same or higher than 110 kV voltage level and all connection wires. This is grid from producer to the end user or distribution grid or another neighbors transmission grid. Middle voltage level: 35kV, 20kV and 10kV also included, in the transmission grid and also 110 kV.

Distributed Generation Not available

Micro Generation: production unit with nominal power smaller than 50 kWe;

D.6 Country Specific list of references

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E GERMANY

E.1 Country Specific Market Design for RES-E

E.1.1 RES-E Promotion Scheme

A feed-in tariff system in place has recently been adapted via an amendment of the "Renewable Energy Law" [40].
A technology specific feed-in-tariff is granted over a period of normally 20 years. For small hydro power plants up to 5 MW capacity it is granted over 15 years.

Except for some technology specific particularities, the feed-in tariffs stay constant over the whole period for a plant, once it is installed, and there is no compensation for inflation. Additionally there is a decrease of the feed-in tariffs depending on the year of installation. Consequently, plants that are installed later receive a lower compensation for their feed-in. The decrease for PV has been raised in the new Renewable Energy Law to approximately 10% (dependent on the year of installation, installed capacity and total installation) to stimulate the cost reduction for PV-plants.
The decrease of the feed tariff for other renewable energy resources has also been adapted in the last amendment of the "Renewable Energy Law" and is now - depending on the technology – in the range of 1 to 2 percent per year. On the other side, the feed in tariffs for wind and for biomass with CHP and/or renewable biomass have been raised in the last amendment to compensate for increased costs for biomass and to stimulate the installation and reinforcement of wind power plants.

The grid operators are obliged to feed in and recompense the produced RES-E, if it is technically possible (see also E.1.3 and E.2.1).

E.1.2 Balancing Responsibility

According to the EEG ("Renewable Energy Law") the grid operator in whose grid the EEG plant is situated is obliged to feed in the produced RES-E. According to an adjustment process RES-E is transferred to the transmission grid operator (TSO), which is balancing responsible.
In case of pure energy metering of generators the DSO has to refine the unknown and variable feed in of RES-E to according to a standardised profile or weather dependent profile.
In order to guarantee that each TSO bears an equal relative share of the total RES-E there is an immediate "horizontal" clearing between the four German TSOs according to the total load in their area. Finally each TSO has to deliver his share of the RES-E in form of fixed profiles to the energy traders. The detailed mechanism is described in [41].
Consequently, each TSO receives a fluctuating feed-in of RES-E and has to deliver a fixed profile, which means that he is not only responsible for balancing, but also for refining the RES-E. The TSO can balance forecast errors via the intraday market and the normal balancing market. There is also the possibility to tender special balancing capacities for RES-E.

In order to reduce refinement costs, the adjustment process will be adapted in near future. According to the actual plans, the four TSOs will not longer deliver renewable energy as a fixed profile to the traders. Instead, the energy will be sold by the TSOs or a third party at the market/energy exchange.

E.1.3 Financing:

According to the EEG ("Renewable Energy Law") [40] the grid operator who is obliged to feed in the produced RES-E is also obliged to pay the compensation fees to the RES-E operator. The DSO is handing the renewable energy over to the TSO (vertical adjustment) and is therefore compensated by the TSO. This payment amounts to the cumulative compensations paid to the RES-E operators minus avoided charges for the use of the transmission grid (see also E.3.2). In accordance with the horizontal adjustment process a financial clearing takes place between the four TSOs. In a further step, the TSOs transfer the costs for RES-E together with the energy as average costs to the traders. Each trader has to bear an equal fraction in relation to the relevant load. It should be stated here that only traders are considered which have less than 50% renewable electricity in their portfolio.

Electricity traders finally can either transfer the costs of attributed RES-E to their costumers in the form of a specific supplement or they can choose to sell the energy from the adjustment process as green energy. Some energy intensive industrial consumers and railway operators may request a reduction of respective compensation payments.

Costs for balancing and refining RES-E feed-in on the side of grid operators are included in the general system charges. In [42] the EEG-supplement for households is estimated to 3% of the electricity costs, the share in the system charges for households that is due to balancing of RES-E is estimated to 0,6% (equivalent to 0,56 ct/kWh and 0,11 ct/kWh for a total household electricity price of 18,7 ct/kWh).

E.2 Specification of Regulatory Regime in place

E.2.1 Grid Access for RES-E

According to the Renewable Energy Law (EEG, [40]) the network operators are obliged to provide grid access in a non-discriminatory way. Grid access has to be given immediately and with priority.
The responsible operator is the operator of the grid with the nearest, technically possible grid access point. It is also in its responsibility to undertake grid extensions, if grid access was enabled by such measures and if they are economically acceptable. According to these terms the measures have to be carried out if the RES investor requires it.
RES-E systems exceeding a rated capacity of 100kW only gain a right on compensation if they include a load measurement device and are capable to limit the power output by remote control. According to the so-called generation management the grid operator has the right to limit RES-E feed-in if the grid situation requires it. If feed-in is curtailed, the DSO has to compensate plant operators for financial losses

and has to ensure that the grid will become capable to feed in the hole RES-E power output in future [43].

E.2.2 Tendering of grid connection work

In general the grid operator is charged with the grid connection work including connection of the devices and installation and operation of the measuring devices. According to 13§, EEG [40] the RES investor can also charge a competent third party for the grid connection work.

E.2.3 Cost allocation for RES-E system integration

The RES-E investor bears the costs of grid connection to the economically next-best and technically possible grid connection point. This includes the costs for the necessary measuring devices [40] and corresponds to the so-called “shallow costs”. For generation up to 30kW on a plot of land with an existing connection to the grid this plot’s grid connection point is deemed to be the economically next-best and technically possible grid connection point by definition.

Extension measures in the grid that are necessary for the connection and reception of the RES-E have to be born by the grid operator (“deep costs”) [40]. If the grid operator can prove, that the grid extension costs related to RES-E exceed 0.5% of regulated capital costs, an increase of system charges can be claimed; otherwise these costs are at the expense of grid operators. System charges have to be authorized by the regulatory authority [44].

In the case of offshore wind farms the transmission grid operator and not the EEG investor has to bear the costs that result from grid connection between the transformer station of the wind park and the nearest grid connection point [44]. Grid operators also have to reimburse the costs that investors had spent prior to 17.12.2006 for planning and authorization procedures of grid connection-lines. Transmission grid operators are obliged to bear connection costs of offshore wind parks for which installation has started prior to 31.12.2011. The resulting costs are shared among the German transmission grid operators and are added to the system charges.

E.2.4 Competent Authority to Judge Design and Cost of Connection

The grid operators have to publish the technical requirements for grid access and have to communicate them to the Bundesnetzagentur according to §19, EnWG [44]. According to [44] and [40] they are obliged to grant non-discriminating grid access and to give priority to RES-E. Additionally, there is a clearing court located at the Bundesnetzagentur, which can be called free of charge from investors, plant operators and grid-operators.

E.2.5 DNO/TSO regulation

The cost based regulatory regime has been replaced by an incentive scheme for DNOs and TSOs on 1. January 2009. Within the incentive scheme the "Bundesnetzagentur" uses a comparative method evaluating the system charges of different grid operators to identify inadequate system charges.

The incentive scheme is determined by decoupling costs from revenues. Only upper limits of system charges (prices) are fixed and the grid operators can increase their profits by reducing costs. The tariff scheme is intended to consider not only efficiency specifications but also quality of supply and investments. Due to the special role of TSOs for grid security and their limited number (four TSOs in Germany) special regulations are intended for them. Especially, investments in the transmission grids are ensured by authorizations of specific investment budgets.

E.2.6 Asset Base Determination

The costs that were authorized by the Bundesnetzagentur in the course of the cost based regulatory regime up to the 1. January 2009 serve as a starting point of the incentive regulation scheme [47].

E.2.7 Exemption for RES

Investments in the distribution grid due to RES-E will be considered in the calculation of the price limit by applying a factor based on the amount of new connection points. Grid extension costs due to RES-E without a new connection point can only be considered if the RES-E related costs for the DGO exceed a certain limit of their system charges.

E.2.8 Micro Scale Connection:

In general, the Renewable Energy Law does not specify limits to the rated capacity of eligible plants. Yet, in case of Biomass, sewage gas and landfill gas the duty of the grid operator to off-take and compensate the feed-in is limited to a certain amount per year. This amount is defined by an average power output. In case of landfill gas and sewage gas this limit is equal to 5MW, in case of biomass 20 MW. If a plant exceeds this limit, the operator can decide whether to sell all the energy or only the energy above the threshold to the free market.

In contrast to CHP-Plants the remuneration for decentralised RES-E generation and the feed-in at low voltage Levels is included into the compensation fees. The remuneration is the amount of the costs that are reduced in the upstream grids due to the decentralised generation [46].

For generation up to 30kW on a plot of land with an existing connection to the grid this plot's grid connection point is deemed as the macro-economically cheapest and technically feasible connection point for the generation facilities as well.

E.2.9 Role of TSO/DSO regarding RES-E integration

The administrative issues of grid access, feed-in and compensation for RES-E have to be managed by the grid operators. The responsibilities of grid operators include the approval, that the plant operator is fulfilling the requirements of the Renewable Energy Law.
Dedicated balancing groups (EEG-Bilanzkreise) are also managed by grid operators [48].
As stated in E.1 grid operators give grid access to RES-E and feed in and remunerate the RES-E. The transmission grid operators are responsible for balancing and attributing schedules to suppliers within their balancing area. The costs are transferred to the end-consumers via EEG supplement and system charges.

E.2.10 Regulatory Authority

The “Bundesnetzagentur” is the German regulatory authority for electricity (and gas, telecommunication, post and railway). In the electricity sector it has the following tasks: securing efficient and secure electricity supply, securing effective competition and realizing the dedicated European guidelines. In particular, it authorizes the grid system charges and eliminates barriers to general grid access. The Bundesnetzagentur is supported by corresponding authorities (“Landes-regulierungsbehörden”) in the federal states (“Laender”) of Germany.

E.3 Overview of disaggregated grid related charges

E.3.1 One-Time-Charges and yearly fixed charges (non-output-related charges)

- Grid Access: **G**(enerator), **L**(oad)
  In low-voltage grids the grid operator is responsible for the installations and measuring devices providing grid access to the grid. He charges the strictly attributable expenditures like measuring devices to the account of the grid user [49]. Exemptions are RES [40] and power plants in high-voltage grids that have a capacity over 100 MW [50]. They have to bear the costs of grid connection to the economically next-best and technically possible grid connection point.
  According to the EnWG [44] grid operators are obliged to connect producers in a non-discriminatory way.

- Metering and billing charge: **L**
  This charge covers the annual costs of collection, handling and provision of measuring data and of billing for each metering point. The costs are depending on the necessary measuring device. According to the liberalisation of metering services, the grid operator is the default operator of the measuring device and the default provider for the measuring procedure. But every competent third party can become operator of measuring devices and provider of metering services.
  (e.g. 3853 € in the transmission grid or 1325 € in the medium voltage grid plus 2952 € for billing. [51])

E.3.2 Use of System Charges (Energy/Power related charges)

There are only **L**-charges. The following price indications do not include turnover taxes.

- Use of system charge (“Netznutzungsentgelt”): L
  This charge is split into a capacity related and an energy related fraction. It covers the costs of installation and maintenance of the grid at the actual and higher voltage levels. It includes also costs of system operation like voltage and frequency stabilisation or grid losses.
  Typically, the capacity and energy rate are charged annually and differentiated between less than 2500 h/a full load hours and more than 2500 h/a full load hours. There is also the possibility of a monthly based charging system.
  Capacity Charge:
  (e.g.: High voltage grid: 4,42 or 35,4 €/kW. Medium voltage grid: 9,34 and 44,49 €/kW (for more or less than 2500 h/a) [52]
  Energy Charge:
  (e.g.: High voltage grid: 1,4 or 0,16 ct/kWh. Medium voltage grid: 1,96 and 0,56 ct/kWh (for more or less than 2500 h/a) [52]

- Charge of reactive current [52]: **L**
  There can be an additional charge for reactive current if the extend of its use is not included in the general system charges.

- Special reserve-charge [53]: **L**
  For self-generating consumers there exists the possibility to order time-limited reserve capacities.

E.3.3 Additional grid costs

Within the framework of system charges, additional components are charged to the grid user. These additional components are not part of the regulated tariffs.

- Concession levy: **L**
  Concession levies are fees which have to be paid to communities for the right to use public transport ways for the grid installation. The grid operators are allowed to transfer these costs to the grid customers. (e.g. 1,32 ct/kWh [52]).

- CHP-supplement: **L**
  The grid operators have the right to transfer costs related to the promotion of CHP-plants to the end users in the framework of the system charges.

E.4 Summary of barriers and incentives for connection of RES-E

Several grid-related incentives for RES-E exist next to the guaranteed feed-in tariffs in the Renewable Energy Law, EEG.
RES investors are only responsible for grid connection to the macro economically cheapest grid connection point and do not pay deep connection charges. In the case of wind offshore energy the investors are exempt from the costs for the transmission line between the wind park transformer station and the next grid connection point.
Small plants up to 30kW peak on a plot of land with an existing grid connection point do not have to cover any grid connection costs.
The following barriers can be identified:
The output of RES can be limited by the grid operator in the course of the generation management if the grid situation demands it. But there is no risk for the plant operator in terms of discrimination, as the grid operator responsible for the limitation has to compensate losses caused by generation management.
In the future there might result a reduced willingness of grid operators to grant grid access to RES as grid operation becomes more and more complicate. As already mentioned, RES investors have to cover the costs of grid connection to the next grid connection costs (shallow connection costs).

E.5 Conclusions

Thanks to the guaranteed feed-in tariffs there are important incentives for RES-E. Especially under consideration of the special regulation for offshore wind energy the grid-related barriers seem to be less relevant. The non-discriminatory access to the grid has to be controlled by the regulatory authority.

In the future grid-related barriers can become important if the physical capacities of the grid are no longer sufficient for additional RES-E. This can lead to curtailing RES-E output (limiting production) and a delay of grid connections for technical reasons. Therefore it should be assured that additional grid investments are undertaken. It must especially be assured that the incentive scheme delivers sufficient incentives for further grid investments.

E.6 Country Specific Definitions

Concerning the grid system charges the following voltage levels are defined in [46].

1. Transmission Grid: 380 kV and 220 kV

2. Transformation 380 kV – 110kV and 220 kV – 110 kV

3. High Voltage Level 110 kV

4. Transformation 110 kV – medium voltage

5. Medium Voltage Level (typically 5 – 60 kV)

6. Transformation medium voltage – medium voltage

7. Low Voltage Level (typically 230 V and 400 V)

E.7 Country Specific list of references

Most recent documents concerning electricity regulation can be found at the website of the German regulatory authority for electricity, http://www.bundesnetzagentur.de/, and at the website of the association of German grid operators, http://www.vdn-berlin.de.

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F GREECE

F.1 Country Specific Market Design for RES-E

F.1.1 RES-E Promotion Scheme

The key provisions of Greece's RES support System are as follows:

i) The Transmission System Operator (TSO) is obliged to grant priority in load dispatching to RES installations (up to 15 MWe in the case of small hydroelectric units).
ii) RES installations are not charged with Transmission Use of System charges.
iii) Remuneration for energy output of RES installations is guaranteed through 10-year contracts with the TSO, which can be extended to 20 years in total (by unilateral declaration).
iv) The electricity produced from RES installations (or the surplus electricity production of a RES autoproducer) is sold to the TSO at a predetermined buy-back rate, which is adjusted annually[2].
v) The feed-in tariff system is diversified by technology as follows :

Table F.1*: Overview over feed in tariffs in Greece:*

RES technology:	Feed-in tariff (euros/MWh)	
	Interconnected System	Non-interconnected islands
Wind power, small hydro, geothermy, biomass, HE-CHP	75,82	87,42
Offshore wind	92,82	
Photovoltaics <100kW	452,82	502,82
Photovoltaics >100kW	402,82	452,82
Solar thermal <5MW	252,82	272,82
Solar thermal <5MW	232,82	252,82

Source: 4th National RES Report

Additionally, the Operational Programme "Competitiveness" which uses funds from the 3rd Community Support Framework provides public funding for RES investments. Public aid ranges from 30-50% of investment costs, depending on the technology and geographical area of the investment. The construction of transmission lines receives 45-50% public aid.

[2] On the basis of the weighted average increases of the incumbent utility's bills, whereas after the full liberalisation of the electricity market the revisions shall take place at 80% of the consumer price index

F.1.2 Balancing Responsibility

Balancing responsibility for RES-E generation within the Greek System lies with the Transmission System Operator. Costs resulting from settlement of balancing energy are borne by customers.
In the non-interconnected islands, the distribution network is operated by a separate department of Public Power Corporation which is also responsible for the dispatching of the generating units. Under the terms of the contract signed with a RES producer, the DSO in the non-interconnected islands has the authority to cut-off generation from the RES plant for a certain number of hours in case the operational security of the grid is compromised.

F.1.3 Financing

Funding for the feed-in tariff subsidy scheme is provided from a special account held by the TSO which is balanced via a “Special RES fee” in euros per MWh which is borne by all customers. The level of the special RES fee is determined by ministerial decree and takes into account the total RES electricity generation and the System Marginal Price. It currently is 0.4€/MWh.
Public funding for RES investment costs as mentioned above is given through the National Operational Program under the CSF.

F.2 Specification of Regulatory Regime in place

F.2.1 Grid Access for RES-E

Priority dispatch provisions applicable to RES plants connected to the Transmission & Distribution Networks in mainland (non-Interconnected Islands are excluded), are as follows:
On condition that network operational security is not compromised, HTSO is obliged to prioritise dispatch of RES plants as follows:

- RES plants (wind, solar, biomass, biogas, geothermal, wave energy, waste heat, industrial bi-products, CHP, hybrid plants for the energy generated by RES) regardless of installed capacity.
- Small hydro of installed capacity less than 15 MWe
- High efficiency CHP using RES or a combination of RES and gas fuel, regardless of installed capacity
- High efficiency CHP other than above with installed capacity less than 35 MWe.

F.2.2 Tendering of grid connection work

According to the Grid & Market Operation Code, the HTSO establishes and publishes, at least every two years, a regular 5 year estimate of the generating and transmission capacity that is likely to be connected to the Transmission System, the interconnection needs to other Systems or Networks, the transmission capacity needs and the electricity demand.
In this framework, the HTSO elaborates and publishes annually the five-year plan for the development of the interconnected transmission system, which is approved by the Minister of Development following RAE's opinion and the views of the owner of the transmission system (PPC). In this plan, the development projects are specified, as well as the progress timeframe and the estimated costs.
PPC S.A., as the owner of the transmission system, is responsible for the reinforcement of the existing transmission system. In case that PPC invokes inability either to respect the time schedule or to finance a specific project, a third party can undertake this project.
Article 11 of the latest RES Law 3468/2006, states that the owner of a RES plant can construct the connection works to the HV System and operate that part of grid. At the same time, the connection works are characterized as being of "public interest".
Regarding especially the construction of large wind farms on islands with high wind potential and of the interconnections to the mainland grid, it should be noted that according to the Law 3468/2006, such projects have to be envisaged in the annual System Development Plans established by the HTSO where the way the interconnection is constructed and operated will be determined, as well as the allocation of relevant expenses.

F.2.3 Cost allocation for RES-E system integration

Typically, *connection works* concern all new equipment and installations needed to connect to a point on the existing network. Construction of Connection works can be done by the RES Producer and the cost is borne by the producer. However, the construction of transmission lines for RES plants is eligible to receive 50% public aid
Reinforcement works on the existing network are not included in Connection Works.
Ownership & responsibility of connection equipment and installations that become part of the existing network is transferred to the respective Network Operator/Owner. Typically this concerns equipment located upstream of the HV CB (System/User boundary). The producer retains ownership and responsibility for downstream connection works.
Provisions exist for compensating the producer in case of future connection of additional Users through the same connection works (either upstream or downstream of boundary).
When major expansion or reinforcement of existing network is needed in order to accommodate considerable RES generation planned to be developed in certain regions (deep connection), associated works are included in the Transmission System development plan and their cost is covered through TUoS tariffs.

F.2.4 Competent Authority to Judge Design and Cost of Connection

All connection works have to be constructed according to specifications provided by the Network Operator.

F.2.5 DNO/TSO regulation

The operation of the Transmission System is assigned to an Independent Transmission System Operator ('Hellenic Transmission System Operator S.A.'). According to the provisions of Law 3426/2005, which amended the basic electricity Law 2773/1999, PPC SA, as the exclusive owner of the transmission system, is responsible for the development of the transmission system, following the relevant 5-year plan produced by the HTSO and approved by the Minister of Development following RAE's opinion. Moreover, PPC is responsible for planning and carrying-out the maintenance and actual functionality of the transmission system.
PPC SA is also the exclusive owner of the electricity distribution network. According to the provisions of Law 3426/2005, a special department of PPC undertakes currently the responsibilities of the Distribution System Operator, which consequently will be transferred to the HTSO (along with the special unit of PPC). The Distribution System Operator is responsible for ensuring the reliability, functionality and efficiency of the distribution network, and for third party access to the distribution network. The Distribution Network Code has not been approved yet. Until then, PPC, as the distribution network owner and operator, follows internally defined rules and procedures.

Network tariffs are calculated on the basis of the annual system cost. The annual system cost is adjusted to also take into account the differences between the forecasted and realized transmission expenses during the previous year.
The 2005 Grid and Market Operation Code prescribes that the Transmission System charges are allocated to generation -including imports- (G) and load –including exports- (L) according to a 15% - 85% split. Both G and L components are based only on the capacity of the corresponding user. The L component is uniform throughout Greece, while G has a zonal variation, according to the location of each generator. The 2005 Code provides for two zones, namely (a) Attiki-Viotia, where G is zero, and (b) the rest of the interconnected system.
The operating expenses of the HTSO are not covered by the Transmission Network Tariffs. The annual budget of the HTSO, as approved by the Minister of Development, following an opinion by RAE, is debited in a regulated account which forms part of the Uplift Account. The Uplift Account is also used for the coverage of the cost of the ancillary services and for resolving system constraints. To balance the Uplift Account, a charge is imposed to all suppliers and self-supplied eligible customers in proportion to their share in total consumption.

Legal unbundling of the operation of the distribution network has not yet been established. Also, due to lack of the Distribution Network Code there is neither a methodology nor a procedure for the approval of the distribution system charges. Such charges are assumed to be incorporated into the retail tariffs of PPC, which are approved by the Minister of Development, following the opinion of RAE.

F.2.6 Asset Base Determination

The annual System Cost is defined as the sum of the annual barter owed by the HTSO to PPC SA (i.e. the sum of the annual depreciation of the assets of the Transmission System, its operational and maintenance expenses and the return on the non-depreciated capital of the Transmission System, with the rate of return being approved by RAE) and the annual cost of any works for the expansion of the System.

F.2.7 Exemption for RES

As far as RES generation is concerned, RES generating plants under feed-in tariff are not charged with Transmission Use of System charges. Large hydro plants (>15MWe) are charged with TUoS charges (€/MW) on 50% of their registered maximum net output.

F.2.8 Micro Scale Connection

The Distribution Network Code has not been approved yet. PPC as the DSO continues to receive applications for connection to the grid. There are no legal obligations to the DSO for the publication of data, since neither the Distribution Network Code nor the terms for the Licence of the DSO are available.
Micro-scale RES installations are also promoted through their exemption from obtaining a generation licence. This exemption applies to geothermal installations <500kW, biomass installations <100kW, PV installations <150kW and other RES installations <50kW.

F.2.9 Role of TSO/DSO regarding RES-E integration

Historically, the Austrian TSOs operated a special balancing group, which acted as a single buyer of supported RES-E. The responsibility for forecasting feed in and attributing schedules to suppliers lied within this balancing group.
DSOs are accepting applications for grid access from RES-E producers and have to decide approval and propose a specific charge for the technical installations to connect a new plant to the existing grid.

F.2.10 Regulatory Authority

Market reform of the Greek electricity sector begun with the Law 2773/99 which was adopted in order to comply with the EU Directive 96/92 concerning common rules for the internal market for electricity.
An independent Regulatory Authority for Energy (RAE) was put in place. Its role is to facilitate competition in the energy sector, to secure the national energy strategy in the liberalised market context in a cost-effective and environment-friendly manner while protecting the consumers and to guarantee security of supply. RAE overviews and monitors the energy markets, provides opinion to the Minister of Development for regulations (Grid Code, Power Exchange Code), for transmission access and captive consumer tariffs and for Generation and Supply Licenses.

The Ministry of Development has the primary regulatory responsibility and is not bound to follow RAE's opinions and recommendations.

F.3 Overview of disaggregated grid related charges

RES generating plants under feed-in tariff are not charged with Transmission Use of System charges.

F.4 Conclusions: barriers and incentives for RES-E integration

The overall financial support mechanism for the promotion of RES in electricity generation in Greece is considered as satisfactory by practically all market participants. Moreover, the exemption of RES installations from TUoS tariffs is a significant grid-related incentive.
The most important barriers to further RES development in Greece have to do with:

i. Lengthy licensing procedures that typically take more than 2-3 years to complete
ii. Limited grid availability in areas with high wind potential
iii. Negative public attitudes in various areas
iv. The absence of a Special Framework of Land-Use Planning for RES installations that may lead to the halting of works by the State Court

From a grid-related point of view, it is important that the construction of the expansion-reinforcement works anticipated in the 5-year System Development Plans is accelerated and that they are being planned with detailed budgetary and timeframe requirements.

F.5 Country Specific Definitions

Low Voltage:	230/380V
Medium Voltage:	15-20kV
High Voltage:	150kV
Super-High Voltage:	400kV

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G NETHERLANDS

G.1 Country Specific Market Design for RES-E

G.1.1 RES-E Promotion Scheme

The major support scheme for electricity from renewable electricity sources (RES-E) in the Netherlands is the “Stimulering Duurzame Energieproductie” (SDE), which works through a feed-in premium for RES-E. The SDE is safe-guarded against overspending by an expenditure ceiling. The SDE in 2006 replaced the "Milieukwaliteit Electriciteitsproductie” (MEP) which worked through a feed in tariff. The SDE is safeguarded against overspending by an expenditure ceiling. The SDE also applies for CHP.

In its climate policy, the Netherlands set a global target of 5% renewable energy by 2010, and 10% by 2020. According to the EU Directive, the RES-E share of the Netherlands should reach 9% of the gross electricity consumption in 2010. The national biofuel targets are in line with the EU Directive, meaning 2% by energy content in 2005 and 5.75% in 2010.

Progress towards meeting national targets:
Between 1997 and 2004, progress has been made towards the RES-E target. In 1997, the RES-E share was 3.5%, and by 2004, it had risen to 4.60%.
The biofuel target for 2005 was not met, since the biofuel share by energy content in that year was 0.02%. The targets set for 2006 and 2007 are the same as the one set for 2005 (2%) [59].

G.1.2 Balancing Responsibility

Program responsibility; the role of TenneT

This paragraph describes in short the situation in the Netherlands for system balancing, as per-formed by TenneT.
Program Responsibility can be defined as the responsibility for market parties to keep their own energy balance within each settlement period, i.e. provide energy programs (E-programs) to the TSO and act accordingly. Deviations on energy programs during realizing are settled by the im-balance pricing system. To get an open market for the price setting of imbalance, the regulation market was introduced. The System Code foresees in the obligation to all suppliers (with connection capacity > 60 MW) to offer all available reserve capacity to TenneT at a market energy price but without capacity payment. Additional bilateral contracting with suppliers of regulating power obliges these suppliers to bid (all together) at least 250 MW of regulating power on the daily regulation market [60].

G.1.3 Financing

Main supporting policies

RES-E policy in the Netherlands is based on the 2003 MEP policy programme (Environmental Quality of Power Generation), and is composed of the following strands:

- ✓ *Source specific premium tariffs*, paid for ten years on top of the market price. These tariffs were introduced in 2003 and are adjusted annually. Tradable certificates are used to claim the feed-in tariffs. The value of these certificates equals the level of the feed-in tariff. Due to budgetary reasons, most of the feed-in tariffs were set at zero in August 2006.

An energy tax exemption for RES-E was in place until 1 January 2005.

- ✓ *A Guarantee of Origin system* was introduced, simply by renaming the former certificate system.

In the Netherlands, biofuels have traditionally been supported by means of R&D funds. To this date, technological innovations in this field are encouraged by means of financial support. In 2006, a tax relief system was introduced. The mechanism that was chosen links the quantity of biofuels to the national targets, by requiring of suppliers that regular fuels contain a 2% share of biofuel from 2007 onwards, and a 5.75% share from 2010 onwards.

Limited investment subsidies are available for RES heating and cooling activities. Feed-in tariffs (see above) are also applied to CHP [61].

G.2 Specification of Regulatory Regime in place

G.2.1 Grid Access for RES-E

Grid connection procedure

- The network operator is obliged to offer each decentralised electricity producer (and consumer) access to the grid
- The connection is built by the network operator, resulting in a connection point near to the producer
- The investment costs of the connection (shallow costs) are paid by the producer
- The producer pays an annual contribution for the system use to the network operator
- In case the grid operator must adapt the network in order to connect the producer, the costs (deep costs) are socialized among all connected producers and consumers
- The use of system charge is fixed by a competent authority (DTE)

Distribution network:
If a distribution company and an electricity user agree that the electricity to be supplied to the user shall be generated in full or in part in an environmentally responsible manner, the distribution company may stipulate that the payment it shall charge for supplying electricity to that consumer in relation to the distribution thereof shall be increased by a sum to cover the costs incurred by generating electricity in one of the ways referred to in section 36(c)(7)(a) of the Environmental Taxes Act,11 in so far as such costs exceed the costs incurred by other methods of generating electricity [62].

Transmission network:
TenneT is working towards a systematic expansion of the national high voltage grid in order to be able to meet the growing demand for transmission capacity. Work is already underway for example on a new connection for the Randstad via the Randstad 380 kV project.

A further three new projects have also been announced. Work is ongoing on the construction of a new 380 kV high voltage line between Doetinchem and Wesel in Germany. The new line, 60 kilometres in length, will increase import capacity by 1000 to 2000 MW and lead to an expansion in opportunities for trade. The project is expected to be completed in 2014.

Construction of a new 380 kV line from Eemshaven to the Centraal-Nederland loop line is also planned. This project will last for 8 years. The Zwolle-Hoogeveen line will remain in operation in the short term (2-3 years), and will be upgraded together with the Vierverlaten-Zeijerveen-Hoogeveen stretch [65].

G.2.2 Tendering of grid connection work

DNOs currently have a monopoly on the building of the connection to the grid, and that has given rise to complaints from generators, especially wind farms, and different consumers. They argue that this causes excessive high costs of connection charges, especially when generators are situated far away from the grid. The Dutch government intends to change the current regulatory framework, and consequently allow customers carry out the connection installations to the grid by their own means. Competition will be therefore promoted and reduction of costs expected [66].

G.2.3 Cost allocation for RES-E system integration

A connected generator that produces renewable electricity or combined heat and power electricity may submit a request for the connection to the network operator in the region concerned a request.
On request the network operator shall provide an EAN code to identify the connection referred to in the second sentence of this article. The connected party may commission the network operator or an accredited party with metering responsibility to perform the metering installation readout referred to in Section 16, subsection 1i of the Act [65].

G.2.4 DNO/TSO regulation

The Electricity Act 1998 regulates operational activities relevant to the electricity networks. In the Netherlands separate companies are charged with operating these networks. They are referred to as regional network operators. The Minister of Economic Affairs has given his consent to the appointment of regional network operators. DTe advised the Minister on this matter. DTe safeguards general access to electricity (and gas) networks. Tariffs and conditions concerning access and transport, as set out by electricity network operators, should not discriminate against anyone. DTe annually fixes access and transport tariffs for the regional electricity network operators [69].

Economic regulation of DSOs
Regulation of the DSOs is by incentive: price cap with yardstick competition [69].

TSO
TenneT B.V is the national Transmission System Operator of the Netherlands, headquartered in Arnhem. Controlled and owned by the Dutch government, it is responsible for overseeing the operation of the 380 and 220 kV high-voltage grid throughout the Netherlands and its interconnections with neighbouring countries. It is additionally responsible for the 150 kV grid in South Holland following a €249-million acquisition of the regional system operator Transportnet Zuid-Holland in 2003.
As of 2006, it operates 3,286 km of lines and cables at 150 kV and above, connecting at 51 high-voltage substations. Peak demand for 2006 was 14,846 MW. TenneT declared a turnover of €417.2 million in 2006 with a workforce of 490 employees. The sole shareholder is the Dutch Ministry of Finance.

G.2.5 Micro Scale Connection

The technical regulations for micro scale connections are incorporated in the National Grid Code. Micorgenerators are considered as standard feed-in grid applications. Systems should be reported to the grid operator. Smaller systems (< 2,25 A) can be connected without notice to the DNO, but should comply with the Dutch Technical Agreement NTA 8493 [70.

G.2.6 Regulatory Authority

The regulatory authority in the Netherlands is the Office of Energy Regulation DTe: http://www.dte.nl/engels/home/index.asp

G.2.7 One-Time-Charges and yearly fixed charges
and

G.2.8 Use of System Charges (Energy/Power related charges)

The Electricity Act (1998) stipulates that the joint grid administrators must submit proposals to the Office of Energy Regulation (DTe) detailing a tariff structure and a set of technical conditions (regulations) for grid administration. **The Tariff Code** describes the tariff structure (i.e. tariff components and calculation method) of the regulated tariffs that grid administrators can charge their customers.

The establishment of the Tariff Code is stipulated in the Electricity Act and explains how the tariffs for the following services are calculated:

- connection service (connection to a grid);
- transmission service (input, output and throughput of electricity);
- system service (performance of system services).

Each grid administrator must submit an annual proposal for the maximum tariffs that it may charge for the above mentioned services. This proposal must take account of the prescribed tariff structures. The Director of the Office of Energy Regulation determines the annual tariffs [67].

Connection tariffs in the Netherlands depend on the type of connection [66].

- Connections up to 10 MVA are shallow, regulated and averaged. Connection charges are set by the regulator and are not individually calculated but cover a different number of connection profiles.
- Connections over 10 MVA are negotiated and deep. Charges are determined through negotiation processes between users and the DNOs.

Article 2.2 of the Tariff Code outlines the costs covered by the connection tariff, which can be broken down in two components:

- the initial investment costs,
- maintenance costs.

Transmission network
The connection tariff comprises two components [71]:

- the initial connection tariff
- the periodic connection tariff.

Initial connection tariff: The initial connection tariff covers the costs of creating the connection to the high-voltage grid. The costs of a standard connection include the ‘break’ into the high-voltage grid, the security of the high-voltage grid and 25 metres of cable. Connections to TenneT’s high-voltage grid are tailor-made. Therefore, the initial connection tariff varies between connections. As soon as the connection is completed, TenneT will send an invoice for the full initial connection tariff.

Periodic connection tariff: The periodic connection tariff covers the costs of maintaining and, if necessary, replacing the connection. Connected parties with multiple connections receive a separate invoice for each individual connection. The periodic connection tariff is a fixed amount that is updated once a year.

Table G.1*: Transmission network Tariffs 2007:*

	25-50 kV [73], [74]	**110-150 kV (up to 600 hours per year)**	**110-150 kV**	**220-380 kV** [74]
Annual standing charge for transmission services	-	2 760	2 760	124 78.96 EUR
kW max per year	21.81		19.48	
kW contracted per year		4.87	9.740	
kW max per month		0.34	0.97	
Tariff for ancillary services per kWh ??				0.00117
Tariff for minimizing grid losses per MWh (RUN)				0.47365

RUN
Following a review of DG by the regulator Dte in 2004, the Regeling Uitgespaarde Netverliezen (RUN) measure was introduced which provides DG with a compensation payment for avoided network losses. The network operators reward distributed generators per kWh fed into the grid.

G.3 Summary of barriers and incentives for connection of RES-E

RES-E support mechanisms

After a period during which support was high but markets quite open, a system was introduced (in 2003) that installed sufficient incentives for domestic RES-E production. Although successful in encouraging investments, this system (based on premium tariffs), was abandoned in August 2006 due to budgetary constraints. Political uncertainty concerning renewable energy support in the Netherlands is compounded by an increase in the overall energy demand. Progress towards RES-E targets is slow, even though growth in absolute figures is significant.

DNO incentives
The Dutch government introduced a price cap system to regulate the tariffs charged by DNOs. The system establishes the maximum tariffs firms can charge for their services during the regulatory period, and the tariff reductions per year depend on the x-factor and the inflation index. The x-factor is the discount to promote an efficient operation by network firms. Impacts of this regulatory framework include :

- DNOs are incentivised to minimise expenditures in order to minimise costs and maximize benefits.
- Due to the unbundling of the sectors, a long-term cost minimisation policy through integrated resource planning cannot be achieved. DNOs face constraints in determining how and where infrastructure developments should take place in the most efficient way.
- The fact that DNOs are encouraged to minimise operational and capital expenditures is hinders invoation. This can harm the development of DG [66].

Distribution Charging

Whilst smaller DG projects have benefited from shallow, regulated and averaged type of connection charging, connection charging has represented a barrier to the development of larger DG projects, as for connection capacities over 10 MVA a deep charging philosophy has been in practice. It has been observed that many operators of generation plants exceeding 10 MVA have many times split the total capacity of the system into several smaller capacity systems in order to avoid the deep connection charges. Because of this, the Dutch regulator is presently studying the possibility of reducing the capacity limit of shallow connection costs from 10 MVA down to 1 MVA. The Dutch government intends to change the current regulatory framework in order to allow DG projects' promoters to develop and build the connections to the existing network [72].

G.4 Country Specific Definitions

Country specific definitions for Netherlands are as follows [77]:

- National high-voltage network: networks intended to transmit electricity at a voltage of 220 kV or higher and that are operated as such, and also cross-border connections with a voltage of 0.5 kV or higher;
- High-voltage network: networks intended to transmit electricity at a voltage of 50 kV or higher, but lower than 220 kV and that are operated as such;
- Medium-voltage network: networks intended to transmit electricity at a voltage of 1 kV or higher, but lower than 50 kV and that are operated as such;
- Low-voltage network: networks intended to transmit electricity at a voltage lower than 1 kV and that are operated as such.

G.5 Country Specific list of references

References Netherlands:
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[61] Netherland – Renewable energy fact sheet
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[62] Electricity Act 1998:
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H NORWAY AND OTHER SCANDINAVIAN COUNTRIES

In the following we proved information for Norway and other Scandinavian countries. For Scandinavia (Norway, Sweden and Denmark) we describe the RES-E support system, balancing responsibilities and country specific definitions. Some information is also given for Finland.

H.1 Country Specific Market Design for RES-E

H.1.1 RES-E Promotion Scheme

Norway

Up to recently, almost all Norwegian power generation has been renewable hydropower. Presently, support to renewable energy production is handled by the state enterprise Enova. Since 2001 Enova has operated a fund to provide investment aid to renewable energy production and energy savings. The support should be the triggering factor for investments, and priority is given to efficient projects in terms of the energy/support ratio.

The Norwegian support system for renewable electricity generation is in transition. A new scheme for support to renewable electricity generation was planned from 2008. This has been delayed because it has not been passed through the EFTA Surveillance Authority (ESA) yet. ESA is a legal body for the cooperation between the EU and EEA countries like Norway. In the following we will describe the planned scheme, cf. OED (2007).

In the new scheme that was planned from 2008 the support is given on basis of the produced amount per kWh. Table 1 gives an overview of the support to different technologies. There are similarities between this support scheme and so-called feed-in tariffs. In Norway, the support will be managed by the state owned agency Enova, and financed over Enova's budget.

The support will be given for 15 years. However, if the average annual power price at the Nordic power exchange Nord Pool exceeds 45 øre/kWh (approx. 5,6 EuroCent/kWh) the support will be reduced by 0,6 øre/kWh for excess amount of the power price.

It is a goal for the Norwegian government to establish a common Swedish – Norwegian market for green certificates ("elsertifikater") for new renewable generation.

Table H.1: Support for RES-E in Norway:

Technology	Support per kWh		Comment
	Øre	EuroCent[3]	
Hydropower	4	0,5	Max 3 MW per. unit supported For new and upgraded units
Wind-power	8	1	Land-based
Bio-power	10	1,25	
Immature technologies	10	1,25	Off-shore wind-power Wave-power Tide-power and others Additional support through Enova is possible

Sweden

In Sweden the major support scheme for new renewable generation is a market for green certificates ("elcertifikat") that started in 2003. The initial system is described in SFS (2003), while modifications are described in Regerings proposition (2005). See also the web-sites for the Swedish Energy Agency for a quick introduction.

In this system, producers of RES-E obtain one certificate per MWh renewable electricity produced. Electricity suppliers must buy a number of certificates proportionally to their electricity supply (except to power intensive industry) or pay a penalty corresponding to 150% of the average certificate price for that year. This creates a demand and a market-price for certificates. The average price on certificates (1 MWh) was 216 SEK / 23 Euro in the period 19th May 2007 to 19th May 2008.

New renewable generation obtains certificates in maximum 15 years and only up to 2030. All renewable generation (existing and new) and CHP-plants using peat obtains certificates for the produced power, but there are special rules for hydropower. The following hydropower generation are obliged to certificates: small scale generation (less than 1,5 MW), increased production in existing generation and new large scale hydropower. Certificates can be stored from one year to the next. This is important to reduced possible price-variation because of varying renewable generation from year to year depending on weather conditions.

For consumers the certificate cost is a part of the electricity price. The amount of certificates that must be purchased by consumers, as a share of electricity consumption, is shown in Figure 1. The goal of the implemented system is to increase the use of renewable electricity with 17 TWh from 2002 to 2016.

[3] Assuming 1 Euro = 8 NOK.

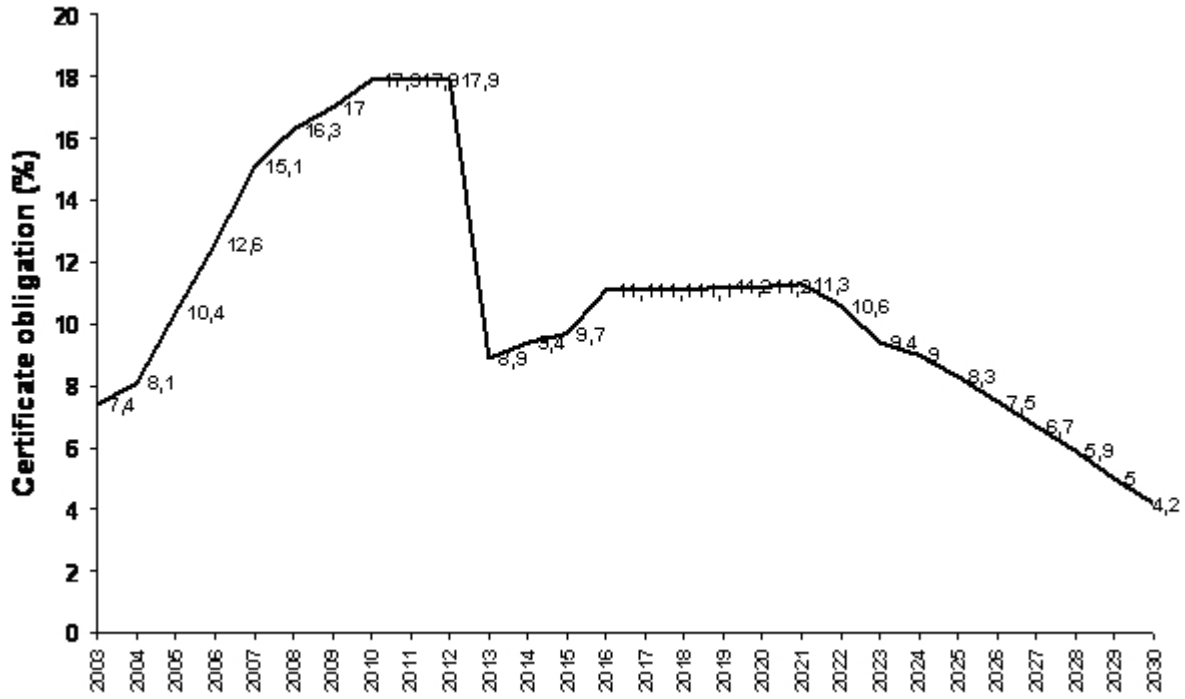

Figure H-1: Certificate obligation for Swedish consumers as a share of electricity consumption.

In addition to the certificate-scheme there is additional support to wind-power through a reduction in the energy tax ("Miljöbonus"). This system has been in operation since 1994. When the energy tax increased the extra support increased too (from 9 øre/kWh in 1994 to 16,2 øre/kWh in 2000). However, from 2004 the support has been reduced and the plan is to end this system in 2009. For 2008 the support is 2 øre/kWh for wind-power on land and 13 øre/kWh for off-shore wind-power.

Denmark

The Danish support system for RES-E is described on the web-pages of the responsible energy-agency in Denmark, which is Energistyrelsen. Additional description is provided by Energianalyse (2007).

In Denmark, land-based wind-power established after 1.1.2005 is supported with a 10 øre/kWh feed-in tariff (which corresponds to 1,3 EuroCent/kWh at the exchange rate 1 Euro = 7,44 Danish krone). In addition, a 2,3 øre/kWh feed-in tariff is granted for the coverage of expected balancing costs, cf. Energistyrelsen (2008) and Energianalyse (2007). Different rules apply for wind-power established before 2005. If a new installation replaces an older one there is an additional support of 12 øre/kWh for the first 12000 full load hours.

The support to off-shore wind-power is a result of the bids from potential investors in a tendering. Two new wind-parks that is expected to be in operation before 2010 will have a fixed settling price on 51 øre/kWh and 50 øre/kWh respectively for the first 50000 full load hours, and no support after this.

For centrally electricity production based on bio energy there is a guaranteed electricity price on 40 øre/kWh for 10 years. For decentralized renewable electricity production except from wind-power, waste and biogas there is a guaranteed price on 60 øre/kWh. For decentralized electricity production based on waste and biogas >5 MW there are separate rules for yearly support independent of the present generation, and guaranteed prices for <5 MW capacity which corresponds to between 30 and 40 øre/kWh on an annual basis. For biogas only generation in operation before 2008 will be supported and only a limited amount per year.

H.1.2 Balancing Responsibility

There is a common liberalised electricity market for Norway, Sweden, Denmark and Finland. The day-ahead spot market for electricity trade are organised on the common power exchange Nord Pool. There may however be different spot-prices in different areas because of congestion. The transmission grid in the Nordic countries is illustrated in Figure 2.

Nordel is a collaboration organisation of the Transmission System Operators (TSOs) of Norway (Statnett), Sweden (Svenska Kräftnet), Denmark (Energinet.dk), Finland (Fingrid) and Iceland (Landsnet). The transmission system operators have the overall responsibility for balancing. Presently there are similar and interconnected systems for balance management in the Nordic countries, but the systems are not identical. However, a harmonized system is planned from 2009, cf. Nordel (2008).

There are different kinds of reserves to be used during operation. The frequency-controlled (primary) reserves respond quickly and automatically to maintain the balance between production and consumption and to adjust frequency and time deviations in the synchronous Nordic system. To maintain this reserve its use is replaced by the (secondary) fast reserves which have 10-15 minutes response time. The use of these fast reserves is handled manually in a balancing market which is called the Regulating Power Market (RPM) in Nordic countries.

Bids for altered production / consumption in the regulating power market are ranked in merit order before operation (the closure is presently different in different countries). During operation units are contacted manually to adjust production / consumption. This is a common market for the Nordel area (except Iceland), but because of congestion it is sometimes necessary to use units which have the correct geographical location. In these cases there will also be different prices for balancing in different areas.

Figure H-2: The transmission grid in the Nordic countries (figure is copied from Nordel's web-site).

In the balancing market, the units that offer balancing services get a price which is better than the corresponding spot market price for that hour. If additional production (or reduced consumption) is needed the payment for the adjustment is higher than the spot price. If less production is needed the price for adjustment is less than the spot price. The TSO pass the balancing costs (i.e. the difference between the balancing market price and spot market price) through to those who are responsible for the imbalance (balance responsible entity).

In some cases participants have imbalances that actually help the system operator to deal with the overall balancing of the system. A wind-power plant may for instance produce more than expected in hours where the system operator needs additional power because demand is larger than expected. For these cases there have been different pricing-rules in the Nordic countries. In Norway, the party responsible for a imbalance always get the balancing price (one-price model). This implies that wind-power with excess production during operation get the higher balancing price if there is a need for additional generation during operation. In the same example, the wind-power plant will only get the spot price for excess generation in Sweden, Denmark and Finland (two-price model). The Nordic system operators have, however, agreed to use the same principle from 2009. The Norwegian model (one-price model) will be used for consumption while the two-price model will be used for generation. Thus, extra wind-power generation will only obtain the spot price in cases where there is a need for additional generation (or reduced consumption), cf. Svenska Kräftnet (2007).

In the intra-day Elbas-market there is continuous power trading up to one hour prior to delivery. Thus the Elbas-market is in practice an adjustment of the spot market quantity, and this reduces the need for balancing during operation. There has not been an Elbas-market for Norway so far, but it is planned to open January 2009.

In Denmark the rules for balancing costs are different for the older wind-power plants that obtain a guaranteed price than for new plants that received the described feed-in tariff. For the older plants the system operator must take care of and pay for imbalances. Newer wind-power plants that receive the feed-in tariff must however pay for balancing during operation (the 2,3 øre/kWh part of the feed-in tariff is however meant to cover this expense). So far Elbas has not been used actively in Denmark to deal with unbalances, cf. Energianalyse (2007).

The system costs of uncertain wind-power production are partly covered by the responsible for the imbalance, as explained. Thus, the price in the balancing market gives an important incentive for making capacity available for the balancing market. Still, the system operators make arrangements to make sure that enough reserves are available during operation. In Norway, Statnett organise a weekly market for reserves. Reserves (producers and consumers) are paid a premium to be available in the balancing market next week. This income comes in addition to the income from the balancing price if the reserves are actually used during operation. Statnett pays for these reserves, but costs are passed on to consumers through the tariff. If the need for reserves increases with a larger share of wind-power Statnett will pay for this in the present system. A similar system with reserves, handled from day to day, has been developed in Denmark. In Sweden and Finland the TSO's have gas-turbines available, and in Finland there are also bilateral agreements for disconnection of consumption, cf. Nordel (2008).

H.1.3 Financing

In Norway all support to RES-E goes through the energy fund ("energifondet") which is handled by the governmental enterprise Enova. There are two main income sources for the energy fund. Firstly, there is a 1 øre/kWh mark-up on the distribution-net tariff. In 2007 this generated 700 million NOK. Secondly, the government has put 10 thousand millions NOK in the fund in 2007 and the plan is to put in 10 thousand millions extra in 2009 and additional 10 thousand millions within 2012. The estimated return from this fund is 710 million NOK in 2007, double in 2009 and triple in 2012, cf. OED (2007).

In Sweden, the price for certificates is a part of the power price for general consumption.

In Denmark the feed-in tariff for renewable electricity production is mainly financed through an addition to the electricity price (øre/kWh) for all consumers, cf. Energistyrelsen (2007).

H.2 Specification of Regulatory Regime in place

H.2.1 Grid Access for RES-E

According to the Norwegian Energy Act Regulation (OED, 1990), concessionaires for the electric network are obliged to provide grid access to those who ask for it in a non-discriminatory way, and with objective conditions and tariffs. Tariffs shall give adequate signals for an efficient operation and development of the grid. No special arrangement is mentioned for RES-E in the Energy Act Regulation.

H.2.2 Tendering of grid connection work

For large construction work in the main grid, tender competitions are arranged.

H.2.3 Cost allocation for RES-E system integration

Grid connection for wind-power has the same economic conditions as other power generation. This implies that upgrading of the grid due to additional wind-power must be financed by the wind-power producer. The cost shall not be covered by the grid owner, cf. NVE (1998). The concession work for new wind-power in specific regions is however co-ordinated and the need for increasing the transmission capacity is considered simultaneously, cf. MD / OED (2007).

Additional system costs e.g. because of an increased need for balancing reserves in a system with much unregulated production, will be covered by the Norwegian TSO (Statnett) and passed on to consumers through the tariff. However, the power

generation controllability is generally good in Norway because of the flexibility in hydropower.

H.2.4 Competent Authority to Judge Design and Cost of Connection

The Norwegian regulator, NVE, makes the rules for calculating tariffs. The grid owners calculate the tariffs in their area and demand payment for their cost for necessary grid expansion to new producers and consumers etc. The users of the electric network can however complain to NVE which will make the decision if tariffs or cost coverage is in accordance with the general principles, cf. NVE web-site.

H.2.5 DNO/TSO regulation

For the Norwegian electrical transmission and distribution sector revenue cap regulation was introduced in 1997. In this model the Regulator is granting a maximum permitted revenue for the utilities separate from their actual costs.

From 2007 a new regulatory period started. Two main changes were introduced:

- The total income cap for the Norwegian DNOs will be equal to the total costs - including depreciation costs and a regulated rate of return
- Norm costs will be used to divide the total income cap between the companies.

The allocation of the total income cap between the DNOs is in principle determined by eq. (1) giving the ex ante income cap for company 'i' in year t:

$$IC_{i,t} = \alpha \cdot K_{i,(t-2)} + (1-\alpha) \cdot K_i^* \qquad \text{Formula H-1}$$

where

α	-	Weighting factor (0%< α <100%)
$IC_{i,t}$	-	Income cap year t
$K_{i,(t-2)}$	-	The DNO's costs in year 't-2'
K_i^*	-	The norm cost for the DNO in year 't'

The t-2 part comes from the regulatory reporting time lag. So the overall principle is that a part (α) of the DNO's income will be decided by the DNO's own costs (including regulated return on assets and customer interruption costs) while the reminder (1- α) will be decided by the norm cost K_i^*. The factor α is set by NVE to 50% in 2007 /2008 and to 40% from 2009 – i.e. the norm cost will have an increased weight after an "introductory" period.

An important prerequisite is that the average capital rate of return for the whole industry should be equal to the NVE regulated rate of return. The total norm cost K* will be adjusted accordingly to meet this requirement. This requirement leads to the situation that total income for the Norwegian DNOs will be equal to the total costs. But the rate of return for the individual companies might be very different. The expectation values for 2007 rate of return (based on 2005 costs and asset base) varies between 2%-12% (excluding some special cases).

H.2.6 Asset Base Determination

The asset base in the regulation consists of the total costs $K_{i,(t-2)}$ comprising the following:

- operation and maintenance costs
- cost of customer management
- cost of electrical losses
- depreciation costs
- regulated return on assets (historic book values) using the NVE regulated rate of return
- CENS i.e. Costs of Energy Not Supplied (customer interruption costs)

H.2.7 Exemption for RES

There are no special exemptions in the grid regulation for RES, it is dealt with as a regular grid customer. In the DEA benchmarking determining the norm costs, the RES customers are not specifically included in the model, i.e. they are treated as a regular customer. This has been criticised, and NVE is looking for how to change the model to better reflect the grid costs given by distribution generation.

H.2.8 Role of TSO/DSO regarding RES-E integration

Transmission and distribution system operators have important formal and informal roles for the integration of RES-E. From the perspective of a possible investor in new wind-power there are several challenges. Firstly, a project must be economically viable. On the income side there is an electricity price plus a feed-in tariff (in the new system). On the cost side there are many elements including possible project costs ("anleggsbidrag") to cover the expenses for DNO[4] and possible TSO, and a tariff that is affected by marginal losses calculated by DNOs. Thus, the cost of a specific project is affected by the general development of the grid, which is the responsibility of system operators. In this way DNOs/TSO affect the potential / costs for new power generation.

[4] In Norway, distribution network owners usually own the network they operate. In the following we use the term DNO and we don not differentiate between the terms DNO and DSO.

In Norway, DNOs and the TSO are much involved in the general planning of the energy system. The perspectives taken in these plans for the development of the energy system on a local level as well as a national level will probably affect the views in the general public, local institutions as well as governmental agencies, and in this way affect if projects obtain needed local support and concession.

H.2.9 Regulatory Authority

Two regulatory bodies exist in the field of electricity regulation.

The Norwegian Water Resources and Energy Directorate (NVE) has to approve general terms and conditions for grid access, determines tariff principles, non-discrimination, unbundling, market rules, and is responsible for the monopoly regulation.

The Directorate for Civil Protection and Emergency Planning (DSB) aims to maintain a full overview of risk and vulnerability for society in general and is responsible for safety issues and EMC.

H.3 Overview of disaggregated grid related charges

H.3.1 One-Time-Charges and yearly fixed charges (non-output-related charges)

Distribution system operators can demand coverage of project costs (“anleggsbidrag”) when establishing new excess to the network and when the existing grid is reinforced. When a new investment is necessary because of the needs of a specific customer, the full cost may be charged from this customer. If it is possible to identify those who benefits from a reinforcement of the grid (single customer or group of customers), then it is possible for the distribution system operator to charge for the project costs also when investments in joint infrastructure (“fellesanlegg”) is needed. This applies to radial distribution. There is presently no special treatment for RES-E in this respect. However, costs for reinforcement in meshed distribution cannot be charged from specific customers even though it is the needs of a new producer that gives a need for reinforcement.

Fixed yearly charges from the users of the existing infrastructure are described in the next paragraph.

H.3.2 Use of System Charges (Energy/Power related charges)

In the following we describe the energy/power related charges in Norway for 2008 as well as yearly charges. The information is based on NVE's web-pages and NVE (2008).

For consumption there are mostly two parts of the system charge. A fixed amount per year and an amount per kWh consumed. Usually, specific costs for connection of consumers are covered by the fixed amount, while the fee per kWh covers losses in the grid. Thus, the fee per kWh gives incentives regarding location. Other fixed costs are covered by both fee-types, and there are differences between different utilities. For large industrial consumers a NOK/kW fee per year is used instead of the fixed yearly tariff.

Average numbers are provided for Norway. The highest and lowest of average tariffs for 19 Norwegian counties are indicated in parenthesis. VAT is not included. The special tax for electricity consumption is not included.

Households

1450	NOK per year	(800 - 2284)
16,4	øre/kWh	(13,0 – 26,2)

Business sector

Small customers

1779	NOK per year	(800 – 3742)
16,9	øre/kWh	(11,7 – 26,2)

Large customers

808	NOK per kW each year	(664 – 1027)
20,2	øre/kWh	(16,6 – 25,7)

There are separate tariffs for weekend cottages and demand that can be disconnected.

Suppliers

For electricity suppliers there are two parts in the tariff. The first part is 0,56 øre/kWh for 2008. For new production with a favourable location this term can be reduced to 0,1 øre/kWh. For suppliers <1 MW the fixed term shall be no larger than 30% of installed capacity times 5000 hours per year.

The second part of the tariff shall be set in accordance with marginal losses if additional production is fed into the grid. In areas with surplus of electric power the needed transmission increases if additional power is fed in, and losses increases. Thus the second part of the tariff is positive. In deficit areas, however, this tariff can

be negative since additional production can reduce the need for transmitting energy to the area. For 2008 this second term of the tariff is in the interval [-2,4; 2,8] øre/kWh for connections to the distribution net.

H.4 Summary of barriers and incentives for connection of RES-E

In Norway there is financial support for new renewable electricity production and increasing budgets for the responsible governmental enterprise. The planned support scheme from 2008 discriminates between different technologies.

The general principles for charges for access to and use of the grid are relatively transparent, and they give incentives regarding the geographical location for demand and supply. If grid reinforcement is needed because of new RES-E supply and this supply is the only present beneficiary of the reinforcement, the full project cost can be charged.

Renewable generation is not negatively discriminated in the regulatory regime for grid connection. But there is not a positive discrimination either.

H.5 Conclusions

Support levels for RES-E is lower in Norway than in the other Scandinavian countries, and uncertainty regarding a possible better support scheme in the future, such as a common market for green certificates with Sweden, may have stopped many economic viable RES-E projects.

The large amounts of controllable hydropower in Norway will probably make it less expensive to balance large amounts of incontrollable RES-E generation such as wind-power.

The charges for needed grid investments when connecting new generation can be a barrier for investments in new generation, and there is a danger that investments will be lower than the socio-economic optimal amount when there are several possible projects in the same area. There is for instance the possibility that some investors postpone profitable projects and hope somebody else pay to remove a present bottleneck.

H.6 Country Specific Definitions

The definitions are mostly based on Dickson (2007).

Norway

Transmission Grid: Voltage Level (132kV) 300 - 420 kV

Regional Grid: Voltage Level 45-132kV

The regional grid is the 'connection' between the transmission and local distribution grids.

Distribution Grid: Voltage Level 11-22 kV and 0,23-0,4 kV

Distributed generation: Local production at end-users and other production connected to the distribution network (≤22kV).

Sweden

Transmission Grid: Voltage Level 220 - 420 kV

Regional Grid: Voltage Level 130, 70 and 40 kV

The regional grid transmits electricity between the national grid and major consumers such as big industries and distribution companies.

Distribution Grid: Voltage Level <1kV, 10-20 kV

Distributed generation: Small generation with a maximum generation capacity of up to 1,500 kW,

Denmark

Transmission Grid: Voltage Level 220-420 kV

H.7 Country Specific list of references

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I SLOVAKIA

I.1 Country Specific Market Design for RES-E

I.1.1 RES-E Promotion Scheme

The specific feed-in tariffs are used. Under the Decree of the Regulatory Office of Network Industries (hereinafter only “regulatory office, RONI”) dated 27 August 2007 No. 2/2007 the support mechanism used for renewable energy is represented by the fixed price charged for electricity generated from renewable energy sources. Regional energy utilities purchase such electricity from electricity producers based on the certificate on origin of electricity from renewable sources, under Regulation of the Government of the Slovak Republic No. 317/2007 Coll. issued by the regulatory office. DSOs purchase such electricity for the fixed price determined in line with the above - mentioned office, then, for the coverage of internal losses in the distribution system.

The fixed tariff is determined for individual types of generating stations using RES or CHP for the purpose of production of heat and electricity on the basis of installed capacity and the date of commissioning such plant (before or after 1 January 2005). Such fixed price is determined in such a way that the assumed payback investment would achieve 12 years. The level of support is determined so that it covers production costs of the producer with the specified payback period of investment.

The duration of support has not been so far limited and it was legalised for the first time by the regulatory office Decree No. 2/2005 with the date of effect since the year 2006.

The fixed price is determined for every year. Costs resulting from settlement of balancing energy are borne by customers.

For the year 2008, price of electricity generated from renewable energy sources is determined by RONI Decree dated 27 June 2007 No. 1/2007.

The level of feed-in tariffs for year 2008 is presented in the following table:

Table I.1: Level of feed-in tariffs for RES-E installations in Slovakia for year 2008:

Technology	category	start of operation	2008 feed-in tariff	
			SKK/kWh	c€/kWh
Wind energy	all	before 2005	2,63	7,41
		after 2005	2	5,63
		after 2008	1,7	4,79
Small hydro (< 5 MWe)	all	before 2005	2	5,63
	new locations <=1 MW	after 2005	2,42	6,82
	new locations > 1 MW	after 2005	2,82	7,94
	reconstructions	after 2005	2,52	7,10
Biomass combustion	energy crops	all	3,15	8,87
	waste biomass	before 2005	2,94	8,28
	waste biomass	after 2005	2,96	8,34
	waste biomass from bioethanol production	all	3,6	10,14
Biomass co-firing with fossil fuels	waste biomass	before 2005	2,19	6,17
	waste biomass	after 2005	2,65	7,46
Sewage and landfill gas combustion	all	all	2,63	7,41
Biogas combustion (biogas from biogas stations)	anaerobic digestion with capacity <=1 MW	all	4,31	12,14
	anaerobic digestion with capacity >1 MW	all	3,9	10,99
Geothermal electricity	all	all	3,68	10,37
Solar electricity	all	all	8,41	23,69
Exchange rate SKK/EUR		35,5		

I.1.2 Balancing Responsibility

In the Government Regulation of the Slovak Republic No. 317/2007 Coll. on the rules for the functioning of the electricity market there is an obligation imposed on the system operator to make preferential purchase of electricity from renewable energy (as well as from CHP and local coal) to cover the system losses.

The fees for balancing services and system costs are related only to transmitted work (kWh).

I.1.3 Financing

DSO and electricity generators using RES and CHP conclude mutual agreements on annual electricity supply to the distribution system (up to the size of internal losses in the distribution system). Purchase of electricity from RES and CHP to cover losses is compulsory under current legislation (Regulation of the Government of the Slovak Republic No. 317/2007). Prices of such elektricity purchase are determined by the Decree of the regulatory office. Any likely increase in costs of DSO due to the connection may be taken in account in the connection fee in line with the Technical Conditions.

I.2 Specification of Regulatory Regime in place

I.2.1 Grid Access for RES-E

According to the Energy Act 656/2004:

- The producer generating from RES has the preferential right for transmission, distribution and supply of electricity if the technical and business conditions arising out of a special law are met.
- The producer generating from RES has the right to issue the certificate on the origin of the power, which is issued by the regulatory office.
- The supplier is obliged to buyout power generated from RES and CHP units generated within a specific area in general economic interest.

Technical and business conditions are stated by the appropriate Distribution Company respecting Energy Act 656/2004, Governmental Decision 317/2007, and Decree of Ministry of Economy 337/2005. The appropriate agreement between Distribution Company and supplier has to be signed. There is stated who is responsible to build up connecting line.

I.2.2 Tendering of grid connection work

The European RES-E directive [8] mentions the options for member states to implement provisions requiring the socialisation of RES-E system integration costs and allowing RES-E producers to issue a call for tender for the connection work. These options are not put into force in Slovakia.

The right of issuing a call for tender for the grid connection work is not mentioned in respective regulations. But as work on own account has to be accounted for, this option seems to be open in principle.

I.2.3 Cost allocation for RES-E system integration

Slovakia applies the deep connection charges approach.

The cost for grid connection (according to capacity of the resource, necessity to build up a new line or reconstruction of existing one) has to be covered by applicant for connection (RES-E generator) in the form of the fee for connection.
The connection fees are calculated according to transparent rules presented in the business conditions of individual TSO or DSOs that determined them, whereas the regulatory office gives approval to them based on the background information for the proposal of price for a connection of a market participant to the system.

The conditions and process of connection to the grid and conditions for sharing of connection costs are specified in the Annex No. 6 to Decree of RONI No. 2/2007.

The price for connection of the electricity generator to the distribution system (1 kV – 110 kV) takes into account the following:

- overall costs of DSO associated with the connection of the applicant, and associated with the modifications of the distribution system and the transsmission system (in SKK);

- available capacity for the connection established by inevitable modifications of energy equipment in the DSO´s distribution system related to the connection of the applicant to the distribution system (in MW);
- maximum reserved capacity of the applicant for the connection (in MW);

The coefficient of the share of the applicant (RES-E generator) on connection costs is 0,5.

The size of fees for the connection corresponds to the size of costs required for essential technical modifications and a fee for reserve capacity. Such fees are transparent and the person interested in the connection may simply derive them from the published technical conditions of the system operator. There are no such cases known, when the applicant was discouraged from an intention due to fees or some kind of discrimination in this sense.

I.2.4 Competent Authority to Judge Design and Cost of Connection

DSO is competent authority to decide on a technically feasible point for connection. Technical and business conditions are stated by the appropriate Distribution Company respecting Energy Act 656/2004, Governmental Decision 317/2007, and Decree of Ministry of Economy 337/2005. The appropriate agreement between Distribution Company and supplier has to be signed.

Regulatory Office for Network Industries (RONI) is one of the state administration bodies established to find the balance between two poles of interests -consumers and suppliers of energy - in a way that the economy works well on both sides. Decree of the RONI of 30 June 2005 No. 2/2005 Coll., lays down the scope of price regulation in the electric energy sector and the method of its implementation, scope and structure of eligible costs, method of determination of reasonable profit and background documents for price proposal including to judge the costs for connection.

I.2.5 DSO/TSO regulation

In the area of electricity transmission at the level of very high voltage (400 kV, 220 kV) there is one transmission system operator SEPS, a. s. – the company with a 100% share by the state, which simultaneously plays the role of a system operator. With regard to the character of services provided and the fact that these services are provided in the restricted territory, being identical with the territory of the Slovak Republic, SEPS, a. s. has the monopoly in the market and for this reason it is subject to the process of regulation.

Electricity distribution at the voltage level of 110 kV, 22 kV and 0, 4 kV is provided by the following three distribution companies: ZSE, a. s., SSE, a.s. and VSE, a.s. with the amount of distributed electricity exceeding 1 500 GWh a year. Individual supply areas do not overlap and represent regional monopolies.

Due to the non-existence of a competitive environment in the given supply area the activity of electricity distribution is also subject to the process of regulation. In 2007 these companies undergo the process of legal unbundling.

Apart from the so-called regional distributors these are also local (area) distributors in the market whose volumes of distributed electricity are below 1500 GWh a year.

For the TSO, the Regulatory Office determines and approves the following:

- Tariffs for a connection and access to the transmission system, plus management of the power system (tariff for electricity transmission),
- Tariff for electricity losses during electricity transmission,
- Tariff for provision of balancing services for the users of the transmission system,
- Tariff for system operation,
- Tariff for deviation settlement for the market participants that opted for the regime of mutual responsibility for deviation.

Furthermore, the following are determined for the TSO:

- Maximum prices for purchase of individual types of ancillary services,
- Maximum permitted costs for purchase of all ancillary services,
- Maximum prices of offered positive regulatory electricity,
- Maximum prices of offered negative regulatory electricity.

For the DSO, whose electricity distribution in the previous year exceeded 1 500 GWh, the Regulatory Office determines and approves the following:

- Tariffs and maximum prices for access to the distribution system and for electricity distribution,
- Tariffs for electricity losses resulting from electricity distribution,
- Tariffs and maximum prices for electricity supply to households,
- Tariffs for a connection of the producer and the final consumer.

Tariffs and prices for electricity distribution are determined similarly to electricity transmission as a two-component price composed of the payment for reserved capacity and the distributed amount of electricity. Tariffs for transmission and distribution losses are determined as a single component tariff based on electricity flows at voltage levels.

Electricity generation is not a regulated activity, except for the values of economic indicators related to the planned costs incurred from the system operation and prices for supply of electricity generated from renewable energy sources, combined heat and power technology and local coal.

The Regulatory Office determines as the method of compensation of increased costs for provision of operation stability of the system and for the generation of electricity from domestic coal and a respective part of obligatory levies to the State Fund for Liquidation of Nuclear Installations.

The prices for access to the transmission system are determined by the cap price method of a regulated company, taking into account eligible costs and adequate profit earned from a regulated activity, derived from the value of assets used for the purpose of electricity transmission as determined by the Regulatory Office. The Regulatory Office motivates TSO towards investment activities that will raise reliability of the transmission system and reduces the costs for transmission services.

The price for access into the distribution system and for electricity distribution is determined by means of the cap revenues method, applied to a regulated company, taking into account eligible costs and adequate profit earned from a regulated activity, derived from the value of assets used for the electricity distribution as determined by the Regulatory Office. The price does not include the costs for electricity supply. The Office incentives regulated companies to investment activities

that will improve reliability of distribution systems and reduces the costs for ancillary services.

The Regulatory Office determines the method of regulation of electricity distribution prices by the operators of local distribution systems applying the same principle as in the case of the distribution system whose distribution system the local operator is connected to.

In the area of electricity production and supply the Office will further develop current support activities by setting the prices of electricity generated from renewable and cogeneration plants and by establishing more favourable economic conditions for electricity supply from local sources into the distribution system.

I.2.6 Micro Scale Connection

Permit to conduct business activities is not required from utilities operating unit with total installed output below 5MW, and utilities generating power from RES with total installed output below 5 MW.

Other provisions, including grid connection do not differ from larger installations.

I.2.7 Role of TSO/DSO regarding RES-E integration

DSOs are accepting applications for grid access from RES-E producers and have to decide approval and propose technical and business conditions to connect a new plant to the existing grid.

I.2.8 Regulatory Authority

Regulatory Office for Network Industries (RONI) is one of the state administration bodies established to find the balance between two poles of interests -consumers and suppliers of energy - in a way that the economy works well on both sides.

The Regulatory Office is the state administration authority established by the Act on Regulation. It is the state budgetary organisation based in Bratislava.

The Board for Regulation as an independent collective state body in charge of strategy and control of regulation in network industries:

- develops the proposal of the regulatory policy,
- approves the scope of price policy and a way of its implementation,
- proposes the Government of the Slovak Republic the candidates for the appointment of the function of Office chairman and the Office vice-chairman and proposes their dismissal,
- approves the annual accounting closing of the Office,
- elects and removes the chairman and vice-chairman from the Board members,
- approves the negotiating order of the Board,
- approves the proposal of the Annual Report (on the activities and economic management of the Office), on the performance of regulatory policy and the results of the fulfilment of tasks of the Regulatory Office,
- makes decisions on the appeals against decisions of the Regulatory Office in the first instance price proceedings,
- fulfils different tasks associated with regulatory activities of the Office.

State Energy Inspectorate is a state administrative body to watch the duties of both physical and legal persons acting on electricity market. It is issuing the decision and measures and has the rights to impose a fine in the case of breach of the law, decrees, etc.

I.3 Overview of disaggregated grid related charges

I.3.1 One-Time-Charges and yearly fixed charges (non-output-related charges)

- The charges for connection differ case by case. The way of calculation of charges for connection of RES-E installations into grid is specified in Annex No. 6 to Decree of RONI No. 2/2007.

- There are no other one-time or fixed non-output related charges for RES-E sources.

I.3.2 Use of System Charges (Energy/Power related charges)

The RES-E generators have to pay UoS charges.

Use-of-system fees are determined by the Decree issued by the Regulatory office for each regulatory period on a case-to-case basis. They are identical for all users of the system and include transmission fee, distribution fee, SyS system fee, fee for the costs of system operation.

Fee for transmission and distribution is related to the size of transmitted (connected capacity (kW), and also to the size of transmitted capacity (kWh).The fees for balancing services and system costs are related only to transmitted work (kWh).

I.4 Summary of barriers and incentives for connection of RES-E

One of key barrier for larger scale RES-E production is the **missing long-term stable conditions in the system of feed-in tariffs from RES**. Due to the missing guarantee of the purchase price, banks are not willing to finance project demanding from the investment point of view.

Another barrier is imposed on CHP plants that experience the problems with concluding the contract including the guarantee of the biomass price for a sufficiently long period of time when switching to the biomass-based space heating.

I.5 Country Specific Definitions

Transmission Grid: Voltage Level >= 220 kV (220 kV, 400 kV)

Grid Voltage Level 1:
Extra High Voltage (400 kV, 220 kV)

Distribution Grid: Voltage Level >= 110 kV (110 kV, 35 kV, 22 kV, 10 kV, 0,4 kV)

Grid Voltage Level 2:
Extra High Voltage (110 kV)

Grid Voltage Level 3:
High Voltage (35 kV, 22 kV, 10 kV)

Grid Voltage Level 4:
Low Voltage (0,4 kV)

I.6 Country Specific list of references

References Slovakia:
Most recent documents concerning electricity regulation can be found at the website of the Regulatory Office of Network Industries.
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J SLOVENIA

J.1 Country Specific Market Design for RES-E

J.1.1 RES-E Promotion Scheme

In support schemes Feed-in system is used in two alternatives: power purchase obligation and premium as a form of operating aid.
Feed-in with power purchase obligation will be used for CHP plants ≤ 1 MW and RES plants ≤5 MW. For the rest of power plants feed-in with premiums will be used.
CHP power plants ≥200 MW and RES≥100MW are excluded from the scheme and will be notified to the Commission on case by case basis
Duration of the supporting for the eligible power plant is ≤ 10 years.
Eligible power plants for the supporting:

- new power plants
- mostly new power plants ≤10 years old [108]

The technology specific feed-in tariff system applies to electricity producers who have obtained the status of qualified producer, except for qualified producers generating electricity in large hydroelectric plants, large power plants using municipal waste, large district heating plants and medium or large industrial heating plants.
Uniform annual prices and uniform annual premiums for an individual qualified power plant shall apply for a period of five years from the start of operation, and shall then be reduced by 5 %. Ten years after the start of operation they shall be reduced by 10 %.
For qualified power plants receiving a non-refundable state subsidy, for every 10 % of non-refundable state subsidy received, depending on the level of the investment, the uniform annual price or uniform annual subsidy shall be reduced by 5 %. The operator of a network, to whose network a qualified power plant is connected, and the qualified producer shall conclude an Agreement covering the purchase of electricity from the qualified producer for a period of ten years [106].
The actual feed-in tariffs and premiums are fixed on annual basis with the decree from the Ministry for Economy. Tariffs might be adjusted within the double tariff system, if RES-E producers choose the option to get variable tariffs depending on load categories defined within the FIT-system. Three different seasons and two daily categories are distinguished [107]. This regulation is subject to an amendment in the year 2009 in line with an amendment of the Energy law in the same year. See section J.4.

J.1.2 Balancing Responsibility

Qualified producers shall not draw up daily schedules for micro and small qualified power plants from which the purchase of electricity takes place on the basis of a decree. Qualified producers shall not pay for non-permitted deviations. It is further determined that costs incurred by the network operator because of this shall be included in priority dispatch costs [106] and borne by the customers.

J.1.3 Financing

Financing of the subsidy scheme is provided via a fixed tariff for attributed RES-E by suppliers (to be passed on to end users) and via a fixed yearly charge on nominal power usage paid by end users depending on the voltage level [108].

J.2 Specification of Regulatory Regime in place

J.2.1 Grid Access for RES-E

According to the Energy Law [108] the network operators are obliged to provide grid access in an objective, clear and non-discriminatory way and have the same basis as for connecting end users. TSO or DSO has to give priority to RES and CHP power plants.

J.2.2 Tendering of grid connection work

The right of issuing a call for tender for the grid connection work is mentioned in new Energy Law [108].

J.2.3 Cost allocation for RES-E system integration

Energy Law states [108]: for all registered RES and CHP production units “shallow” approach regarding the connection to the electricity network is used. RES and CHP power plant covers only its connection to the distribution or transmission network. Possible investments (reinforcements) into the grid, because of new connection of RES and CHP power plants finances DSO or TSO. Also costs of studies and analyses for issuing consensus for grid connection. These costs are than socialized trough grid tariff for end users.

J.2.4 Competent Authority to Judge Design and Cost of Connection

If the investor of the power plant is not satisfied with the assessment he can than prepare his own proposal and hand it over to the Ministry of Economy (or ministry competent for energy). If the ministry approves; he can execute the construction himself with equal rights and duties as a public service company.

J.2.5 DNO/TSO regulation

Method for defining grid charges for the end user is non-transactional method of post stamp. It is the common charge of the grid use not related to the length of transmission path. It is used for all users and for all voltage levels. The grid use is paid to the system operator of distribution grid; it does not include the grid connection costs, but includes costs of grid development and investments into the grid.
Regulating with the price cap is based on the assumption that there is enough of income to cover eligible costs for performing system operator activities.

The limit of allowed price rise is defined with the relationship to the authorized income and is based on the equation CPI-X:

$$(1+CPI-X)(1+Q) \geq \frac{\sum_{i=1}^{n}\sum_{j=1}^{m} p_{ij}^{t+1} q_{ij}^{N}}{\sum_{i=1}^{n}\sum_{j=1}^{m} p_{ij}^{t} q_{ij}^{O}}$$

Where for performing regulated activities of **n** tariff categories that have **m** elements means:
– Tariff item charging in year **t** for element **j** of the tariff **i**,
– Suggested tariff item for element **j** of the tariff **i** in next year **t+1**,
– Predicted or actual quantity of element **j** tariff **i**, which will be used (**N** means quantities in the year **t+1** and **O** quantities for year **t**),
CPI – yearly coefficient of changes of prices for life needs,
X – Coefficient, determined by the Agency for Energy, which fixes demanded improvement of efficiency (**U** factor), additionally **X** also assures leveling incomes in regulative period,
Q – Coefficient of reliability (continuance) of supply.
Source: [117]

J.2.6 Asset Base Determination

As a starting point of the incentive regulation scheme, capital costs are related to original investment costs including normal market profit on capital.
Determination of capital cost has been based on average historical developments of interest rates for capital and loans. Investment costs are estimated according to average production costs of different new power plants.

J.2.7 Exemption for RES

There are no exemptions for RES-E in place concerning cost pass through in the installed incentive-regulation scheme. Therefore extra costs for RES-E grid integration on the grid operators' side directly negatively impact their profit margin. Incentives are only for RES below 125 MWe nominal power and for CHP below 200 MWe.
If investor without declaration for production device, is connected to the grid, do not deliver the declaration to the system operator within 6 months from the start of the operation, than he has to payback all the costs to the system operator, that he had with the grid reinforcement while connecting this plant to the grid.
No research or innovation related incentive mechanisms are in place to compensate grid operators for extra efforts with this respect. [108]

J.2.8 Micro Scale Connection:

No specific regulation for the connection of micro scale generators (smaller than 50 kWe) in Slovenia exists. Maybe with new decrees according to the new Energy Law amendments, more specific detail will be determined. For now we have only that physical persons can sell electricity from micro scale connection and 30% of income is the basis for income tax. [108]

J.2.9 Role of TSO/DSO regarding RES-E integration

According to the past Energy Law TSO and DSO were responsible for the purchase of all the electricity from RES and CHP and to put the electricity on the market and sold it. TSO and DSO are in this Energy Law separated from any activity related to the power generation, electricity supply, including trading. No DSO [110], system operator of distribution grid is responsible for normal operation of the distribution grid and for the purchase of electricity form RES and CHP, system services and so on [109].
TSO and DSO accept applications for grid access and publish set of Rules of technical requirements regarding the equipment of generating installations connected to their network for the RES and CHP plants ≥ 10 MW, for larger are set in energy license for individual cases.
DSO shall publish Tariffs for the connection for RES and CHP plants ≤ 10MW . The tariffs will be based on different areas and the types of connection.
TSO and DSO shall prepare in 60 days the basic technical report, costs and construction time assessment for the connection and also determine which costs will be borne by investor and which by DSO or TSO for the plants ≥ 10 MW.

J.2.10 Regulatory Authority

In the field of feed-in tariffs the public body preparing legislation is the ministry responsible for energy corresponding to the Ministry for Economy.

Ministry of the Economy, Directorate for Energy [111]

The Energy Directorate of the Slovenian Ministry of the Economy is responsible for the development of systemic energy legislation and for implementing procedures in the area of energy use and supply. It performs professional tasks in the area of management and privatization of state assets in companies in the energy sector that are state owned. It also covers energy matters in the international relations of the country and directs and co-ordinates the work of official bodies in the energy sphere including i.e. the Energy Inspectorate of Slovenia and the department for activities of the Efficient Use and Renewable Energy Sources from the Ministry for Environment and Spatial Planning.
The Energy Office actively cooperates with the Energy Agency and non-governmental organizations operating in the energy field. The directorate defines, orders studies and accepts laws and decrees on feed-in tariffs.

The Energy Agency of the Republic of Slovenia [112]

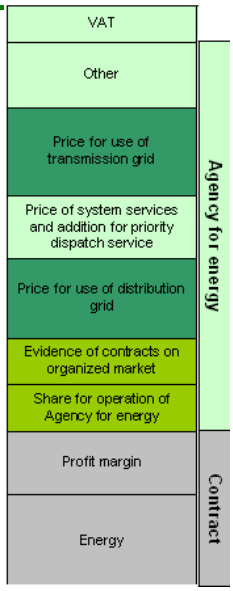
The Slovenian energy agency is the energy regulatory authority, whose responsibilities and duties are defined in the EU directives, defining common rules for electricity and gas markets, the Slovenian Energy Act and the corresponding secondary legislation. Its main tasks are related to energy networks, network price and network access apart from licensing. They work on the determination of pricing methodologies for the use of electricity and gas networks, determination of electricity network charge, approval of gas network charge, and methodologies for setting tariff systems. In its duty of market monitoring, the regulatory authority publishes annual reports on the state of the energy sector and some aspects of competition. The regulatory authority is also the dispute settlement body for disputes, arising from

network access, network connections, breach of general conditions or system network codes. It also runs the register of qualified producers and grants the status of qualified producers.

J.3 Overview of disaggregated grid related charges

Grid charges are paid according to different voltage level according to power and load hours and in correlation with accounted power and distributed energy. [118]
Example for end user in tariff class: low voltage without power measurement:

Without 20% VAT and valid from 31. January 2008	VT	MT	
€/kW	**€/kWh**	**€/kWh**	
0,15125	0,00363	0,00279	Transmission charge
0,28665	0,03132	0,02409	Distribution charge
0,1789			System services
0,04499	0,0021		priority dispatch and RES-E charge
	0,00013		charge for Agency for Energy
	0,00013		Charge for market operator Borzen
0,66179	0,03731	0,02924	Total



The charge could also include:

1. possible other charges. [119]

– for special system service

High voltage	0,00626 €/kvarh
Middle and low voltage	0,00835 €/kvarh

- charge for the use of cross border transmission capacities paid by the owner of the right 0,50 EUR/MWh.

Average connection cost for new end user of for increasing nominal power is 28,34 EUR/kW

Grid Access Charge, no incentives for Connection of RES-E plants.Charge should be based on strictly attributable expenditures for installations providing access to the grid. According to Electricity Act [108] grid operators are obliged to connect producers in a non-discriminatory way. The costs till now were not publicly available.

J.4 Summary of barriers and incentives for connection of RES-E, Conclusions

Type of the barrier	Description	Source
Support mechanisms do not give appropriate economic incentive	Only focused on the use of RES technologies, no financial incentives for technology and economic development of RES (production of turbines etc.). The contract to sell the electricity with Feed-in was signed only for 10 years (the pay-back period for photovoltaic even without depreciation is 12-15 years), The tariffs were reduced after 5 and additionally after 10 years of operation. In an amendment of the Energy law in 2009 this period is changed to 15 years, still, at the time of research, details are not agreed, and therefore the effect on economic attractiveness in unclear.	Operational program for wood biomass [113]
No satisfactory support mechanisms for small RES-E (<10 MW)	Feed-in tariffs for individual RES are not stimulating, the scope of state budget for the 2007-2013 period insignificant, it represents only around 10 % of financial incentives, that would help to boost investments in RES.	Feed-in decree [107]
Difficult access to the grid	But only from the administrative point, long procedure. The requirements for connection to the grid are not standardized and known to all involved actors: distribution utilities, designers, installers and investors. In this way the connection represents a serious barrier for potential investors of PV power plants, especially for households. At the time of research, it is unclear if the amendments to according regulation in 2009 will remove this administrative barrier.	PV technology platform [114]
Acquiring status for qualified producers in order to sell the electricity on Feed-in	To get this status of QPP, all the renewable energy sources (RES) and the cogeneration power plants with high efficiency are eligible. The process for qualification is rather complicated and time consuming. At least for RES this process is not necessary. From 2009 RES-E producers issuing guarantees of origin are eligible to enter into a contract for receiving feed-in tariffs after submission of a respective declaration and receipt of an order to obtain government support. Still, this procedure may constitute an administrative barrier.	Franko Nemac, APE [115]
No central national point for promotion and use of RES-e, no cross-sector coordination	Weak connections among governmental and local institutions and also within sectors: Ministries can hardly interfere with decisions of another ministry. This especially concerns Environmental ministry and Directorate for Energy of Ministry for Economy.	Operating program for wood biomass [113]
Political priority for the RES-E use is small	Priority is still set on fossil fuels. The RES-E use (without large hydro) as a development factor is not well defined in short and long-term development programs of rural and urban areas and strategic documents. There is also not enough middle and long term planning on local level (energy concepts). The consequence is uncritical and bad planning and in favor of fossil fuels in areas with huge RES potential.	Operating program for wood biomass [113]
Poor analysis of RES potential locations	Some studies on best locations for new RES-E exist, but no significant emphasis on their results and possible investments “push” is present.	Katarina Vertin, APE [116]
Relatively weak grids in areas with the best	If wind farms are in question, grids are relatively old and in need of new investments and updating	Katarina Vertin,

RES-E potential		APE [116]
Low share of quick start power plants for balancing wind farm production	Not enough quick starts, when planning wind farm this should always be in question also.	Katarina Vertin, APE [116]

J.5 Country Specific Definitions

Distribution Grid (Voltage Level) 400/ 230V objects creating distribution grid and needed for distribution of electricity on high middle and low voltage level. It is the grid from transmission grid to the end user.

Transmission Grid 400/220/110 kV objects creating transmission grid and needed for transmission of electricity on same or higher than 110 kV voltage level and all connection wires. Grids are built from producer to the end user or distribution grid or another neighboring transmission grid. Middle voltage level: 35kV, 20kV and 10kV also included, mainly on rural area of the transmission grid.

Micro Generation: production unit with nominal power smaller than 50 kWe

J.6 Country Specific list of references

Most recent documents concerning electricity regulation in Slovenia can be found at the website of the legislation (in Slovene language):
http://zakonodaja.gov.si/rpsi/kazala_podrocje/kazalo_8_1_0_0.html .

[106]	Governmental regulation of rules for definition of prices and for purchase of electricity from qualified producers of electricity (OJ RS, No. 15/02).
[107]	Decree on prices and premiums for purchase of electricity from qualified producers of electricity (Off.Gaz. of RS No. 29/01, 15/02, 8/04, 75/06, 65/08)
[108]	Energy law (Off. Gaz. Of RS No. 70/08) http://www.uradni-list.si/1/objava.jsp?urlid=200870&stevilka=3025
[109]	Decree on the method for the implementation of public service obligation relating to the electricity distribution system operator, and public service obligation relating to the electricity supply to tariff costumers (Off. Gaz. Of RS No. 117/04, 23/07) http://www.uradni-list.si/1/objava.jsp?urlid=2004117&stevilka=4795
[110]	www.sodo.si
[111]	http://www.mg.gov.si/en/areas_of_work/energy/#c9273
[112]	http://www.agen-rs.si/en/
[113]	Operating program for wood biomass, http://www.aure.si/index.php?MenuID=193&MenuType=E&lang=SLO&navigacija=on
[114]	PV Technology Platform, www.pv-platforma.si
[115]	Franko Nemac, APE, d.o.o.
[116]	Katarina Vertin, APE, d.o.o.
[117]	Act determining the methodology for the calculation of network charge and methodology for setting the network charge, and the criteria for determining eligible costs for electricity networks (Off. Gaz. Of RS No. 121/2005), http://www.uradni-list.si/1/objava.jsp?urlid=2005121&stevilka=5547 http://www.uradni-list.si/1/objava.jsp?urlid=2005121&stevilka=5547
[118]	Decision on setting the network charge for the use of electicity networks and the correction factors for balancing the revenues fron network charges (Off. Gaz. Of RS No 111/2007) http://www.uradni-list.si/1/objava.jsp?urlid=2007111&stevilka=5513

[119]	Ministry for Economy, grid charges. http://www.mg.gov.si/si/delovna_podrocja/energetika/aktualne_informacije/

K UK

K.1 Country Specific Market Design for RES-E

K.1.1 RES-E Promotion Scheme

The Renewables Obligation (RO) is the UK's key mechanism for encouraging new renewable generating capacity. The RO was introduced in 2002 and requires licensed electricity suppliers to source a specific and annually increasing percentage of their sales from eligible renewable sources. For 2007/08 the level of the RO is 7.9% rising to 15.4% in 2015/16. Suppliers can meet their obligation by either presenting Renewable Obligation Certificates (ROCs); paying a buyout price (GBP 34.30 per MWh in 2007/08 rising each year with inflation); or a combination of the two. Renewable Obligation Certificates (ROCs) are issued to generators for every 1MWh of eligible renewable electricity that they generate. These ROCs can then be sold to suppliers. At the end of an obligation period the money in the buyout fund is recycled to those suppliers who presented ROCs on a pro rata basis.
Minor changes to the RO introduced in April 2007 included measures to make it easier for small generators such as photovoltaic systems to access the benefits of the RO.

More significant changes to the RO are planned for 2009 and consultation on the proposed changes was conducted during 2007. The changes include providing differentiated levels of support to different technologies in order to encourage a larger contribution from emerging renewable technologies. Microgenerators (i.e. generators under 50kW) will receive two ROCs per MWh generated from April 2009.
Additionally, there are plans to raise the quota, if necessary, to prevent over-compliance and resulting price declines. This is seen as a necessary precondition to maintain a stable investment horizon.

A consultation on how the UK is to meet its contribution towards the European Union's 20% renewables by 2020 target was announced in November 2007. A full renewable energy strategy is to be published in 2009.

K.1.2 Balancing Responsibility

ELEXON is the Balancing and Settlement Code Company (BSCCo) for Great Britain. Its role is defined and created by the Balancing and Settlement Code (BSC). The BSC contains the rules and governance arrangements for electricity balancing and settlement in Great Britain and all licensed electricity companies must sign it (other parties may choose to do so) [120].

K.1.3 Financing

As suppliers are obliged to present Renewables Obligation Certificates in proportion to their overall delivered volumes of energy, the respective market price is automatically internalised into energy prices in the form of opportunity costs.

K.2 Specification of Regulatory Regime in place

K.2.1 Grid Access for RES-E

Distribution Network
A DNO has a duty to connect on request under section 16 of the Electricity Act. Standard Condition 4D of the distribution licence obliges a DNO to make a connection offer including to distributed generators, within three months of receiving a valid application. During 2006, 135 connection offers were made by the DNOs for a total capacity of 2GW.

Transmission Network
In parts of the transmission network, predominantly Scotland and northern England, the demand for transmission capacity exceeds the existing capability of the network. Parties wishing to connect in these areas may therefore be unable to connect for some time while contingent reinforcement works are carried out.

In December 2004, Ofgem approved funding of around £560 million through the Transmission Investment for Renewable Generation (TIRG) mechanism for a significant programme of transmission investment to connect renewable generation. Following the Transmission Price Control Review for 2007/12, a further £4 billion was approved for works on the GB transmission system by the three licensees during the five year period. However, this includes maintenance and replacement of existing assets, as well as the connection of new generators.

Transmission Access Review (TAR) [121]
Currently generators pay for transmission access based on the capacity of their TEC[5] holdings. Their payments are not determined by the extent to which they use their access capacity. The 2007 Energy White Paper announced a review, to be led jointly by Ofgem and the Department for Business, Enterprise and Regulatory Reform (BERR, formerly DTI), of the present technical, commercial and regulatory framework for the delivery of new transmission infrastructure and the management of the existing grid capacity to ensure that they remain fit for purpose as the proportion of renewable generation on the system grows. A number of possible models for access to the Transmission Network have been analysed:

- Model A adopts a ‘connect and manage’ approach to transmission accerss in which the right to access the system is driven by the requirements of connecting generators.
- Model B uses market-based mechanisms to deliver access to the part that values it most at any given time (and is based on the ‘Evolution’ model proposed by National Grid)

[5] Transmission Entry Capacity: The contracted maximum amount of electricity that each user is permitted to export on to the GB transmission system at any given time.

- Model C is based on a locational marginal pricing approach

The TAR project will culminate in a final recommendations document in May 2008.

Licensing of generators

Generation licences are granted pursuant to Section 6 (1) (a) of the Electricity Act, 1989. Any generator capable of providing 100MW or more to the total system in Great Britain is required to have a Generation Licence. In this context the total system means the GB transmission system and all distribution systems.

Generators capable of exporting between 50MW and 100MW to the total system that connected after 30 September 2000 may apply to the Department of Business and Regulatory Reform to seek a Licence Exemption. Power Stations that are not capable of exporting 50MW or more to the total system are automatically exempt from the requirement to hold a generation licence.

In England and Wales embedded generators of size between 50MW and 100MW, although generally exempt from being licensed, nevertheless are bound by some Grid Code requirements. However, as they have no relationship with National Grid Company, these Grid Code requirements are reflected in Distribution Code requirements in Sections DPC7.5 and also in DOC 5.6. In Scotland, in SP Transmission's area, these Grid Code requirements may apply to generators in the 5MW to 30MW range.

K.2.2 Tendering of grid connection work

Customers can seek competitive quotations for some of the works required to make a new connection to the electricity distribution system. The work involved in providing new connections can be split into two categories. The first category is Non-Contestable work. These works can only be undertaken by the host network. The second category is Contestable work. These works may be undertaken either by the DNO or by an accredited Independent Connections Provider (ICP).
Works which can only be carried out by the DNO are as follows [123]:

- Assessing how the connection will affect the network
- Planning the type of connection required and specifying the materials to be used
- Deciding the point of electricity connection to the network (known as a POC)
- Connecting to the network
- Entering into legal agreements with 3rd parties for the installation of electrical cables and overhead lines on their property
- Repairing any faults with the connection and maintaining supply of electricity
- Approving any design work that has been carried out by an Independent Connections Provider
- Inspecting, monitoring and testing any work done by an Independent Connections Provider

In 2007 Ofgem launched a Review of Competition in Gas and Electricity Connections [124].

K.2.3 Cost allocation for RES-E system integration

From 1 April 2005 a common connection boundary was introduced across generation and demand. New generators (connecting to the distribution network, i.e. 132 kV and below) pay shallower connection charges and will begin to pay use of system charges. In addition there is a requirement for DNOs to publish their charging methodologies and justify their approach to setting tariffs in accordance with the licence objectives.

K.2.4 DNO/TSO regulation

There are 14 licensed distribution network operators (DNOs) in the UK each responsible for a distribution services area. The 14 DNOs are owned by seven different groups. There are also four independent network operators who own and run smaller networks embedded in the DNO networks.

Ofgem administers a price control regime that ensures that efficient distributors can earn a fair return after capital and operating costs whilst limiting the amounts that customers can be charged. Price controls are generally set for five year periods and the current price control runs from 1 April 2005 to 31 March 2010.

Electricity transmission assets are owned and maintained by regional monopoly Transmission Owners (TOs) being NGET for England, Scottish Power Transmission Limited (SPTL) for southern Scotland, and Scottish Hydro-Electric Transmission Limited (SHETL) for northern Scotland [125].

Price controls
Every five years Ofgem approves a specific revenue for each company, thereby incentivising monopolists to improve efficiency. Companies submit detailed business plans for the next five years including projections of operating and capital expenditures. Capital expenditure plans detail load and non-load related investments and make specific reference to proposed major projects. Ofgem reviews these plans and make initial proposals for price revisions according to the RPI-X formula proposed by Littlechild in 1983 and in use in telecoms, gas, airports, water as well as in electricity.

The regulatory review consists of efficiency studies of operating costs. These are of two types: bottom up - consultant estimates of cost categories; and top down – using efficiency methodologies such as corrected ordinary least squares. Capital expenditure plans are assessed using engineering consultancy audits of capital expenditure plans. Companies can then respond to the proposals which are then revised (once or twice) until a final proposals document is published. This final proposals document can be appealed to the Competition Commission by one or more of the companies that it covers. The process of a price review takes around 18 months and is completed four to five months before the new prices are due to take effect.

K.2.5 Asset Base Determination

The National Grid Company is currently conducting a pre-consultation on the options available to modify the charging arrangements for assets local to generation connections. Several approaches to achieving a more specific treatment of assets local to generators are presented within the pre-consultation document. These are:

- **Specific treatment of generation assets** Local assets are identified, removed from the transport model and charged separately using specific expansion and security factors.
- **Specific treatment of distance to zonal hub** The marginal investment cost associated with a generator is separated into a cost from the generator to a zonal hub and a cost from the zonal hub to the market hub (reference node). Specific expansion and security factors are then applied to the calculation of the cost from the generator to the zonal hub.
- **Deepening of the use of system/connection asset charging boundary** The charging boundary is redefined so local generation assets are charged as connection assets. The full cost of installed substation and circuit assets are charged to the user with a methodology used to apportion shared assets [126]

K.2.6 Exemption for RES

In England, Wales and Scotland, generating stations that export under 50 MW of electrical power to the public system are automatically *exempt* from the requirement to hold an electricity licence to operate.

Generators from 50-100MW (known as Medium Power Stations in England and Wales) can seek an exemption from a generation licence, which would be granted by the BERR. This exemption means that the generator avoids: the requirements to join the Balancing and Settlement Code, signing up to the CUSC, or complying with the Grid Code, if the generator is embedded [127].

In March 2007, an order was introduced amending Schedule 3 to the Electricity (Class Exemptions from the Requirement for a License) Order 2001 to add a new class exemption from the requirement of section 4(1)(bb) of the Electricity Act 1989 (which prohibits the distribution of electricity without a license). The new class exemption applies to those who are engaged in the activity of offshore distribution [128].

K.2.7 Micro Scale Connection

Improved and simplified regulatory arrangements for microgeneration[6] have been introduced in the UK [129]. Many aspects of the regulatory framework for the electricity industry include de minimis exemptions, which mean that microgeneration - especially at household level - is (appropriately) subject to far less regulation. Examples of this include:

- All microgeneration equipment is exempt from the obligation to hold a generation licence. This removes the obligation to be a full participant in a number of industry codes, and frees microgenerators from any obligations to the national system operator.
- Microgeneration is generally exempt from use of system charges for the distribution and transmission systems.
- Microgeneration is exempt from the need to have more expensive half-hourly metering in order to sell electricity in to the network.
- Domestic scale microgeneration (below 16 Amps per phase) does not need to seek prior consent form distribution companies to connect to the network.
- Under the Renewables Obligation, small generators have a number of benefits including that make it easier to qualify for support under the RO such as the ability to aggregate outputs over longer periods. The changes brought about by the Climate Change and Sustainable Energy Act 2006 will allow further benefits, including aggregation of outputs across a number of sites and the use of agents.
- The Climate Change and Sustainable Energy Act 2006 will also allow for microgeneration exports to be considered as carbon savings in the administration of the Energy Efficiency Commitment.

K.2.8 Role of TSO/DSO regarding RES-E integration

Distribution Network Operators (DNOs), are obliged under Condition 9 of their licences to maintain a Distribution Code detailing the technical parameters and considerations relating to connexion to, and use of, their systems.
All DNOs currently operate the same version of the code, and the code is maintained by the Distribution Code Review Panel. All modifications to the Code have to be approved by Ofgem [130].

K.2.9 Regulatory Authority

The regulatory authority in the UK is the Office of Electricity and Gas Markets, Ofgem. http://www.ofgem.gov.uk

[6] defined as the small-scale production of heat and/or electricity from a low carbon source below 50kW and includes the following technologies: solar PV, solar thermal, micro-wind, micro-hydro, heat pumps, biomass, micro combined heat and power (micro CHP) and small-scale fuel cells

K.3 Overview of disaggregated grid related charges

Generators and suppliers directly connected to the electricity transmission grid pay charges for use of the network refered to as Transmission Network use of System Charges (TNUoS). As signatories to the Balancing and Settlement Code (BSC), generators incur other charges including Balancing Services use of System charges (BSUoS) and BSCCo costs.

Smaller generators which are not connected to the transmission network but to a distribution network and are not signatories to the BSC, are not subject to these charges. These benefits from being embedded in the distribution network are known as 'embedded benefits'.

K.3.1 One-Time-Charges and yearly fixed charges (non-output-related charges)

Distribution network
Distribution network operators are required to publish their charging methodologies and charges. A summary of charges made by all the DNOs can be found on the website of the Energy Networks Association http://2008.energynetworks.org/use-of-system-charges/
As an example, North West Electricity (formally United Utilities), DNO for the North West of England charges which came into effect on 1 January 2008 are set out below [131]:

- *Asset annuity charge* – An annuity charge based on 80 percent of the total cost of the reinforcement works required to connect the distributed generation plant, over a 15 year life, with a rate of return of 6.9 percent.
- *Capacity Charge* – A standard EUR 2.16 (£1.50) per kW per annum of generation capacity installed.

Transmission Network
Connection at transmission level is by way of a shallow policy operated by National Grid Electricity Transmission (NGET). The TSO provides all of the reinforcement and extension works, some of the interconnecting connection assets and extension works and all the generator has to do is 'plug in' [132].
Embedded generators pay application fees for Connection and Use of System Agreements of between zero and £17 000.

K.3.2 Use of System Charges (Energy/Power related charges)

Distribution network
A standard EUR 1.44 (£1.5) per kW per annum of installed generation capacity of the distributed generation plant installed to recover the allowable operation, repair and maintenance on the sole use and reinforcement assets of the connection.

These rules are applied to reinforcement costs up to a cap of £200 per kW of installed Generation Capacity. All reinforcement costs in excess of this cap will be charged in full to the connecting generator along side other connection charges [131].

Transmission Network Use of System charges
Transmission Network Use of System charges are designed to reflect the cost of installing, operating and maintaining the transmission system for the Transmission Owner (TO). The basis of charging to recover the allowed revenue is the Investment Cost Related Pricing (ICRP) methodology, which was approved for use for GB in March 2005. Charges are based on the customer's location and on their import and export requirements as calculated by a DC Load flow (DCLF) ICRP transport model. The GB charging methodology was implemented in April 2005.

The TNUoS charge is split in the ratio 27:73 respectively between users that export onto the system (Generators) and users that import from it (demand customers), and is calculated annually [133].

There are currently 21 generation TNUoS tariff zones. The charges for these zones display a north to south differential and vary from positive tariffs in the north to negative tariffs in some southern zones. This locational message reflects whether the generation contributes to or alleviates the need for additional transmission reinforcement/investment. The basis of the generation charge is the highest Transmission Entry Capacity (TEC) applicable over the year for positive tariff zones, or the average of the three highest metered volumes over the winter period for negative tariff zones.

TNUoS range from 22.26 £/kW in North Scotland to -8.54 £/kW [134].

The Transmission Entry Capacity (TEC) of a power station is defined as the access capacity that the generator requires to export power onto the main transmission system.

In accordance with licence Condition C13, small generators connected to the 132kV transmission system in Scotland are eligible for a reduction in the listed Generation TNUoS tariffs. This discount equates to 25% of the combined generation and demand residual components of the TNUoS tariffs. For 2008/9, this figure has been calculated as £4.88 /kW.

Balancing Services Use of System (BSUoS) charges
BSUoS charges are paid by suppliers and generators based on their energy taken from or supplied to the National Grid in each half-hour Settlement Period. These charges are paid to NGET to cover the costs of keeping the system in electrical balance and maintaining the quality and security of supply.

K.4 Summary of barriers and incentives for connection of RES-E

Whilst some of the barriers to the connection to microgeneration have been removed in recent years there are a number of key challenges for connecting more renewable generation in the UK:

- The need to invest in new infrastructure in particular to connect increasing amounts of renewable generation in locations where there is no, or limited, transmission infrastructure. Gaining relevant planning consents often delays this investment;

- Delayed connection dates offered to renewable generators as a result of the number of projects under development, the need for new infrastructure and the uncertainty about which projects will actually go ahead;

- Uncertainty about when existing generators may disconnect, thereby freeing up capacity for new generators;

- The need to adapt technical standards to take account of the particular characteristics of new generation technologies and continue to maintain the integrity of the transmission system;

Transmission charging remains a key barrier -The TEC concept is designed to reflect the requirements of conventional generation; it is not aligned to the costs imposed by non-conventional generation technologies or the requirements of other network users such as DG and demand.

Ofgem is beginning the consultation process for Distribution Price Control Review 5 which will review both the distributed generation incentive and registered power zones. **The Distributed Generation Incentive** was introduced to encourage DNOs to undertake the investment required to connect DG in an efficient and economic manner and to generally be more proactive in responding to connection requests. There is a perception that the DG incentive has not worked as well as expected with the volume of DG connecting to date being significantly less than was forecast to connect at the time of setting the incentives.

Registered Power Zones (RPZ) are intended to encourage DNOs to develop and demonstrate new, more cost effective ways of connecting and operating generation that will deliver specific benefits to new distributed generators and broader benefits to consumers generally. If a DNO employs genuine innovation in the way that it connects generation it can seek to register the connection scheme as an RPZ. For registered RPZs, the incentive element of the DG Incentive is increased for the first five years of operation by EUR 4.3 (£3) per kW. Early evidence suggests that the RPZ incentive has been less successful than hoped. It generally requires the generator to take relatively higher risk than it otherwise would due to the innovative nature of the technical solution needed for the DNO to qualify for the incentive under RPZ. To date only four schemes have been registered as eligible schemes [136].

Regulatory barriers

It can be difficult for distributed generators to participate effectively in the electricity market, largely due to its relative complexity and the high fixed costs involved. In order to ensure system security, all licensed generators and suppliers must be registered with the system operator, National Grid (NGET), and comply with onerous requirements set out in industry codes for the submission of information. Equally, market arrangements are similar for the large energy supply companies as for a local authority wanting to operate a low carbon energy scheme, at a fraction of the size.

The issue of a disproportionate regulatory burden on distributed generators was cited as a key barrier to DG by respondents to the Call for Evidence. In addition to the problems mentioned above, the difficulties of getting planning permission for DG technologies were raised, especially in the context of community developments and new housing, where the associated costs and delays acted as a disincentive.

Export reward. Currently the rewards for exporting the excess electricity produced by distributed generators to the wider network are small or in some cases non-existent. The problem is more extreme the smaller the distributed generator. As discussed in chapters 4 and 5, current electricity market and metering arrangements mean that the value to suppliers of very small amounts of electricity is low. Government and Ofgem have taken steps to address this issue.

A recent joint consultation by BERR and Ofegm found that by far the most commonly cited barrier to DG was a lack of reliable information on the options available. Whilst there are some excellent examples of advice provision, there is a lack of co-ordination and clarity. In some areas, information tailored to the needs of potential distributed generators simply does not exist. However, there is no one organisation which comprehensively covers microgeneration, CHP and other DG solutions. There would be clear benefit to the provision of information through a trusted provider with a remit which covers all aspects of DG (including microgeneration) and energy efficiency measures.

Energy Bill 2007 - 2008

The Energy Bill was introduced in the House of Commons on 10 January 2008, finished in House of Commons committee on 11 March and had report and third reading in the Commons on 30 April. It had its first reading in the House of Lords on 1 May. The Energy Bill will implement the legislative aspects of the 2007 Energy White Paper: meeting the energy challenge.

The Energy Bill will update the legislative framework by putting in place new legislation to reflect the availability of new technologies (such as Carbon Capture and Storage and emerging renewable technologies) and correspond to the country's changing requirements for security of supply infrastructure. The Energy Bill, alongside the Planning and Climate Change Bills, is designed to ensure legislation underpins the long term delivery of our energy and climate change strategy. The content of the Bill includes:

- Carbon Capture and Storage: creating a regulatory framework to enable private sector investment in CCS projects. CCS has the potential to reduce the carbon emissions from fossil fuel power stations by up to 90%.
- Renewables: Strengthening the Renewables Obligation to drive greater and more rapid deployment of renewables in the UK. This will increase the diversity of the UK's electricity mix, thereby improving the reliability of our energy supplies and help lower the carbon emissions from the electricity sector.

Clause 4 of the energy bill aims to put in place the enabling legislation for a set of tariffs to cover all three of the sectors listed below:

1. On-site renewable electricity generators i.e. householders and commercial entities which could produce power primarily for their own use e.g. warehouses, hospitals, supermarkets, factories etc. Please note this is *not* just microgeneration (which is equipment under 50kW capacity).
2. Producers of renewable heat including biomass/biogas CHP, biomass boilers, ground, air and water source heat pumps and solar thermal.
3. Producers of renewable gas, (i.e. those who purify biogas and feed it into the gas mains. This is sometimes referred to as bio-methane.)

As well as the New Clause 4 the following were also debated on 30 April 2008, All of these failed:

- Clause 11 – electricity from hydro-microgeneration – to increase the microgeneration definition from 50kW to 100kW for this technology
- Clause 17 – promotion of renewable energy – to increase money available for spending on renewables from the fossil fuel levy fund from £60 million already allocated to £250 million
- Clause 20 – access for renewable energy to the electricity and gas grids – to introduce priority access for renewables
- Clause 21 – adjustment of transmission charges – to allow caps to be put on zonal transmission charging

K.5 Country Specific Definitions *[137]*

- **The Transmission System:** The major Power Stations are connected to the Transmission System (The Grid) which operates as a fully interconnected system within Scotland, England and Wales. The Grid operates at 275kV and 400kV. The 132kV network in Scotland is also classed as part of the Transmission System but this is not the case in England and Wales. The Transmission System provides a secure supply of electricity to Grid Supply Points, ie the Grid Exit Points, which are also the Entry Points to the Distribution System, and also to the Exit Points for Customers with large or special Demands.

- **The Distribution System** operates at nominal voltages of 66kV, 33kV and 22kV EHV), 11kV and 6.6kV (HV) and 400 volts and 230 volts (LV). The 132kV network in England and Wales is also classed as part of the Distribution System but this is not the case in Scotland. The Distribution System provides a supply to the Exit Points to all remaining Customers for industrial, commercial and domestic purposes. The voltage of the connection depends on Demand, the purpose for which the supply is used and the local technical requirements of the Distribution System.

- **The Distribution Code** covers all material technical aspects relating to connections to and the operation and use of the Distribution Systems of the DNOs. is prepared by the DNOs and is specifically designed to:
    - Permit the development, maintenance and operation of an efficient coordinated and economic system for the distribution of electricity.
    - Facilitate competition in the generation and supply of electricity.

  The Code is not however exhaustive as to the requirements to be complied with by those connected to the Distribution System who must also comply with the requirements of the Electricity Act 1989, the Electricity Safety, Quality and Continuity Regulations and all other relevant legislation which from time to time comes into force.

K.6 Country Specific list of references

Most recent documents concerning electricity regulation can be found on the website of the UK regulatory authority for electricity, Ofgem, the Office of Gas and Electricity Markets. http://www.ofgem.gov.uk/

[120]	Ofgem and Microgeneration: next steps, 2006 http://www.ofgem.gov.uk
[121]	TAR_Access_Discussion_Document April 2008 http://www.ofgem.gov.uk/Pages/MoreInformation.aspx?docid=74&refer=Networks/Trans/ElecTransPolicy/tar
[122]	Transmission Entry Capacity: The contracted maximum amount of electricity that each user is permitted to export on to the GB transmission system at any given time.
[123]	http://www.edfenergy.com/core/smallservices/downloads/edfenergynetworks-connections-your-choice.pdf
[124]	Review of Competition in Gas and Electricity Connections Proposals Document http://www.ofgem.gov.uk/Networks/Connectns/CompinConn/Documents1/16982-2607.pdf
[125]	Electricity Network Investment and Regulation for a Low Carbon Future, Michael Pollitt and Janusz Bialek, 2007 http://www.electricitypolicy.org.uk/pubs/wp/eprg0721.pdf
[126]	Pre-Consultation Document Gbecm-11, Charging Arrangements for Generator Local Assets, February 2008 http://www.nationalgrid.com/NR/rdonlyres/E3F5A7DA-5010-4C11-8044-9D0328EDC152/23838/PreconsultationonLocalChargesGBECM11.pdf
[127]	BWEA Grid Code Project Monthly Report September 2004 www.bwea.com/pdf/GridCode/0409Grid%20Code%20Monthly%20Report.pdf
[128]	BERR http://www.berr.gov.uk/energy/markets/electricity-markets/licence-exemp/page34529.html accessed May 2008
[129]	Ofgem Decision Document 2006 (Ofgem Ref. 184/06)
[130]	http://www.dcode.org.uk/
[131]	Electricity North West Limited, Proposal to update the Distributed Generation charging methodology, January 2008.
[132]	European practices with grid connection, reinforcement, constraint and charging of renewable energy projects, Report for Highlands and Islands Enterprise by Xero Energy, August 2007
[133]	Energy Networks Association http://2008.energynetworks.org/use-of-system-charges/
[134]	Review Of Distributed Generation, A Joint Government/Ofgem Report, May 2007
[135]	National Grid Statement of Use of System Charges Effective From 1 April 2008 http://www.nationalgrid.com/NR/rdonlyres/FCC7C918-F49D-4542-BD33-35F7C62CBDF6/24474/UoSCI4R0FINAL.pdf
[136]	Electricity Distribution Price Control Review Initial consultation document, March 2008
[137]	The Distribution Code and the Guide to the Distribution Code of Licensed Distribution Network Operators of Great Britain Issue 08: October 2006