ENERGY REGULATORS REGIONAL ASSOCIATION
Tariff and Pricing Committee
Issue Paper:

Renewable Support Schemes for Electricity Produced from Renewable Energy Sources. Review of the ERRA Member Countries and 2 Country Case Studies: Czech Republic and Sweden

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May 2012
Prepared by:

REKK Regional Centre for Energy Policy Research

Regional Centre for Energy Policy Research (REKK)
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Energy Regulators Regional Association (ERRA)

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SUPPORT SCHEMES FOR ELECTRICITY PRODUCED FROM RENEWABLE ENERGY SOURCES

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Executive summary

The present ERRA issue paper has multiple objectives:

- It gives an overview of the recent 'hot issues' in the EU and in the ERRA countries concerning renewable electricity (RES-E) regulation.
- Based on the quantitative analysis of the in-depth questionnaires of the ERRA countries it highlights the most relevant issues for regulators regarding RES-E promotion and tries to determine those regulatory factors that has detectable impact on RES-E deployment.
- It creates a common database on the RES-E regulation of ERRA countries.
- Provides two detailed country case studies - one employing green certificate system, the other feed-in tariffs (FIT) – to identify critical regulatory issues.

Overview of RES-E promotion systems

The most debated current issue - from regulatory point of view – is the oversubsidisation problem in the rapidly developing PV segment and the possible solutions to limit its impact on consumer prices. Oversubsidisation of PV technology – in the meaning to provide higher level of subsidies than economic rationality would suggest – has several negative effects on any RES-E promotion system:

- It reduces the efficiency of the promotion systems, through spending money on a costly technology.
- It could crowd-out cheaper and more resource–efficient technologies, if a budgetary limit exist on the overall RES-E promotion.
- In case, when there is no such an explicit budgetary limit, it increases end user electricity prices that can reach socially and politically unacceptable high levels (e.g. it already exceeds 10% of the overall consumer price in some EU countries).

The analysis of the questionnaire

The paper analyzes the RES-E promotion system of 24 out of the 29 ERRA countries (82% response rate). The survey takes stock of the national RES-E promotion systems in various fields: certification, licensing and grid access, target setting and achieved penetration level, production support methods and the support levels of the various RES-E technologies. The information provided by the regulatory authorities in the answers to the questionnaires were checked and supplemented by data from various databases on electricity consumption, production and prices. Throughout the analysis we have focused on the following four main hypotheses:

- Higher support for RES-E production leads to higher RES-E penetration.
- Good regulatory practices, including transparent, consistent and flexible regulation and simplified network access are preconditions for a higher RES-E penetration.

- Dedicated RES-E policy, e.g. through ambitious and measurable RES-E targets helps to speed up RES-E developments.
- Apart from the features of the renewable support scheme, the general economic and investment environment plays a key role in RES-E development. In this context EU membership is a key factor.

We haven't been able to confirm the expected positive relationship between RES-E growth rate and the implied feed-in tariff/premium level in our sample of ERRA countries.[1] This applies for all analyzed technologies - wind, solid biomass, biogas, small hydro and PV - and also stands if the length of the eligibility period is considered in the calculation. According to the observed patterns one could find countries with high penetration ratios in certain technologies with low level of subsidization (e.g. Turkey, Bulgaria, Estonia and Lithuania wind, and Hungary and Estonia in solid biomass) but the opposite as well: high level of support coupled with low penetration levels (e.g. Latvia). The general investment environment is included in the analysis by using the Standard & Poor's sovereign debt rating index, electricity consumption levels and electricity producer' prices as alternative proxies. Amongst these investment environment variables electricity producer prices performed best in the regression analysis in explaining capacity penetration levels (being the most significant).

Considering the regulatory practices, we have created three indices: 'transparency', 'consistency' and 'easy entry/regulatory flexibility'. The first measures the transparency of regulation, 'consistency' captures the predictability and coherence of the regulatory practice, while the last one tries to measure the ability of the regulator to adjust the promotion system to market developments. Additionally, we have created an overall index including all the above mentioned three dimensions.

'Transparency' has strong positive and very significant correlation with RES-E penetration. The connection between RES-E capacity growth and our 'consistency' and 'easy entry' indices is weaker. The most plausible explanation is that countries that changed their regulation in an unplanned manner (Bulgaria, Hungary and Slovakia) wipe out the expected relationship. The main regulatory message of these results is that countries aiming to increase their RES-E shares should design their regulatory environment carefully from the onset as the success of the promotion system is not a straightforward derivative of high feed-in tariff or premium levels. Good regulation – mainly transparency but to some extent consistency and easy entry - and the general investment environment of the host country are important pre-conditions of RES-E capacity growth.

The joint effects of these factors were also tested in a regression analysis that confirmed the previously described results: the 'transparency' index and general investment proxy (i.e. the electricity producer price) were significant and positive, while the nominal subsidy levels were

[1] Implied FIT means that Feed in Premiums and Green Certificates were recalculated to an implied FIT level by adding premiums and GC premiums to the average wholesale prices.

negative and not significant. It has to be noted - however - that the number of observations was quite low (14) to arrive to a model with full explanatory power.

An additional plausible explanation for this performance of the nominal FIT/premium level is that countries with less developed regulatory and investment environment try to compensate the regulatory/country risk by increasing the offered production support levels for investors. As in many countries this strategy/policy was introduced quite recently (with 2-3 years history: e.g. Serbia, Ukraine, Jordan), it might need more time to deliver the expected tangible results. If this is the case, it could partly explain the negative sign of the variable in the model.

Target setting is an important element of a successful RES-E promotion system. Country comparisons show that pre-set, binding targets make RES-E policy more credible and progress toward these targets measurable. Additionally, if regulators are involved in this process, they become accountable for the progress achieved. On the other hand, regulatory practices of many ERRA members states indicate that the role of regulators are usually more limited than in most of the EU countries in designing and implementing the RES-E promotion system (e.g. limited to distributing the costs to final consumers). Recent activity of regulators in ERRA member countries is also limited in the field of giving incentives for distribution companies accepting RES-E connection to the network.

The answers to the questionnaires indicate that 2011-2012 will bring quite significant changes in the ERRA region, the licensed and applied RES-E capacities will reach around 20% of the total RES-E capacities. This growth is likely to be concentrated in five countries: Romania, Latvia, Albania, Mongolia and Bulgaria. These developments require continuous monitoring where ERRA could also play an active role.

County case studies

The issue paper presents two case studies, one on the Czech RES-E promotion system and its transformation in the last four years, and another one on the design of the green certificate (GC) system of Sweden. The main message of the Czech case study is that careful regulatory design is needed in PV promotion in order to provide flexibility enabling regulators to follow market developments – in this case the sharp production cost reductions of PV technology. An additional lesson learnt is that a rapid and coordinated action of the regulator and the government is a must to avoid delays in correcting regulatory miss-incentives coded in the legislation. Present levels of FIT/Premium indicate that certain ERRA countries are already at the level of PV support that resulted in a high, unplanned capacity growth in the EU countries. The experience of the Czech Republic but also other leading PV supporting countries (Spain, Italy, Germany and recently the UK) raises the possibility that low income countries of the ERRA region should consider a 'wait and see' strategy in promoting the PV technology due to the sharp declining CAPEX costs of the technology. Nevertheless the "waiting time" should not be too long. It should not exclude the preliminary preparations for the technical aspects of network connection necessary for the expansion of PV technologies and the creation of the necessary incentives, as this process could take significant time and resources.

The Swedish experience suggests that a green certificate system as well is a viable tool to promote RES-E. It also points to the fact that in case of very ambitious targets forcing the entry of more expensive technologies into the system, GC systems increase the rents paid to low-cost RES-E producers. On the other hand, undifferentiated green certificates (by technology and by eligibility period) help to achieve targets by the cheapest technologies, thus increasing the efficiency of the support scheme. Differentiation should be left to those countries that perceive some strategic economic advantage in promoting certain segments of the RES-E technology matrix.

Possible future actions

Concerning the possible future activities in the field, a transparent cost benchmarking (web) page for RES-E CAPEX cost development would serve a valuable instrument in the field of RES-E monitoring. It could serve as an essential information source for benchmarking support levels for the ERRA region as many countries are in the early phase of designing and implementing their RES-E support scheme. A second area of activity could be to estimate the RES-E potentials for the members of the region based on a common methodology. If implemented, this could serve many purposes: e.g. help policy makers to set RES-E technology specific targets and could also serve to benchmark RES-E targets and achievements similar to the IEA, EU methodology.

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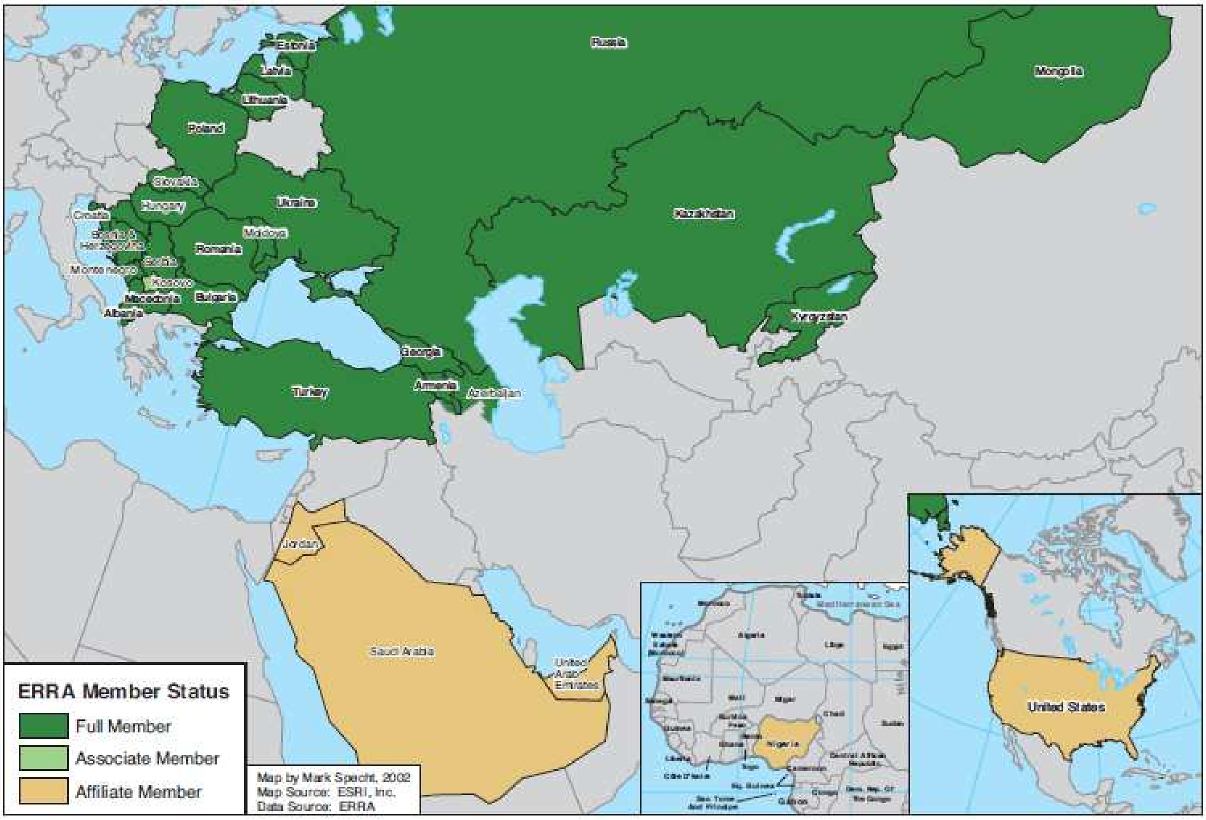
1. Introduction

The present Issue Paper, commissioned by NARUC and the Tariff and Pricing Committee of ERRA, aims to highlight and analyse the most important issues of renewable electricity promotion practices in ERRA countries. The analysis, including the conclusions and recommendations is prepared for the energy regulators in the region, with the aim to enhance information flow between ERRA countries on the best practices of renewable electricity production regulation.

The Regional Centre for Energy Policy Research (REKK) together with the ERRA secretariat have carried out a questionnaire survey of the ERRA member states with the objectives to measure present RES-E developments in these countries and to analyze the various regulatory practices of the countries. The questionnaires have been sent to the national energy regulatory authorities of all ERRA member states, associate and affiliate countries (excluding the US) (Figure 1). The analysis of the survey is supplemented by two country case studies on the RES-E promotion practices: on the Czech Republic and on Sweden. The case studies were selected on the basis of their support system (feed-in tariffs versus green certificates) and their relative development level.

The Issue Paper is structured as follows. It has a general introductory part, dealing with the issues covered in the paper concerning RES-E promotion practices in the EU and ERRA regions. It is followed by the quantitative analysis of the questioners and the two case studies of the Czech Republic and Sweden. The paper is closed by the conclusion and policy recommendation part.

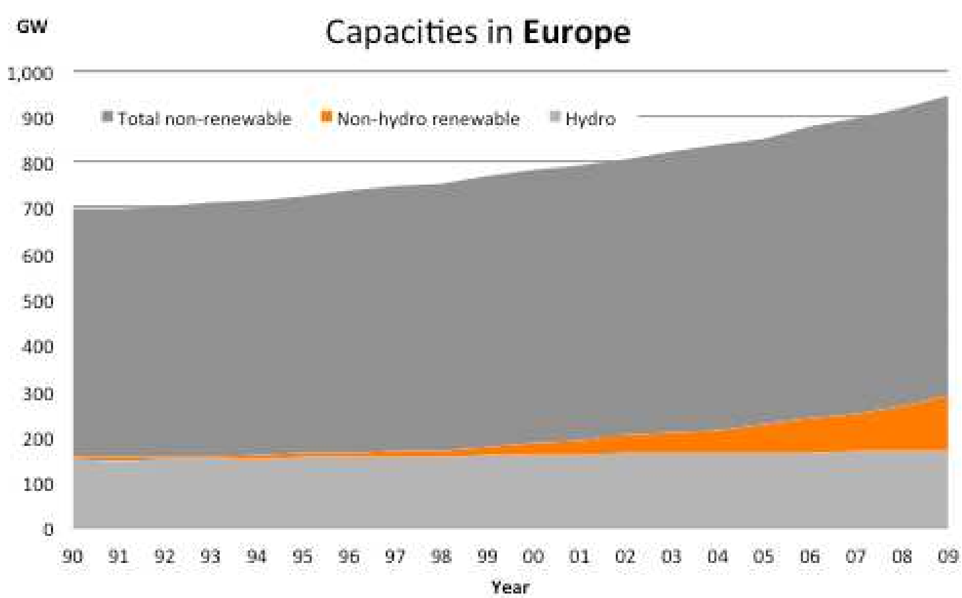
Figure 1: Map of the ERRA member states

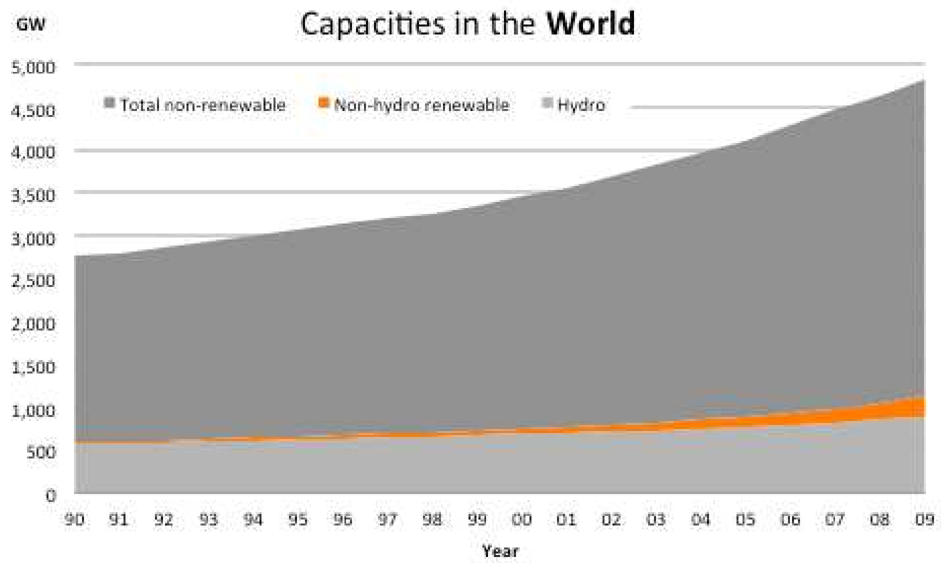


2. Drivers of RES-E developments and recent policy issues

Renewable based electricity generation is becoming a significant factor in electric power systems. Even though electric capacity is still dominated by non-renewable sources, RES-E accounted for approximately half of the estimated 194 GW of new capacity added globally in 2010 and now constitutes a quarter of total global capacity which is estimated at 4950 GW as of 2010 (see Figure 2:) (REN21, 2011).

Figure 2: The development of total, renewable and non-hydro renewable capacities in Europe and in the world (1990





Renewable technologies are in general still more expensive than nuclear or fossil-based production. This is mainly explained by the fact that these technologies have a much shorter development history than traditional electricity generation forms. Within the renewable pool, photovoltaic technology is the most expensive production option, however, over the last 20 years it has shown impressive price reductions. With each doubling of the cumulative volume of PV sold at the market, the price of PV modules decreased by 20% due to a significant learning factor present in this technology (EPIA, 2011). The average price of a PV module in Europe in mid-2011 was around 1.2 € /W which is approx. 70% lower than it was 10 years ago (Figure 3 :). We can expect that with the continuous cost reduction renewable technologies will at a certain point of time require no financial support, or put it differently, they will reach "grid parity".

Figure 3 : Evolution of the average PV module price in Europe

Source: EPIA, 2011

The underlying broad policy goals behind efforts to increase the share of renewable energy in the overall energy consumption/production are: increase security of supply, sustainability and competitiveness. Renewable energy sources are inherently local/national. Hence, in countries that are net energy importers, increasing RES production substitutes increasing volume of electricity and/or fossil fuel import, reducing import dependence that often bears political and price risks. As far as the sustainability goal is concerned, renewable technologies have negligible environmental effects, which are mainly connected to upstream production processes (system parts, concrete, roads, etc.). Most importantly, during their operation they do not emit carbon-dioxide, which is the main greenhouse gas and as such, it is subject to international and European mitigation policies.[2] The renewable industry is often seen as a leading innovative industrial sector that contributes to the competitiveness of the countries leading the technology development process.

RES-E policies are mainly driven by three concerns: policy targets, the efficient use of public subsidies and the impact of renewable support policies on energy prices which ultimately are a derivative of the former two.

In the European Union the Climate and Energy Package has set binding national *targets* for renewable energy – as a means to reduce greenhouse gas emissions - which collectively will lift the average renewable share across the EU to 20% of gross final energy consumption by 2020 (from the 9.2% level in 2006).[3] National targets range from a renewables share of 10% in Malta to 49% in Sweden. According to the requirement of the Directive, Member states have submitted their National Renewable Action Plans indicating the share of renewable electricity (and heat) in reaching their overall 2020 RES energy target. Most ERRA countries outside the European Union have similar renewable energy and/or RES-E target (discussed later in section 3.

In the current cost relation of the various electricity generation technologies, i.e. renewables receiving production support, the increasing share of RES-E production driven by the national policy targets costs an increasing amount of money. The financing source of price support schemes is hardly ever the state budget, rather it is the energy consumer receiving an extra charge included in his/her tariff bill. The financing mode varies across states. Many countries (e.g. Italy, Ireland, France and Spain) finance RES-E support schemes via specific non-tax levies paid by all consumers (CEER, 2011). Another common method is to apply a surcharge that is explicitly stated in the electricity bills (e.g. the Netherlands, the Czech Republic, Germany and Austria). A third way that is characteristic to countries with green certificate systems (e.g. UK, Poland) is to recover the costs of the support system in the form of higher electricity prices. The cost of buying the needed certificates or paying the substitute fee for the difference of acquired and required number of certificates raises the electricity price without explicitly appearing in bills. Estonia includes the RES-E support cost in the network tariffs, while Finland simply covers them from general taxes, which means that the individual financial burden is not based on electricity consumption.

The double aim of governments is to limit the absolute volume of support and hence the electricity price increase due to RES-E support and to maximise the RES-E production for each Euro provided for RES-E producers. E.g. the volume of production support in Germany for example increased tenfold in the last 10 years. The efficiency of the support scheme fundamentally means that it should encourage research and development and subsequent decrease in RES technology costs. Once production cost falls, it leads to increased

[2] The upstream production of part and equipments usually involves CO_2 emissions.
[3] 2009/28/EC

profitability and that in turn attracts even more investors in the field. The government, in cooperation with the regulator, has to intervene and try to share the benefits of technology improvement with final customers by a periodic reduction of support level. However, the system of support adjustments should be such that it maintains the incentive for research and development.

2.1. Supporting RES-E

Renewable sources have smaller environmental impact and external costs (e.g. various air pollutions) than traditional electricity generation. Without the internalization of these costs, fossil-based generators are more competitive and hence crowd out renewables in the generation mix.[4] Assuming that the environment is a valuable asset, we have to rectify the failure of the market to consider all costs (including the external cost) associated with the various energy producing technologies. In real life, the problem is that the external costs of traditional technologies are not factored into the production decisions: dirty technologies are cheaper. To establish a true competitive market, the government has to intervene. The "first-best regulation" is to internalize external costs; the "second-best regulation" is to provide support for clean technologies.

The internalization of external costs can be done either by market based (taxes or pollution markets) or by non-market based instruments (e.g. pollution standards). If the government introduces a pollution tax that equals the external cost of each energy producing plants (lower or zero for renewables and higher for traditional technologies) then the merit order of producers will change: renewables improve their relative position and – depending on the original generation portfolio – can push out the most expensive fossil based generators.

However, environmental regulators tend to charge polluters only for a fraction of the damages they cause (i.e. sub-optimal pollution taxes). Governments can correct for this by providing some regulatory support for producers offering the same product with less or no external cost.

2.1.1. Forms of support

The penetration of renewable electricity sources (RES-E) is usually supported in two broad ways: in the form of institutional and financial support (Table 1). Some of the tools are essentially under the mandate of the national energy regulator (in orange shade), others belong to the government under the heading of general industrial/development/economic policy. Institutional support means that the regulation creates favourable setup for RES-E generators such as positive discrimination in network access, rules that enable RES-E producers to use the required common infrastructure below cost, and public expenditure on R&D in renewable technologies.

[4] This does not mean, however, that these costs disappear but are spread across the members of the society (i.e. paying tax to operate the national healthcare system to heal lung problems).

Table 1: Forms of RES-E support

Institutional support	Type	Forms
	positive discrimination	priority dispatch
		no scheduling requirement
		preferential scheduling rules
		simplified licensing procedure
	access to infrastructure below cost	shallow cost of connection
	R&D	
Financial support	for investment	grants
		supported credits
		tax advantages
		preferential depreciation rules
	for production	feed-in tariff/premium and green certificate scheme

Positive discrimination in accessing the grid and the balancing infrastructure

Network integration is a crucial aspect of RES-E deployment and as such various support tools are employed to facilitate RES-E production. As far as network access is concerned, *priority dispatch* (or obligatory feed-in) mandates the network operator to take over the electricity produced from renewable sources (RES-E) regardless of its production cost. The only exception to this obligation is if the feed-in poses serious risk to system security. Providing an operational definition of system security, however, can be quite challenging. Priority dispatch is sometimes complemented by the appointment of a buyer for RES-E. This buyer can be the network operator or any third party that buys all RES-E, and as such reduces aggregated RES-E balancing cost and settles them against operational subsidies, if any.

As currently we do not possess any low-cost, flexible technological option for large-scale storage of electric power, a continuous real-time balancing of production and consumption in electricity systems is necessary. A way of positive discrimination for renewable producers is the exclusion of RES-E producers from the general requirement of electricity producers to submit *production schedules* to the balancing group executive. Even if they participate in system balancing, the rules allow them a wider deviation range from the schedule they have submitted ex ante or they can modify their schedule closer to gate closure. This preferential treatment means that if RES-E producers are exempt, then the cost of system balancing is distributed only among the other market players (non RES-E producers and consumers in general), in the other regulatory versions (preferential scheduling rules) they have a relatively limited responsibility. Thus they have access to the balancing infrastructure needed for the operation of the electric system below cost.

The exception from or preferential position of RES-E in regular balancing rules/burdens is especially generous considering that weather-dependent renewable technologies – such as wind and solar power – aggravate the balancing task as their production levels cannot be predicted with certainty, not even a few hours ahead of a given time. Another infrastructural problem posed by the deployment of renewable generation is the network development required for the connection to these new production units. Renewable generation units can connect to the distribution or the transmission network. The choice mainly depends on the capacity of the new unit. In Bulgaria, for example, all units above 5MW are required to connect to the transmission network. In both cases the increasing number of new units necessitates investment in the grid but the distribution of cost between the new entrants and the DSO is a matter of policy choice. It is important to note that as in most countries producers do not pay network fees (only consumers), so the DSO share is borne by the electricity consumers.

The *sharing of connection and grid update cost* depends on the national regulation. A deep cost allocation means that the renewable energy producer covers both the cost of grid connection and any necessary reinforcements to the grid. Such regulation is applied e.g. in Spain and Croatia (IMPROGRES, 2010). The more widely used shallow cost allocation requires the renewable energy producer to pay for the cost of connection only. Its major advantage is that it does not constitute a high barrier on entry of the renewable generator and - as connection costs are often 6-10% of the whole investment cost – it helps the spreading of this new form of generation. Additionally, connection costs are more transparent and it is easier for the DSOs to develop and apply consistent cost determination rules and guarantee non-discriminatory access to the grid. RES-E producers can be supported by assigning smaller cost share to them than to other new units. In Hungary, for example, RES-E producers pay 70% of the costs of connection up to the connection point to the public grid if the renewable share of the fuel is no less than 70%, but they pay only 50% if it's minimum RES content is 90%.

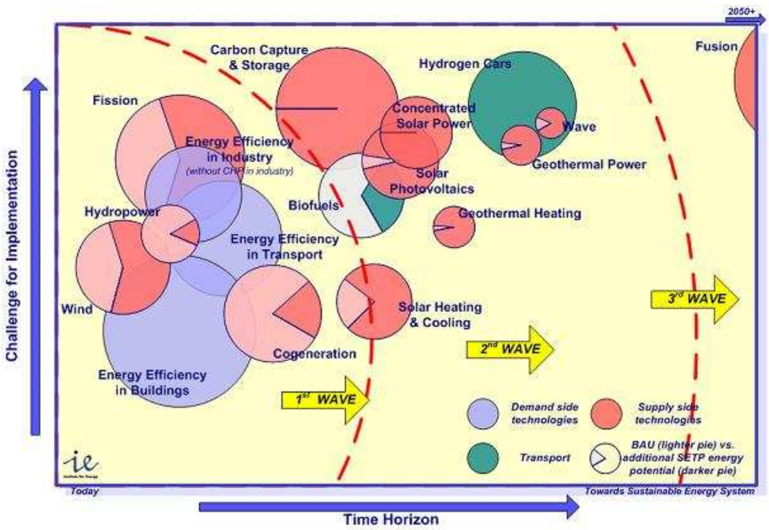
The *licensing procedure* for electricity generation is an important regulatory feature for potential investors. It can be characterised with the number of authorities involved in the procedure, the number of licenses required or the average lead time (from project preparation to fully authorised status) for the authorisation procedure. Cumbersome and long licensing can endanger the financial viability of the relatively small RES-E projects. This is especially true if the investment is predominantly financed from loans, and the banks approval is contingent upon the actual (and sometimes often changing) operational support. The regulator can apply positive discrimination for RES-E producers by no license requirement or simplified licensing rules under a certain size. In Hungary, for instance RES-E plants under 0.5 MW do not need a license from the regulator and those between 0.5 and 50 MW have a batch license for the establishment and the operation. An innovative way to reduce lead time – that has been introduced in Germany - is to batch the required licenses so that the applicant has to apply at a single entity instead of numerous local, regional and national authorities ('one stop shop'). Another important actor guaranteeing objectivity and non-discrimination on a case-by-case basis is the body of appeal to whom developers can turn with their complaints. This body can either be the energy regulator itself, the responsible ministry or possibly a court.

Thus, in parallel to the market penetration of RES-E production, the need for developing a RES-E production monitoring system emerged as governments were keen to track the subsidies. The primary tool for monitoring is the *certification* of RES-E that can serve various purposes. First and foremost, it is the basis for accounting production subsidies to eligible RES-E producers as a prerequisite for a transparent support system. Second, it can fulfil an emerging demand for green electricity among consumers as the environmental attributes of the purchased electricity can now be traced and made visible for the final consumer. Third, it is the basis of aggregate RES production data that is required to check compliance against national/EU targets. Finally, it is the accounting basis of green certificates support systems.[5]

Research and development tools (R&D)

New technologies (such as wave and tidal energy) require considerable investment to move from R&D to prototype stage and then to commercial operation. The funding requirement and the technology risk involved limit the willingness of private actors to finance it. In this case public spending is needed to complement risk-taking private funds. The form of support is typically grants, but some schemes enable the public (let it be the regulator or the consumer) to share financial return from technology success (e.g. the Launch Aid scheme for civil aerospace in the UK).[6] The main R&D tools at the EU level are the multi-annual "Framework Programmes for R&D". The 7th Framework Programme (2007 – 2013) allocates roughly €167 million per year for renewable energy and energy efficiency.[7] The direction of R&D activities are defined by Strategic Energy Technology Plan (SET-Plan) launched in 2007 to overcome the fragmentation of European research efforts.

Figure 4 : "Waves" of technology deployment as outlined in the SET-Plan



Source: European Commission, 2009

[5] It is important to differentiate between guarantees of origins (certificates in the general sense) and tradable green certificates as means of operational support of RES-E producers. The latter is based on the former but not vice versa.

[6] http://www.bis.gov.uk/policies/business-sectors/aerospace-marine-and-defence/aerospace-overview/launch-investment

[7] http://www.erec.org/policy/eu-policies/research-development.html

The Plan envisages "waves" of technology deployment until 2050 (Figure 4 :). A first wave (short-to-medium time horizon) is mainly composed of established technologies, such as energy efficiency improvement in buildings, transport and industry. A second wave (medium-to-long term) includes more advanced technologies, such as advanced solar, second generation biofuels, CCS and possible hydrogen and fuel cells in the transport sector. The third generation of renewable technologies includes ocean technologies and generation IV nuclear reactors, and possible fusion technologies beyond 2050.

Investment support

Financial support schemes can target either investments in energy systems and/or the operation of energy generation facilities.[8] Investment support schemes might be investment grants (refundable or non-refundable), supported investment credits (credit support or credit guarantee), investment tax support schemes (asset tax, turnover tax, import duties, etc.) or preferential depreciation rules for parts and equipment (e.g. India or the federal modified accelerated cost recovery schedule in the US).[9] Recently, for example, Pakistan has abolished its 24% import duty on all renewable equipment but many other countries employ this economic tool to attract RES-E investment. Financing of investment supports comes mainly from state budgets, sometimes from international financial institutions and/or development banks. Cohesion countries in the EU receive considerable financial support from the community budget for the expansion of renewables. For an overview of EU member states see Table 2.

Production support

Production support schemes are focusing either on the price or on the quantity of the renewable energy. The two major forms are the feed-in tariff (FIT) and the green certificate (GC) systems.

FIT schemes

In FIT schemes the RES-E producers receive a pre-set price for electricity that is higher than the market price. Or alternatively, it is eligible for a regulated premium over the standard electricity market price (premium schemes). In premium schemes (sometimes also referred to as green bonus systems) the producers do not obtain a fix amount of money for every kilowatt-hour but only a premium (green bonus) over the market price. This scheme is more risky and thus less attractive for investors because future market prices are unknown.

Operating FIT/premium schemes exhibit considerable design variations. Regulators often diversify tariffs on the basis of technology to create a more diversified renewable mix. A differentiated FIT scheme is less efficient than a uniform one that maximizes production from a fixed support budget resulting in the cheapest technology spread: only the cheapest technologies will enter the market. Most of the existing FIT schemes in Europe, however, are differentiated by technology, reflecting that the development of a diverse technology portfolio remains an important continental objective.

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[8] Additionally, it can target electricity and/or heat production from renewable resources. This paper focuses on electricity (RES-E).

[9] Gevorg et. al (2011): Unleashing the Potential of Renewable Energy in India, World Bank report

The promotion of small scale decentralised RES-E generation is a reasonable policy objective (utilisation of local resources, employment, etc., and also lower network loss of distributed generation - DG) which translates into higher FIT for smaller units, all else being equal. The regulator, however, should also consider the loss derived from the reduced scale economies (higher overall cost), and the increase in network losses after reaching a certain DG penetration level. In addition, FIT preference for small units can induce the disaggregation of investment at the same location.

Load following RES-E technologies (mostly biomass, and to some extent biogas and hydro power stations with reservoir) can be motivated by differentiated tariffs to produce in peak periods and go off-line in periods of low electricity demand. This option does not apply to intermittent generators.

New installations often receive a lower tariff that takes into account the technological development resulting in lower production cost. The same goal motivates the application of digressing tariff (pre-schedules, gradually decreasing FIT) for already operating installations.

The most important features of any FIT regime are the transparent setting of rates (based on cost-plus method and/or benchmarking) and the long-term (10-15 years) regulatory stability regarding the tariff rates, the eligibility for FIT, grid access rules, possible phase-out (conversion to green certificate system) and balancing rules. Additional design tools to reduce the risk of investors are the annual correction of tariffs with inflation or a re-defined exchange rate correction regime (e.g. Ukraine).

Green certificate schemes

Green certificates are tradable commodities that represent the environmental value of RES-E, and their demand is driven by an administrative obligation of traders/consumers to buy a prescribed amount of RES-E that can be delivered freely by any renewable source. Thus, it provides the highest profit to the cheapest technology. Alternatively, the number of green certificates per MWh electricity differs according to the production technology (like in Romania). This is called ‘technology banding’. This allows the regulator to consider the different cost of the various eligible technologies. The cost of delivery is logically borne by the market players (traders or consumers) who are obliged to purchase the prescribed amount of renewable energy.

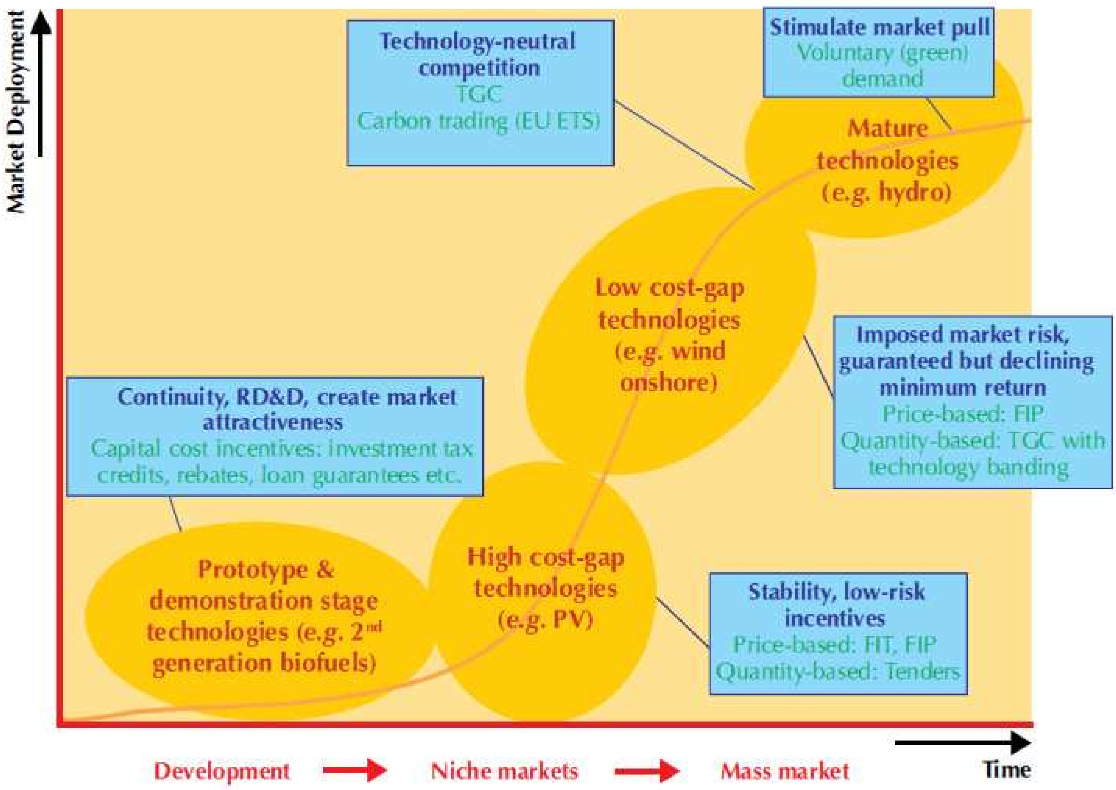
To ensure an effective regulation, authorities need to verify that the prescribed volume of renewable energy consumption has been met. Participants under the obligation to purchase a specific volume of renewable energy can prove to the authorities that they have commercially fulfilled their obligations only by a certificate issued by the renewable energy producer, declaring that a particular quantity of renewable energy has in fact been generated and sold. Certificates should be retained until the end of the regulatory period when they must be submitted to the authorities, usually once a year. Needless to say, the renewable energy sold/purchased is also physically fed into the network and equally fulfils the role of satisfying demand. GCs are transferable independently of the underlying energy. GCs are often traded in power exchanges resulting in a transparent and uniform price that is beneficial from a regulatory and the investors’ point of view as well.

Quantity based support schemes operate with a significant price risk, since they fulfil the desired volume target at literally any price. There might be significant pressure on the regulator to mitigate this price risk. Pressure comes from consumers wishing to have protection against extraordinarily high prices. When a supplier falls 1 MWh short of its renewable electricity purchase obligation, that is, by submitting 1 MWh less certificates to the authority, then it is obliged to pay a commensurate fixed fee specified in advance. This fee is often called exit fee, since by paying it, the service provider exits from the demand side of the certificate market. The exit price acts as a price ceiling. Renewable producers, on the other hand, would also like authorities to protect them from excessively low prices, generated by market forces when they substantially reduce the price of renewable energy putting at risk the return on their investments. The regulator - similar to the price ceiling - can set a price floor, ensuring that RES-E producers receive at least that minimum price for their green certificate.

2.2.Evolution of RES-E policy tools

The policy framework should increasingly apply market principles as technology matures and deployment increases (Figure 5). As a general principle, less mature technologies need R&D support and stable low-risk incentives such as investment support, FITs or tenders. Low-cost gap technologies (e.g. on-shore wind or biomass combustion) can be aided with more market-oriented instruments (e.g. premium or tradable GC systems with or without technology banding). Technologies that are deployed at commercial scale and competitive with other CO_2 mitigation options might eventually be supported via carbon incentives (e.g. EU ETS), complemented by the voluntary demand of conscious consumers.

Figure 5: Policy incentives as a function of technology maturity



Source: IEA, 2011, p25

2.3.Support of RES-E in the EU

The European regulatory practice is dominated by the use of FIT: 22 countries employ FIT from which 15 exclusively use this tool (Table 2: production support in orange). Only Sweden, Poland, Romania and Belgium operate green certificate system. Italy, and since 2010 the UK have a mixed scheme based either on the capacity of the installation (under 5 MW FIT applies in the UK) or based on technology (in Italy FIT applies for solar, other technologies can choose between FIT and green certificate). Romania has also legal provisions to apply FIT for installed capacities below 1 MW but the secondary legislation is not yet finalised. RES-E producers in Denmark, Estonia and the Netherlands receive a 'green bonus' above the market price (premium). In the Czech Republic, Spain, Slovakia and Slovenia producers can choose between FIT and premium. We should note that every member state applies some form of operational support. Finland was the only country that supported RES-E producers only via tax refunds (lower tax level) up to 2010 but then introduced a mixture of premiums and feed-in tariffs.

Table 2: Different RES-E support instruments in the EU member states

	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	GR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	UK
FIT	x		x	x	x	x			x	x	x	x	x	x	x	x	x	x	x			x			x	x	x
Premium					x		x	x	x	x										x					x		
Quota obligation		x													x						x		x	x			x
Investment grants		x		x	x					x		x	x			x	x	x	x								
Tax exemptions		x							x	x		x						x		x	x			x		x	x
Fiscal incentives			x			x		x											x	x	x				x		

Source: Renewable Energy: Progressing towards the 2020 target (COM(2011) 31 final); RES legal (http://www.res-legal.de) and ERRA questionnaires

2.4.Ways to avoid oversubsidisation and excessive public support volume

Electricity consumers frequently face increasing financial burden – that eventually translates into higher electricity prices - due to the rapid deployment of supported renewable electricity production. In these countries governments and regulators are keen to employ various techniques that are on the one hand try to avoid oversubsidisation of RES-E producers, on the other, limiting the volume of support. We grouped the various techniques employed in RES-E support regimes into 5 categories (Table 3). Most of them are applicable both in FIT and green certificate system, while a few are regimes specific. This list is by no way exhaustive as the RES-E production schemes of the countries are quite diverse, sometime complex and often changing. It should rather be viewed as a collection of tools with concrete examples of application in European countries.

Table 3: Cost limiting techniques in RES-E support schemes

Focus	Forms	Variations
Eligibility	technology specific	
	size	
	vintage	
eligibility period	IRR based	
	technology specific	
	vintage	
	equipment status	
FIT level	degression	entry FIT level
		during the eligibility period
	unplanned cut	
	taxation	
	auctioning	
	subtraction of investment subsidy	
Cap	capacity	
	budget	
Target	reduction of target amounts	

Eligibility rules are standards design features in regulatory practice to exclude production units above a certain size (MW) or certain technologies or certain vintage year. Most often this means the exclusion of large hydro power plants that has been sometimes built a few decades earlier and already paid back their investments. As their variable cost is negligible (no fuel cost), nothing justifies their inclusion in the support system. In Romania, for example, hydro units above 10 MW installed capacity and small hydro units built before 2004 are not eligible for operational support (green certificate). A recent decision in the Czech Republic was to keep PV installations below 30kW (and only if they are installed on rooftops or external walls) in the support scheme in order call a halt to a booming PV deployment (see more details in the case studies section).

Another option is to define the *period of eligibility* (the number of years the unit is eligible for support) distinctively. A technology differentiated approach is employed for example in Austria where biomass and biogas based electricity production is eligible for FIT for 15 years, while all other technologies are eligible for 13 years. The differentiation is based on whether the technology has fuel cost (biomass and biogas). A less normative approach is taken in Hungary where the regulator determines the length of the support period by calculating the payback period (internal rate of return – IRR) plant-by-plant for all technologies, except biomass and biogas.[10] The producer is eligible for the pre-defined FIT until the end of the payback period only, and from that time on it can sell the produced electricity on the free

[10] The uniform eligibility period is 15 years for biomass and biogas power plants but only 5 years for biogas from waste disposal and sewage treatment facilities.

market at the market price. The length of the eligibility period can be linked to the vintage of the plants or to the equipment status that differentiate between new and refurbished units. In Romania, for example, those producers which were already in the GC system before 2008 (the reform year) qualify for a reduced eligibility period. Similarly, refurbished hydro and wind units receive green certificates for 10 and 7 years respectively in contrast with the general 15 years of eligibility.

The third broad category of techniques relates to the *level of feed-in tariff*. Several countries apply degression rules meaning that the FIT level decreases with time. *Degression* is a valuable tool to avoid excess subsidies but if it is modified in an unplanned manner, it becomes harmful for the market. In Spain the regulation clearly states that onshore wind units receive 7.9084 €ct/kWh for 20 years but only 6.6094 €ct/kWh onwards. The German FIT schemes (Erneuerbare-Energien-Gesetz - EEG) applies a degression rate for each technology (except solar PV) depending on the year it starts operation. New systems will receive the tariff level applicable on the day they are put into operation. This tariff level will apply for the entire payment period (for 20 years). The percentages by which the tariff levels will decrease every year are set by law and are not subject to change. This means that the entry FIT level for identical RES-E production units depends on the start-up year: the later you enter, the lower initial FIT you are eligible to. As far as solar PV is concerned, according to the German regulations the degression rate depends on the volume of new capacities. In this so called 'flexible cap' system when the total additional capacity installed exceeds or falls below a certain amount, the degression rate defined by the law increases or decreases by a statutorily fixed number of percentage points every year. Currently the degression rate is set at 9% and depending on market developments, it can increase up to 15% or decrease to 7.5%. If capacity growth is high, the scheduled annual reductions may be applied earlier (in July). An example for green certificate scheme is Romania where – under the new system introduced in 2008 – wind receives 2 GCs per MWh until 2017 but only one from 2018 onwards.

The current German PV support system – despite its sophistication – was unable to break the investment rush and the federal environmental and economy ministries now assume that the cost of PV technology is decreasing so dynamically that it necessitates drastic and dynamic FIT reduction. This means a one-off reduction in March 2012 (20-30%, depending on the location and size of the unit) and monthly reductions onwards (

Table 4). Additionally, the draft law excludes systems above 10MW and sets an annual 'expansion corridor' that is the volume of new capacity supported: 2500-3500 MW for 2012 and 2013 and 400 MW onwards. This means that by 2020 approx. 44GW will be receive operation support (today 25GW is included in the scheme) and the remaining 7.75 GW to reach the German national PV target of 51.75 GW will be supplied by non-supported units.

Table 4: The proposed feed-in tariff for PV in Germany (€cent/kWh)

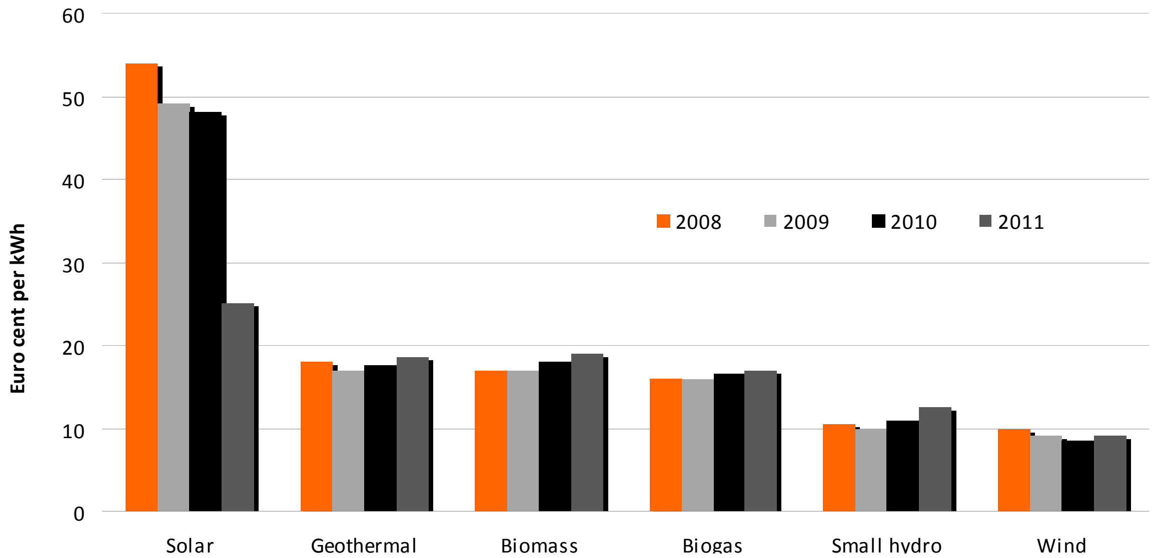
Commissioning	Roof top: up to 10 kW (new)	Roof top: 10 kW to 100 kW (to be abolished)	Roof top: up to 1 MW	Roof top: 1 MW to 10 MW	Stand-alone to 10 MW
From 01.01.2012	24.43	23.23	21.98	18.33	17.94
From 09.03.2012	19.50		16.5	13.50	13.50
Reduction of	20.20%	29.00%	24.90%	26.40%	24.70%
From 01.05.2012	19.35		16.35	13.35	13.35
01.06.2012	19.20		16.2	13.20	13.20
01.07.2012	19.05		16.05	13.05	13.05
01.08.2012	18.90		15.9	12.90	12.90
01.09.2012	18.75		15.75	12.75	12.75
01.10.2012	18.60		15.6	12.60	12.60
01.11.2012	18.45		15.45	12.45	12.45
01.12.2012	18.30		15.3	12.30	12.30
01.01.2013	18.15		15.15	12.15	12.15
Reduction compared to 1.1.2012	25.70%		31.10%	33.70%	32.30%
01.01.2014	16.35		13.35	10.35	10.35
Reduction compared to 1.1.2013	9.90%		11.90%	14.80%	14.80%
01.01.2015	14.55		11.55	8.55	8.55
Reduction compared to 1.1.2014	11.00%		13.50%	17.40%	17.40%
01.01.2016	12.75		9.75	6.75	6.75
Reduction compared to 01.01.2015	12.40%		15.60%	21.10%	21.10%

Source: Platts, 2012

Unplanned, one-off reduction of tariffs and *ex post taxation* of the revenue of RES-E producers from operational support are tools that can ease the financial burden of the state but at the same time undermine the credibility of the support system: if they occur once, investors anticipate that they can to occur any time in the future again, and such anticipations can derail investment plans. A recent prime example for both techniques is that of the Czech Republic where the government imposed an extra tax in 2011 on PV plants commissioned in 2009-10 to compensate for the negative impacts on end-consumer prices (see the case study on the Czech Republic for details).[11] The tax rate is 26 % of the FIT paid to units above 30 kW. In tandem, the support for ground mounted system has been reduced to zero for wall/roof mounted PV systems the FIT has been reduced considerably, while for other technologies it remained stable (Figure 6:).

[11] This tax had a retroactive effect, as it penalised previously built capacities as well. It is important to note that in July 2011 the court declared it unconstitutional.

Figure 6: The evolution of feed-in tariff in the Czech Republic (2008-2011, €cent/kWh)



Source: ERÚ price decisions (2008, 2009 ,2010 and 2011)

Another method for the prudent use of public resources is to auction the capacities. Auctioning forces future RES-E producers to reveal how much support is needed for them to engage in production and thus allows the regulator to provide no more than is necessary. Note that this implies some sort of cap (either stated in MW or in EUR) on new developments. In the Netherlands, the SDE+ scheme introduced in July 2011 set up a single subsidy budget for all technologies, i.e. all technologies compete against each other (Government of the Netherlands, 2011). The scheme's budget was capped at €750m for the second half of 2011. Between 2013 and 2015 an additional €100m will be allocated to the budget annually. From 2015 there will then be an overall ceiling of €1.4bn for subsidies provided in the framework of previous schemes (MEP and SDE) and the SDE+ combined.[12] The regulator estimates the cost price of each technology. The difference between this cost price ('basisprijs') and the market price of electricity is subsidized for 15 years. Subsidies are allocated in four stages each year and the level of subsidy increases with each stage (Table 5). Subsidies are always allocated on a 'first come, first serve' basis meaning that applicants applying at a later stage (but for higher premium) risk of being rejected due to a lack of funds. A biomass project developer (average cost price of 12.1 ct/kWh) may apply for a 9 ct/kWh support in the first quarter or decide to apply for 11 ct/kWh in the second in case there are still funds available. The scheme uses a 'free' category that allows early developers to apply for support in an earlier phase. They often have other financing sources or are able to produce renewable energy cheaper than the estimated average cost price for that particular technology. The stated aim of the SDE+ scheme is to reach the 2020 target in a cost efficient way. The deployment of more innovative and hence more costly technologies is promoted in a different framework.

[12] Source: http://corporateuk.eneco.nl/SiteCollectionDocuments/Standpoints/Standpunt2EN.pdf

Table 5: Illustration of SDE+ (cost prices EURc/KWh)

I	II	III	IV
Incineration (6.2)	Incineration (6.2)	Incineration (6.2)	Incineration (6.2)
Free (9)	Onshore wind (9.2)	Onshore wind (9.2)	Onshore wind (9.2)
	Free (11)	Biomass (12.1)	Biomass (12.1)
		Free (13)	Fermentation (13.4)
			Free (15)

Source: Government of the Netherlands, 2011

Similarly to the assumption behind the "free" category in the Dutch SDE+ scheme that some RES-E producers are in possession of additional financial sources, governments often align their production support schemes with public *investment support* programmes so that producers that received investment support are eligible for reduced production support (lower FIT or premium). This is getting a widespread practice in the new member states (being in force in Hungary and Romania) where a considerable share of EU funds target sustainable energy production investments.

The last broad category is the limiting of either the volume of eligible capacities or the budget used for subsidisation of RES-E production (*'capping'*). The 'expansion corridor' in the German scheme and the budget cap in the Dutch scheme (SDE+) discussed before are good examples for this type of regulation. It should be noted, however, that capping can be a separate tool (without degression or auctioning).

The last method included in Table 3 is specific to green certificate systems where the reduction of the target RES-E amount (usually stated as % of total consumption) eases the price effect on final consumer electricity prices. The reduction of the price ceiling (exit price) have a similar effect.

As we have seen, governments are quite innovative in employing support reduction methods in a planned, but recently in an increasingly unplanned manner. Some measures are primarily aimed at increasing the cost efficiency of the support system such as the Dutch auctioning scheme or the exclusion of large hydro units built decades ago. Others are capable of limiting the absolute volume of subsidy such as the caps (both MW or EUR denominated). Quite often, however, the quoted tools help to achieve both public goals simultaneously: the Czech taxation, for example or the unplanned FIT cuts or planned FIT level degressions.

3. Explaining RES-E penetration in the ERRA countries: the results of a questionnaire survey

3.1. Objective of survey and its hypotheses

The main objectives of the survey were to identify the main drivers and barriers of the RES-E penetration in the ERRA member states and to distinguish those good practices that can be considered in other states as well.

Our main hypotheses behind the questionnaire that were checked in the analysis of the survey were the following:

- Hypothesis 1: Higher RES-E production support levels lead to higher RES-E penetration in the ERRA member states.
- Hypothesis 2: Dedicated RES-E policy, e.g. through ambitious and measurable RES-E targets help to speed up RES-E developments in the region.
- Hypothesis 3: The general economic and investment environment in the ERRA countries also plays a key role in RES-E development in the region. In this context EU membership is a key factor.
- Hypothesis 4: Good regulatory practices, including transparent, consistent and flexible regulation are preconditions for a higher RES-E penetration.

These hypotheses are looked at and analysed separately in various sections of this chapter (See section 3.4 for the target setting, 3.5 for the analysis on the support level and 3.6 for the analysis of RES-E growth for details). Hypothesis 4 on the regulatory practices – being the main focus of this paper – is evaluated in a more detailed way. Furthermore, we have carried out a regression analysis as well (section 3.6), where we check for the impacts and significance levels of the abovementioned factors on the RES-E penetration level jointly.

3.2. Introduction of the questionnaire and its building blocks

In order to test for the abovementioned hypotheses, a detailed questionnaire was sent out to the regulators of the ERRA member states on their present national RES-E support practices.

The questionnaire has been revised by two members of the Tariff Committee and sent out to the regulatory authorities in early December 2011.[13] The majority of countries (24 out of 29) have returned the questionnaire back to the ERRA secretariat. The questionnaire is included in the Annex of this study.

[13] The draft questionnaire was sent to Nebojsa Despotovic (Energy Agency, Republic of Serbia) and Ainars Mengelsons (Public Utility Commission, Latvia) for a review.

Table 6: Questionnaire response data (country ISO codes in parenthesis)

Questionnaire returned		No returned questionnaire
Estonia (EE)	Lithuania (LT)	Montenegro (ME)
Latvia (LV)	Bosnia (BiH,RS)	Azerbaijan (AZ)
Poland (PL)	Turkey (TR)	Kazakhstan (KZ)
Slovakia (SK)	Ukraine (UA)	Kyrgyz Republic (KG)
Serbia (RS)	Jordan (JO)	Saudi Arabia (SA)
Moldova (MD)	Nigeria (NG)	
Russia (RU)	Macedonia (MK)	
Georgia (GE)	Romania (RO)	
Armenia (AM)	Bulgaria (BG)	
Mongolia (MN)	Croatia (HR)	
Hungary (HU)	Kosovo UNMIK	
Albania (AL)	United Arab Emirates (AE)	

The returned questionnaires were quality checked by the REKK staff, and in case of uncertainties, they were sent back to the members for clarifications. The information of the questionnaire was also supplemented by other sources, such as earlier ERRA publication and the Enerdata database.

The questionnaire consists of five main blocks:

1. **General information** on the RES-E support schemes of the country, including:

- RES-E capacity penetration level and production,

- if general or specific RES-E target levels are set out in the country, its timing and other specifications.

2. **Licensing and certification**, including:

- the role of the regulator in the licensing process, the length of licensing and possible simplification for RES-E,

- questions concerning the overall RES-E authorisation process,

- questions on the certification process.

3. **Grid integration issues**, with the following focus:

- whether priority purchase and obliged purchase are applied,

- what are the general rules and conditions for RES-E grid connection,

- network connection cost sharing practices,

- technical standards specifications for RES-E grid connections,

- allocation of scarce grid connection capacities,

- RES-E forecasting, scheduling and balancing responsibilities and practices.

4. **Support schemes** for renewable electricity, including the following dimensions:

- type of support scheme (feed-in tariff, feed-in premium or quota obligation system) and the existence of other support mechanisms,

- responsible authorities and their role in FIT and quota setting,

- primary method for tariff/premium setting,

- tariff/premium levels for the various RES-E technologies, other types of differentiation/specifications. Similar questions concerning the countries with quota obligation schemes,

- existence of a cap in RES-E capacity expansion, allocation mechanism in case of capacity restrictions,

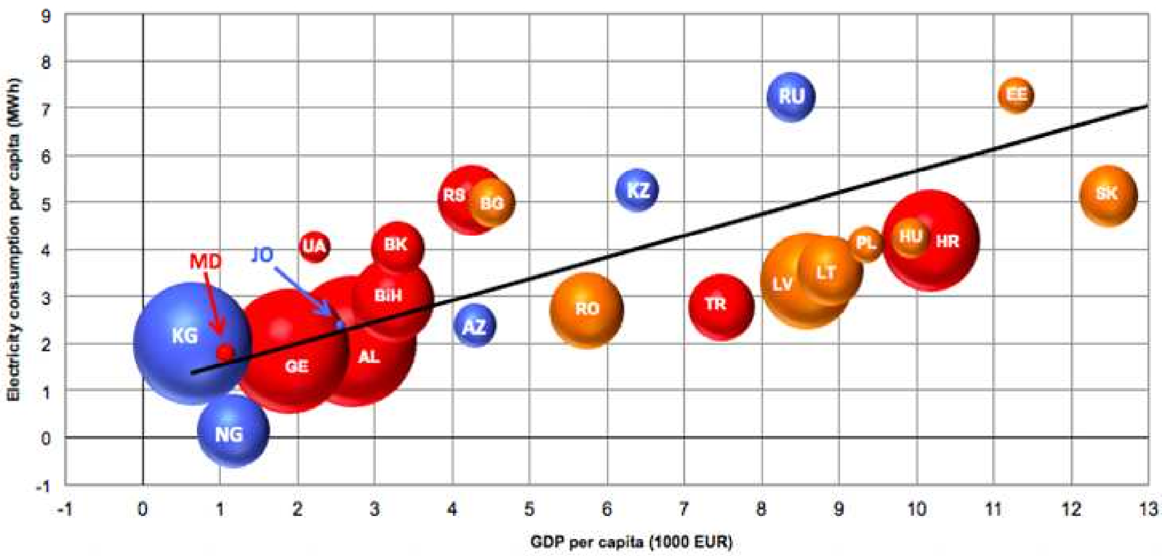
- eligibility periods and methods of regular reviews of tariff/premium levels.

5. **Closing questions**, exploring the most important events, obstacles and examples of success in the RES-E development of the countries.

3.3. RES-E in the ERRA countries: some general comparative statistics

ERRA countries represent a very heterogeneous group of countries, with very diverse RES-E potential and drivers for promoting renewables. These countries are in different stages of economic development, and they are also characterized by a varying level of electricity consumption per capita.

Figure 7: GDP/capita, per capita electricity consumption and RES-E share in ERRA countries, 2010



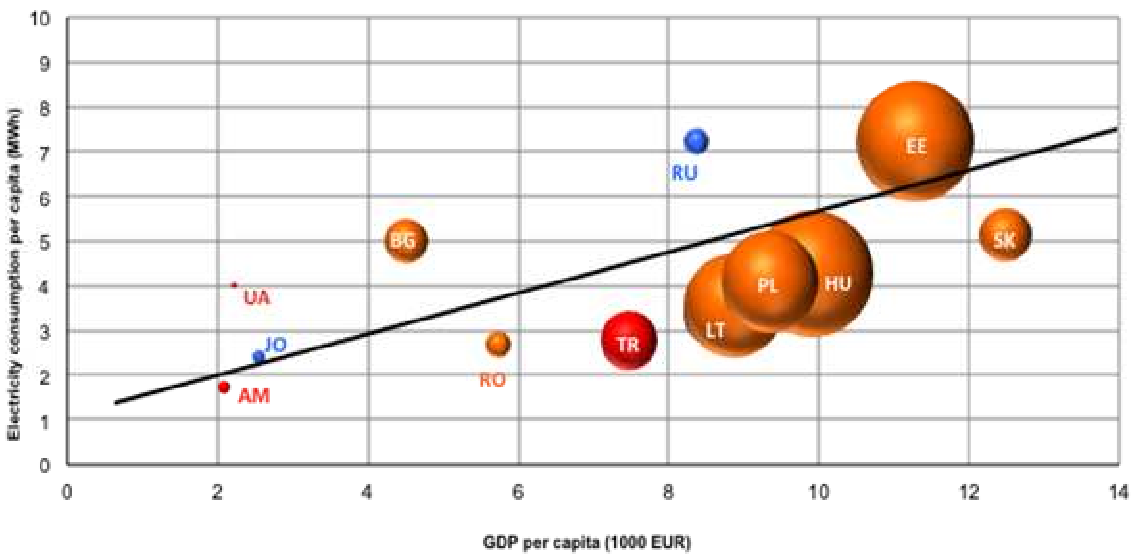
Source: questionnaires and Enerdata

Note: orange – EU member state; red - Energy Community member states; blue - other ERRA countries

Electricity consumption increases with the level of economic development of a country (as represented by the ascending trend line in Figure 7). An additional assumption is that a higher level of development entails higher RES-E share. There are many reasons to assume such a relationship. First, RES-E investments are generally more expensive than traditional technologies, so a country would only invest in RES-E technology when its income reaches certain level. Second, with rising income and electricity consumption, electricity prices tend to increase well due to the higher expected service quality. Higher prices, in turn, would allow for further increase in RES-E production. Our data suggests – however - that economic development is not necessarily accompanied by higher RES-E share among ERRA countries. The size of the bubbles in Figure 7 illustrates the relative share of RES-E in the overall electricity production in 2010. The figure shows that less wealthy countries have higher RES-E production share than their wealthier counterparts. This effect is due to the existence of high level hydro capacities in many countries that were completed during the Soviet times and before the introduction of recent incentives to promote RES-E. If we exclude hydro generation from our analysis, the positive relationship between GDP and RES-E deployment level becomes more straightforward (Figure 8).

We have to note here the specific features of the newly built small hydro capacities in some ERRA member states. Georgia has experimented significant hydro capacity growth in the past few years. These capacities were built without any operational support. Similar increase could be traced in small hydro capacity development in Turkey and Armenia. These hydro capacity additions are excluded in the following two charts, but they are included in the rest of the analysis, when dealing with the RES-E capacity growth.

Figure 8: GDP per capita, electricity consumption and RES-E share without hydro in ERRA countries, 2010



The figure also illustrates that non-hydro RES-E production is an almost exclusive characteristic of EU countries. The two exemptions that are visible on the chart are Turkey and Russia but both countries exhibit a significantly smaller proportion of non-hydro RES-E: 1.8% and 0.3% respectively.

Figure 9: The share of RES-E technologies (excluding hydro) in the different country groups, 2010

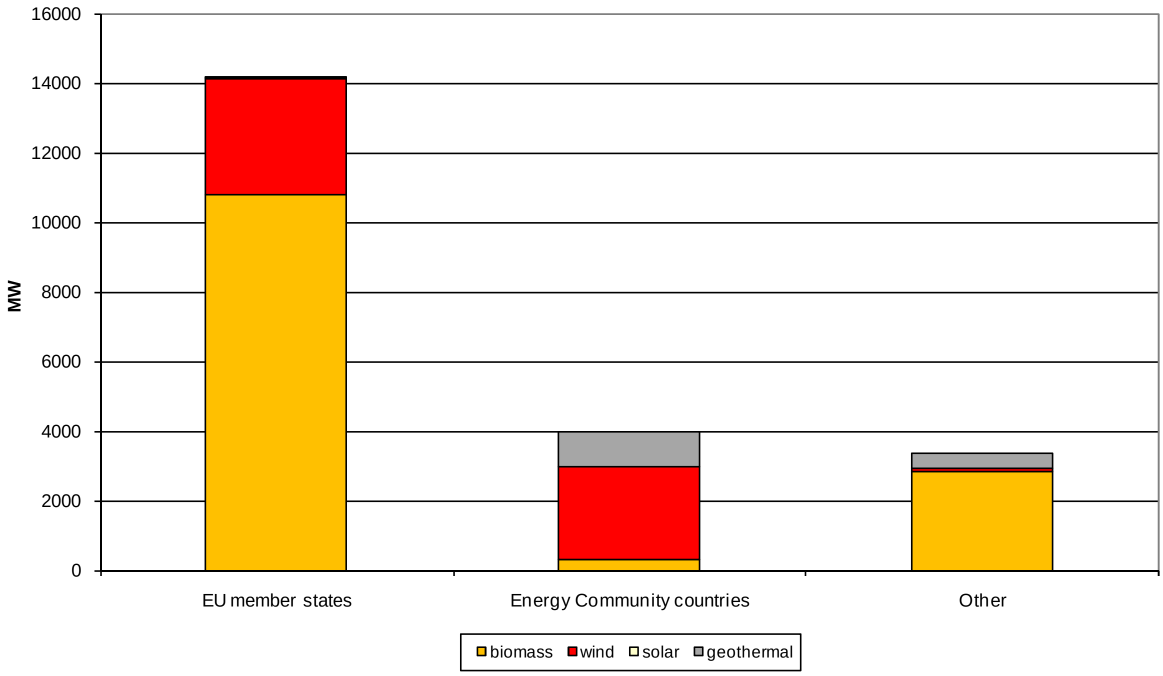


Figure 9 illustrates that EU states dominate the non-hydro segment of RES-E capacities with around three quarters of non-hydro RES-E produced from biomass and 23% from wind. A limited amount of geothermal capacity exists in the other two regions while solar has a very limited penetration level amongst ERRA member states. It has to be noted as well, that a significant proportion of the biomass capacity increase in the EU countries took place through biomass co-firing, where biomass was burnt together with fossil fuels in existing fossil fuel plants. Many of these plants are characterised by low efficiency factors (e.g. in Hungary, Poland). This practice was introduced as a prompt answer to reach the demanding EU RES targets, but probably representing a rather short term and less sustainable solution, as the low efficiency factors entail significant losses using the existing and limited biomass resources. These countries intend to replace co-firing by dedicated high-efficiency biomass plants in their longer term plans.

This figure seems to support our Hypothesis 3, namely that economic growth and income levels of the countries play a crucial role in RES-E development. It also suggests that EU membership has a determining role in this process as well.

3.4. RES-E target setting

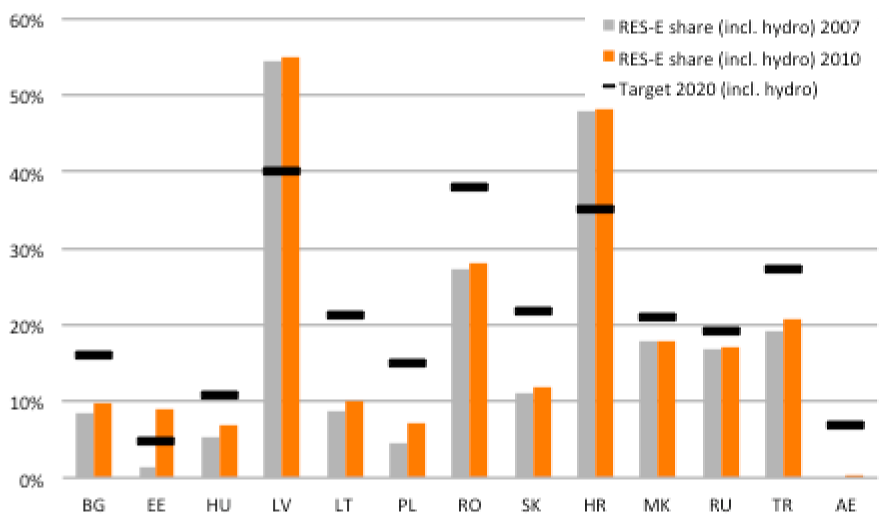
The existence of a RES-E target is an almost compulsory element of a credible and consistent renewable promotion policy. If no targets are set, it is difficult to measure whether the government policy supporting RES-E penetration is effective, and whether the country follows a timely path to achieve the pre-set targets. Targets can be defined in terms of renewable energy (RES target) including both electricity and non-electricity based energy uses (e.g. including heat production or fuel used in transport), or renewable electricity generation (RES-E target).

In the EU, RES targets are a compulsory element for the member states prescribed by EU legislation. Member states have to plan and report their proposed actions and achievements concerning their RES and RES-E development by 2020 in their National Renewable Energy Action Plan (NREAP). The community level target has been set by the European Commission, and has been translated to state level goals based on the country's RES potential, its already achieved RES ratio and income level.[14] Some countries (amongst them Romania and Hungary) undertook even stronger targets than those prescribed by the Directive. The Directive only sets overall RES targets, while the share of RES-E and RES-H is in the mandate of the member states.

The responses in the questioners reflect this 'compulsory' role of the predefined targets (questions number B1Q6-7-8-9).[15] Out of the 24 respondent 20 have both RES and RES-E targets and an additional two countries have either one of the two, leaving four countries without any RES or RES-E targets (Nigeria, Serbia, Ukraine and Albania).

Figure 10 shows how the share of RES-E production (including hydroelectricity) in total electricity production changed between 2007 and 2010 in countries with explicit RES-E targets. It also indicates how current shares relate to each country's 2020 RES-E target.

Figure 10: RES-E shares and targets for various countries



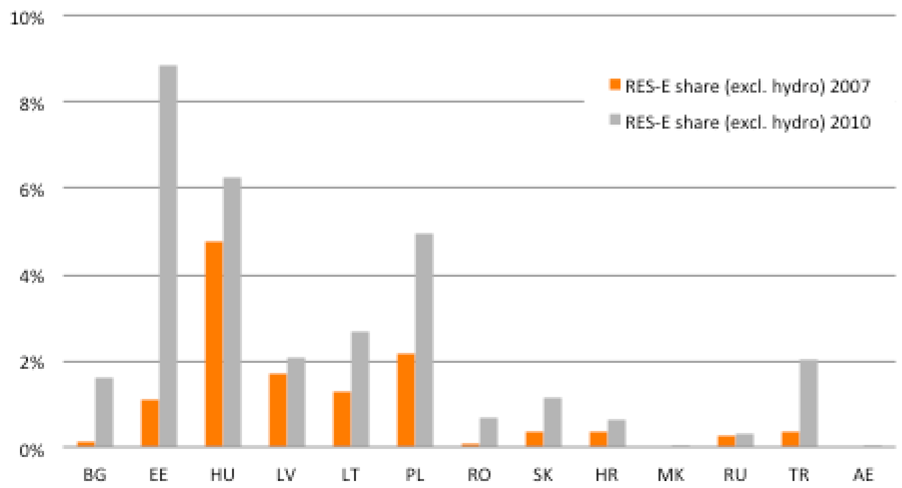
As we see, countries differ significantly in more than one way. First, there are considerable differences in how countries have proceeded with increasing their RES-E shares. While some countries – most remarkably Estonia – showed significant progress over 2007-2010, some others progressed more gradually or hardly at all. Second, some countries have more ambitious targets than others, and some are outright above their 2020 targets already today. Third, RES-E production can have very different weight in these countries which is in large part explained by the inclusion of large hydro production.

If we exclude hydro production entirely (since we do not have data for large and small hydro separately) 2007 non-hydro RES-E shares in total production are below or close to 2% in all countries with the exception of Hungary (Figure 11). Several countries experienced rapid growth between 2007 and 2010. Hungary's initial advantage, in particular, originated from its biomass co-firing capacity which was developed already before 2007.

[14] 2009/28/EC Directive

[15] Countries excluded in the analysis of these questions are: Azerbaijan, Kazahstan, Kyrgystan, Kosovo, Montenegro, and Saudi Arabia. Nigeria, Serbia, Ukraine and Albania have no RES or RES-E target.

Figure 11: RES-E share in total production in 2007 and 2010, excluding hydro

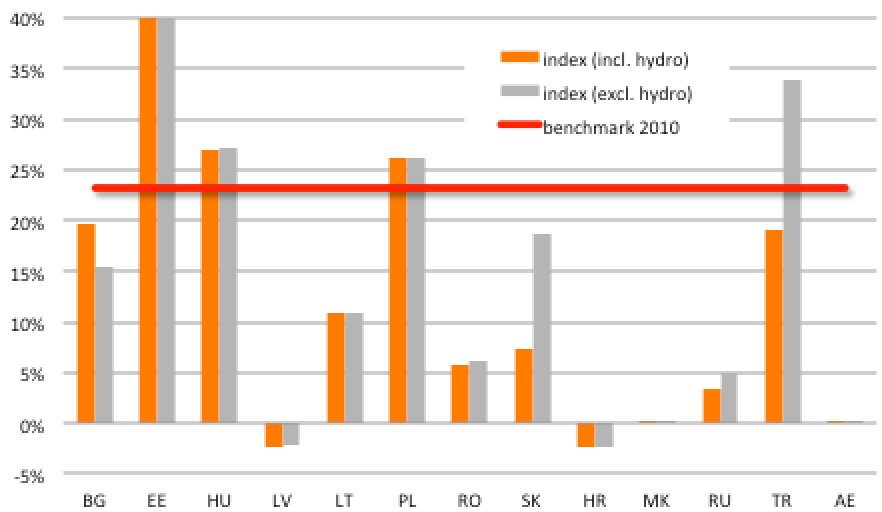


It is also worth emphasizing that some of the difference in initial RES-E shares and growth rates can be traced back to some countries launching their support mechanism earlier than others. For instance, Latvia started supporting renewable production as early as in 1995, Poland being a close follower in 1997. Lithuania, Hungary and Romania had also had 3-5 years of experience with their support schemes by 2007, arguably enough time for investments to begin. In contrast, Russia to date has not started supporting RES-E at all.

For sake of better comparison, we constructed a simple 'performance indicator' to measure how a certain country progressed towards its 2020 RES-E target (including hydro) during the 2007-2010 period. This indicator (see Figure 12) can be expressed by the following formula:

$$I = \frac{\%(\text{RES-E production})_{2010} - \%(\text{RES-E production})_{2007}}{\%(\text{TARGET})_{2020} - \%(\text{RES-E production})_{2007}}$$

Figure 12: Progress indicator



Based on these indicators we were able to create five distinct country groups. The first category consists of only one country, Estonia (its value is 2.2). Estonia is special among these countries in that while its RES-E share was below target in 2007, it grew significantly during 2007-2010, surpassing its 2020 target already by 2010. Hence, its indicator is an outlier with a value above 200% showing a more than twofold overachievement in absolute terms. Estonia's recent RES-E production surge was predominantly based on biomass, but wind energy has also taken up significantly since 2007.

Latvia and Croatia constitute the second group: these countries stood above their 2020 targets already in 2007 (if we include hydro production), and increased further their RES-E shares since then. This results in their indicators being slightly negative, meaning that they have been drifting away from their targets by increasing their RES-E share even further above their targets.

In the third category we find those countries which are relative overachievers: Bulgaria, Hungary, Poland and Turkey. Countries in this group achieved 15-30% of the necessary increase in their RES-E production share to reach their 2020 goal.

The fourth group consists of Lithuania, Romania and Slovakia. While these countries showed some progress during 2007-2010, their 2020 targets seem remote compared to their standing in 2010, with a progress indicator around 5-10%. (Note that Lithuania's nuclear production dropped out entirely in 2010 which the country substituted mainly by imports, meaning a significant drop in domestic production in that particular year. Thus, its actual RES-E share in total production in 2010 was well above of our indicated value, as the latter is calculated using average total production values for the 2007-2010 period.)

The last category consists of those countries that are in a virtual standstill. These are Russia, Macedonia and the United Arab Emirates, closing the gap between their actual RES-E share and 2020 targets very slowly or hardly at all.

The red line in the figure (Benchmark 2010) indicates the value (23%) where the countries would stay, if they would approach their target in a linear manner. Countries above this line approach their target faster than they would do if they were to follow it linearly. Countries below this line are in a delay compared to a linear approach.

3.5. Analysis of Feed-in Tariffs in the ERRA member states

3.5.1. Tariff settings in the ERRA member states

Answers to questions related to the support mechanisms revealed that the feed-in tariff is the most frequently used instrument to promote renewable electricity generation applied by ERRA member countries, which is in line with the international trend.[16] Table 7 presents the types of support mechanisms and supported RES-E sources in the countries which provided information on their support systems. FIT is used in 14 countries, often combined with other mechanisms, such as investment grant, supported investment credit, investment tax credit, regulated premium, quota obligation, tradable RES-E certificates, and tendering or bidding systems. In Estonia a regulated premium system is in place, also applied in Slovakia and the

[16] REN 21 Global Status Report, 2011, http://www.ren21.net/Portals/97/documents/GSR/REN21_GSR2011.pdf

Republic of Srpska in combination with feed-in tariffs in the latter two countries. Moldova and the United Arab Emirates determine unique tariffs for individual RES-E investors.

Table 7: Methods of support and supported RES-E types in ERRA countries

Country	Support Mechanism	Supported RES-E
Albania	FIT	Small hydro
Armenia	Supported inv. credit, FIT, quota	Wind, small hydro, biogas
BiH	FIT, RP, quota	Wind, solar PV, small hydro, solid biomass, biogas
Bulgaria	Supported inv. credit, FIT	Wind, solar PV, small hydro, solid biomass, biogas, waste
Croatia	FIT	all
Estonia	RP	Wind, small hydro, solid biomass, biogas, waste
Georgia		
Hungary	Inv. grant, FIT, inv. tax credit	all
Jordan	Inv. tax credit, tender	all
Kosovo	FIT	Wind, solar PV, small hydro, solid biomass, biogas
Latvia	FIT, tender	Wind, solar PV, solar thermal, small hydro, solid biomass, biogas, waste
Lithuania	Inv. grant, FIT, tender	Wind, solar PV, small hydro, solid biomass, biogas, waste
Macedonia	FIT	Wind, solar PV, small hydro, solid biomass, biogas
Moldova	Individual tariffs	
Mongolia	FIT	Wind, small hydro, solar
Nigeria		
Poland	Inv. grant, supported inv. credit, GC	All
Romania	GC	All
Russia		
Serbia	FIT	Wind, solar PV, small hydro, geothermal, solid biomass, biogas, waste, sewage
Slovakia	FIT, RP	Wind, solar PV, small hydro, geothermal, solid biomass, biogas, waste
Turkey	FIT	All
Ukraine	FIT	Wind, solar PV, small hydro, solid biomass
United Arab Emirates	individual tariffs	Wind, solar PV, solar thermal

Note: RP – regulated premium, Inv. – investment, GC – tradable RES-E certificate (green certificate), tender – tendering or bidding system, quota – quota obligation

In Georgia only non-tradable quota obligation is used to promote small hydro power generation, while in Jordan investment tax credit and tendering system are introduced as yet. No support systems are established in Russia and Nigeria up to now. Supported RES-E types vary across countries, probably due to policy considerations aiming to support the exploitation of RES-E sources of relative abundance in the country.

The majority of the countries having a FIT system uses the 'cost plus' method to determine their feed-in tariff levels (9 out of 14), which is usually based on the costs of generating electricity and a reasonable rate of return. [17] The 'avoided damage' method, which takes account of the avoided negative externalities by using renewable sources, is used solely in Hungary, but is currently under revision. The new RES-E regulation to be introduced in summer 2012 will expectedly switch to the 'cost plus' method. Albania, Kosovo and Macedonia use 'international benchmarking' in setting their feed-in tariffs. This policy, usually applied by countries introducing their support system relatively late compared to others in the region, can be an efficient option to attract investments, but if production costs turn out to be higher than in the benchmark countries, the policy targets may not be achieved. Croatia sets feed-in tariffs on the basis of expert consultation suggesting some sort of implicit cost plus approach.

The structures of FIT systems show large variance across the surveyed countries according to the degree of differentiating tariffs along various aspects. Bulgaria and Bosnia have over 30 different tariffs, while Albania provides feed-in tariff only for small hydro generation, although differentiating among facilities given concession before and after 2007. Mongolia, Turkey, Kosovo and Estonia differentiate their tariffs/premium only according to the source of renewable electricity. In the rest of the countries there are examples for distinct tariffs applied according to the RES-E source, technology, capacity, time of commissioning of the generation facility (vintage of plant investment), time of day or season (e.g. peak, off-peak), as well as the domestic/foreign origin of investments, as illustrated by Table 8.

[17] Countries excluded in this analysis are: Montenegro, Azerbaijan, Kazahstan, Kyrgystan, Nigeria, Georgia, Jordan, Moldova, Poland (GC), Romania (GC), Russia, and Saudi Arabia.

Table 8: Basis of FIT differentiation

Country	Basis of differentiaton						
	energy source	technology	capacity	vintage of plant investment	time of day	domestic/ non domestic component	other
Bulgaria	X	x	x				
Estonia	X						
Hungary	X		x	x	x		
Latvia	X		x	x			
Lithuania	X		x				
Poland							
Romania							
Slovakia	X	x	x	x			
Albania	only SHPP			x			
Bosnia	X	x	x				
Croatia	X		x			x	
Kosovo	X						
Macedonia	X		x				
Serbia	X		x				x - existing/non existing infrastructur e
Ukraine	X	x	x			x	
Armenia	X						
Turkey	X			x		x	
Mongolia	X		x	x			

Ukraine has a unique FIT policy in the sense that it rewards generation facilities with larger capacities, despite their lower per unit costs, favouring larger scale deployment of renewable sources.

Countries using feed-in tariffs as a policy tool to foster RES-E developments also grant long-term power purchase agreements to investors, except Slovakia, where the support policy is basically a combination of a FIT and a regulated premium system. Price support systems integrate the costs of FIT into system charges payable by electricity consumers in all cases, while the source of funding additional investment supports are mainly international funds (6 cases), the state budget (4 cases), carbon sales revenues (2 cases) or system charges (4 cases).

The regulatory body authorized to set feed-in tariffs is the energy regulator in Bulgaria, Lithuania, Slovakia, Albania, Bosnia's Republika Srpska, Kosovo, Ukraine (together with the parliament) and Mongolia. In Estonia it is the parliament who sets the regulated premiums, while in Turkey also the parliament determines the FIT levels. The government is in charge of establishing FITs in Hungary (together with the parliament), in Latvia, Bosnia and

Herczegovina, Croatia, Macedonia, Serbia and (the individual tariffs) in the United Arab Emirates.

An interesting result of the survey is that the overall response to the question of whether the FIT or the regulated premium (RP) is subject to an annual adjustment to account for inflation (e.g. by a price index) was ’no’, while the majority of respondents said ‘yes’ to the question of whether their systems are subject to a regular review. It can therefore be assumed that the rapid changes in the market of RES-E technologies and other inputs motivate policy designers to revise the whole structure of their payment systems periodically rather than implement automatic adjustments according to a pre-established formula. The frequency of regular review is 1 year in most countries, in Macedonia it is 3 years, while Turkey and Ukraine do their revisions in every two years.

Four countries: Bulgaria, Estonia, Hungary and Slovakia reported to have their FIT/RP system revised in a non-planned manner in the past 2 years. In Bulgaria the RES-E act was changed in 2011, in Estonia changes in market conditions necessitated the revision, in Hungary the fossil based cogeneration was excluded from the FIT system in July 2011, while in Slovakia the solar PV FIT had to be revised because of a substantial decrease of investment costs.

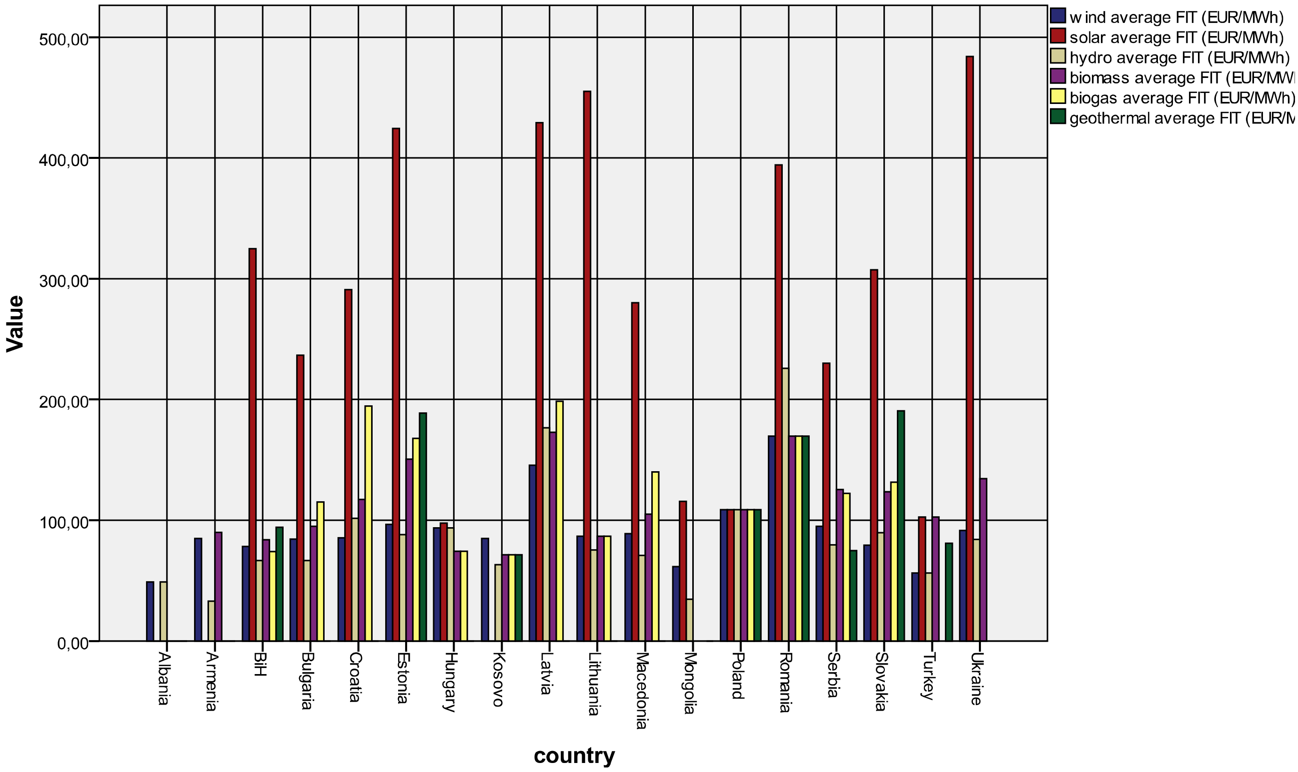
Restrictions on the amount of installed capacity for some supported RES-E technologies exist in Hungary (on wind), Latvia, Croatia and Turkey. In case of limited RES-E development opportunities tenders are organized in Hungary and in Turkey, planned capacity is auctioned in Lithuania, while in Albania, the Republic of Srpska, Croatia, Kosovo, Macedonia, Serbia and Mongolia licences are allocated on a ‘first come first served’ basis – probably due to the fact that in the latter countries no necessary limitations have been incurred as yet.

3.5.2. Tariff levels in the ERRA member states

Figure 13 compares average feed-in tariffs in place in the different countries by RES-E source.[18]

[18] FIT values reported in domestic currencies by the surveyed countries were converted to Euros by using 2011 December 31 exchange rates. In case of countries using a time of day pricing, weighted average FITs by hours/year falling in the different daily periods were computed.

Figure 13: Average FIT levels by technology in the various countries



To be able to investigate the effect of FIT levels on investments in renewable generation, we imputed renewable prices for Estonia, Poland and Romania as well. In the latter two countries, which adopted tradable RES-E certificate systems, we used average certificate of origin/green certificate prices as an approximate for a receivable premium. The premiums were then added to the average electricity prices observed in the relevant period in all three countries.[19] Figure 13 includes these imputed FITs also to illustrate their relative value compared to other countries.

Comparing the level of feed-in tariffs in countries, we can identify countries which pay more and less generous tariffs to investors. The countries having the highest level FITs in case of most technologies are Ukraine, Latvia and Croatia.

To find out whether pricing policies exert influence on the level or the rate of increase of the shares of renewables in electricity generation, we examined the possible impact of FIT levels on the following variables:

- 2010 capacity of different RES-E types / 2010 total RES-E capacity,
- 2010 RES-E delivered to the grid / total amount of electricity fed to the grid in 2010,
- annual change of RES-E capacity share in total capacity between the year of introducing renewable support policy and 2010,

[19] For Estonia the average electricity price in the Estonian Price Area of the Nord Pool Power Exchange was used for the calculations (average price of 2011 December), while for Poland and Romania we drew on the average monthly prices of certificates of origin/green certificates and average electricity prices published by the 2011 December monthly reports of the Polish Power Exchange and OPCOM.

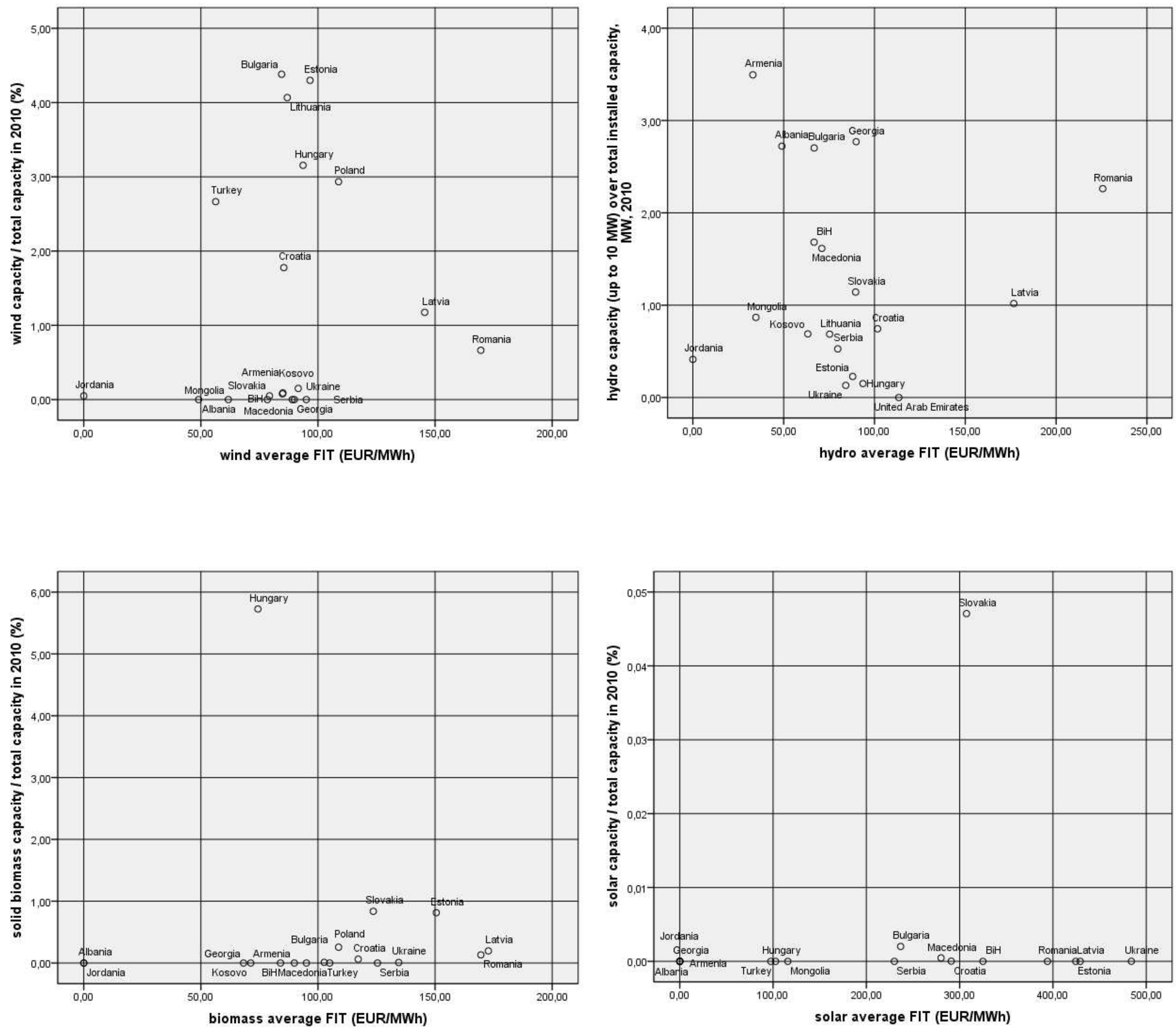
- annual change in RES-E delivered to the grid as a share of total electricity generation, from the first year of introducing renewable support mechanisms until end of 2010.[20]

Because renewable sources were basically non-existent before introducing support mechanisms in most countries, variables related to the annual change in capacity and generation share show very similar patterns to those of current RES-E shares. Overall, one basic conclusion can be drawn from all the results; neither the absolute levels of installed capacity and generated electricity shares of RES-E producers, nor the yearly evolution in these variables showed relationship with the level of RES-E tariffs. In Figure 14 the two first charts present capacity shares of wind and small hydro based electricity (in total production in 2010) as a function of FITs, while the lower two charts depict RES-E generation shares of solar and biomass sources at the corresponding FIT levels.[21]

[20] The source of data for the years of introducing support policies is Enerdata.

[21] For some countries data on biomass capacity was more difficult to obtain than data on biomass-based generation, because of the varying extent of co-firing biomass and coal in coal-fired power stations.

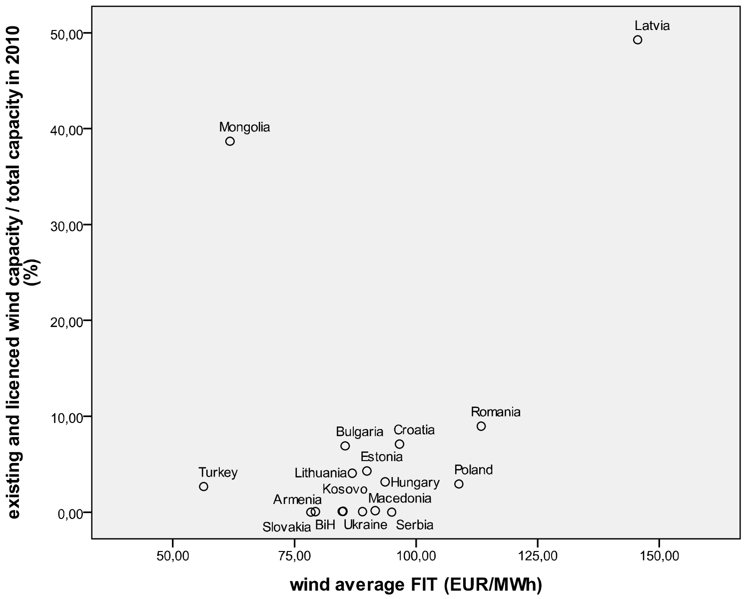
Figure 14: Capacity shares of wind and small hydro, and generation shares of solar and biomass RES-E as a function of FIT levels



We checked whether the slower spread of RES-E generation in spite of higher FIT could be explained by the fact that some countries have started to support renewables earlier than others, but there was no significant difference among countries according to policy introduction dates. EU membership is related to more investments in case of wind, biomass and biogas – not controlling for other explanatory variables – suggesting that compulsory RES-E targets might play a significant role in policy implementation.

Respondents also gave information on the amount of capacity by different RES-E types that have received licence, but were not yet put in operation by the end of 2010. By incorporating these amounts we find that installed capacity will increase in the near future altogether for all types of RES-E sources, but it is again mainly independent of FIT levels. In case of wind, however, the high FIT of Latvia induced a great amount of capacity increase, and Romania's wind capacity also show a rising trend as a result of the relatively higher price investors can receive in the market. On the other hand, significant developments will be realized also in Mongolia and Albania. Albania is not included in the chart because it does not have a FIT determined for wind energy yet, albeit according to the data they provided the amount of wind capacity they have already granted licences for reaches as much as 83.62% of their total capacity in 2010.[22]

Figure 15: The share of existing and licensed but not yet operational wind capacity as a function of FIT levels determined for wind electricity



Taken all these factors together, these findings do not suggest a direct relationship between FIT levels and RES-E penetration, as one would suppose in a global market for RES-E generation, suggesting that other aspects of the regulatory policy, as well as local conditions and cost structures (e.g. rate of return components incorporated in FIT calculations) are also crucial determinants of the pace of RES-E development.

3.6. Explaining RES-E growth – an indicator analysis

Hypothesis 4 suggests a close connection between good regulatory practices and RES-E penetration levels. This connection is difficult to measure, as good regulatory practice has various dimensions.

The aim of widely used renewable production support schemes is to speed up the deployment of these technologies. The regulator is mandated to design a regulatory environment that ensures the flow of sufficient investment into the sector to meet RES-E

[22] The Albanian government provides an attractive investment climate with their present tax policy, luring mainly Italian investors to build large capacity wind farms on the coastal area of Albania, with transmission lines reaching to Italy. (http://www.thebioenergysite.com/news/4435/albania-to-build-major-wind-farm).

utilization targets (effectiveness). On the other hand, the stated targets should be achieved at least possible cost so that electricity prices do not increase limitlessly due to RES-E support (efficiency). This is especially important in countries experiencing energy poverty, at the same time it is getting more and more attention in EU countries with high RES-E penetration levels (see section 2 for details).

Proper investment climate means transparency, consistency, credibility and (a certain level of) stability of regulatory rules for market participants. As of today almost all RES-E technologies need operational support to survive in the market, its level and predictability is a dominant factor in the financial viability of such projects. Stability – however - should be pursued with respect to the efficiency criterion: the support level should follow the decrease of production cost due to technology development. Flexibility i.e. the option to align support level with production cost needs to be incorporated into the design but such adjustments should comply with pre-announced conditions. Non-planned adjustments undermine the credibility of any support scheme.

An additional hallmark of good regulation is the possibility of easy, inexpensive and non-discriminatory entry for RES-E developers to the electricity market. The cost of entry is, on the one hand, the actual administrative cost of licensing, on the other the duration of the whole licensing procedure. The indicators most often used in this respect are the project lead time and the number of authorities involved in the procedure. A 'one-shop' licensing is a good solution for streamlining the licensing procedure but so far only few countries has introduced it (e.g. Germany).

According to these considerations, the questions of the survey have been grouped along two dimensions (Table 9). First, we have allocated them to three main principles: 'transparency', 'consistency' and 'easy entry'.[23] It should be noted that these three groups, just as well as the allocation of the questions from the survey is somewhat arbitrary as many issues contribute to more than a single principle. Those in yellow boxes are explicitly allocated to two groups. The second dimension is more straightforward as it groups the question according to the regulatory area important to RES-E producers: licensing, grid connection and the level and setting of operation support (FIT/premium or green certificate).

The answers for each question used in the analysis have been assigned a value of 1, zero (0) or -1 where positive values mean a positive regulatory practice, while negative values mean a negative assessment of the answer in question. Missing values or ambiguous answers were assigned zero value. It should be noted that not all questions have been incorporated in the analysis. Some questions were omitted due to the homogeneity of the answers. E.g. as one shop practice is not introduced in any of the ERRA countries, it would not explain any differences in the RES-E penetration. Similarly, we have excluded variables that capture similar characteristics of the regulation. E.g. we have selected the 'overall lead time' variable as a single proxy to the length of licensing procedure. The evaluation of the variables are included in Table 10 (positive, neutral and negative answers) together with the reference to the questionnaire (question number. e.g. B3Q7 – Block 3 Question no. 7). The last column ("Note") gives a brief explanation for the assignment of values, with reference to the qualities of 'good regulation'.

[23] We are using the short form of these principles, as 'consistency' also includes factors connected to credibility and stability, while 'easy entry' also includes flexibility of the regulation.

Table 9: The allocation of support scheme characteristics among the three main principles

	Licensing/target setting	Grid	Tariff and GC
Transparency	legal remedy GO certification	connection rules technical standards allocation of connection capacities	capacity allocation FIT/premium/GC setting mandate
Consistency /credibility/ stability	RES-E target lead time	balancing responsibility	non-planned revisions
Easy entry and flexibility	capacity threshold for RES-E licensing	technical standards priority network access	eligibility period regular tariff review tariff level

Table 10: The evaluation scheme of the questionnaire

	short reference	Question	Evaluation			Note
			positive	neutral	negative	
Licensing / target	legal remedy	B2Q11	court		ministry or regulator	Court are independent bodies, whereas ministries and the regulator might be involved in the decisions.
	GO certification	B2Q12	+		-	Guarantee of origin certification improves transparency.
	RES-E target	B1Q6	+		-	The adoption of RES-E target is an important push for the market.
	lead time	B2Q9	less than 9 months		more than 9 months	Long overall lead time (from project initiation to operation) undermines the credibility of the system.
	capacity threshold for RES-E licensing	B2Q1	+		-	The existence of capacity threshold below wich no lincence is required supports decentralised RES-E production.

	short reference	Question	Evaluation			Note
			positive	neutral	negative	
Grid	connection rules	B3Q4	regulator	grid operator	no rules or case-by case	The regulator is an independent body for setting connection rules, whereas the grid operator is a party in the connection contract. Good regulation is not reconciable with having no rules or applying it in a case-by-case basis.
		B3Q5	regulator or tender	negotiated	grid operator	The cost of connection set by the regulator or via tender is preferrable from a regulator point of view to negotiated cost allocation. Setting it unilaterally by the grid operator is a possible source of discrimination.
	technical standards	B3Q7	+		-	The non-existence of technical standards for connection creates uncertainty for investors and it is a possible source of discrimination.
	allocation of connection capacities	B3Q8	tender		first come, first served	Tenders are more transparent and efficient allocation modes than allocation based on the date of application.
	balancing responsibility	B3Q10/2	within RES-E group		plant-by-plant	Joint balancing in the RES-E group eases the balancing requirement and hence cost for individual producers as opposed to plant-by-plant balancing.
	priority network access	B3Q1	+		-	Priority network access provides guaranteed takeover the produced RES-E and hence significanty reduces market risks.

	short reference	Question	Evaluation			Note
			positive	neutral	negative	
FIT/premium/GC	capacity allocation	B4Q14	tender/auction		first come, first served	Tenders are provide more transparent and efficient allocation modes than allocation based on the date of application.
	FIT/premium/GC setting mandate	B4Q5 and B4Q15	parliament or regulator	other	government or ministry	Parliament or regulator mandate
	non-planned revisions	B4Q12c	-		+	Non-planned revisions undermine the credibility of the support system.
	eligibility period	B4Q11	differentiated	uniform	case-by-case	Eligibility period differentiated by technology is more efficient than uniform period as it is likely to factor in the cost differences among the technologies. Case-by-case determination is prone to discrimination.
	regular tariff review	B4Q12a	+		-	Periodical adjustment is a planned and normative modification of the support level and as such it lowers the risk of unplanned interventions.
	FIT/premium/GC level	B4Q6	from 1 to -1			Higher FITs attract more investment.

***FIT level (B4Q6): In four categories (solar, wind, biomass and hydro) the level of FIT has been assigned a score, according to their distance to the maximum and minimum FIT levels in the group of analysed states. Minimum value got -1, while maximum values got +1 value. After receiving these scores, the combined FIT value for each country was calculated as the arithmetic average of the four scores.**

We have created - for each country - a 'transparency', a 'consistency' and an 'easy entry' indicator assigning equal values for the Licensing/Grid/FIT dimensions (each of them calculated as the average of the values in the cluster).[24]

In addition, we have tried to assess whether these three composite indicators align with the effectiveness of the support scheme. For effectiveness we have used the ratio of RES-E capacity growth between 2007 and 2010 to the total 2007 electricity generation capacity of the country (source: Enerdata). This method is similar to what is applied in IEA 2008, Deploying Renewables study.

The results suggest that proper regulation is generally associated with effective support policy outcomes i.e. higher new RES-E capacity in the 2007-2010 period, in the case of all three indicators (transparency, consistency and easy entry) (Figure 16, Figure 17 and

Figure 18). This is equally true for our 'overall' indicator that combines all questions used for the three principle indicators (

Figure 19). Turkey outperform in terms of RES-E investment compared to the relative 'goodness' of its RES-E regulation. This is especially surprising considering the relatively low FIT levels (see section 3.5). The reasons behind are likely to include the strong commitment of Turkey to decrease its dependence on Russian gas, accompanied by its high renewable potential. As far as the most rapidly increasing technology, wind is concerned additional factors behind this successful investment attraction might be the public ownership of most land that are potential sites, the involvement of additional funding sources beyond FIT (carbon standards fulfilling voluntary demand for RES-E) and the plan of the Turkish government to become net RES-E exporters (as Turkey has joined ENTSO-E recently).

Estonia is another country in similar position. The RES-E support scheme has been changed in Estonia in a non-planned manner due to the price effect of the relatively high RES-E capacity growth (4.9% between 2007 and 2010, compared to total 2007 capacity). In this case, again, the high growth rate was achieved in spite of the relatively low FIT level. Bulgaria has gone through similar cutbacks, hence scoring low in consistency (Figure 17). They have higher RES-E rates than the 2010 regulation score would explain as they are in the

[24] The number of countries included in the analysis varies in the different graphs as we had to omit those with many missing values.

process to slow down the speed of RES-E penetration. As the target analysis shows (see section 3.5) Estonia has already achieved its 2020 RES-E target.

There is a group of countries, notably Macedonia, Bosnia and Herzegovina, Ukraine and Albania that are outliers in the opposite direction i.e. having lower RES-E investment growth that would have been predicted by their relatively good regulatory practices. The common feature of Macedonia and Albania is the large share of hydro capacities in their overall electricity generation portfolio (36%, 99% and 53% in 2007, respectively) (Enerdata). This - coupled with the lack of EU driven target and the not too favourable general investment conditions (BB, B+ and B country risk rate, respectively) - seems to outweight the effect of their overall good regulatory practices. Ukraine has introduced its renewable support scheme only in 2010 and its positive effects on investment remains to be seen. (**Table 21** with the exact scores of the countries could be consulted in the Annex)

Figure 16: The transparency (horizontal axis) and the effectiveness indicator (vertical axis) in various countries

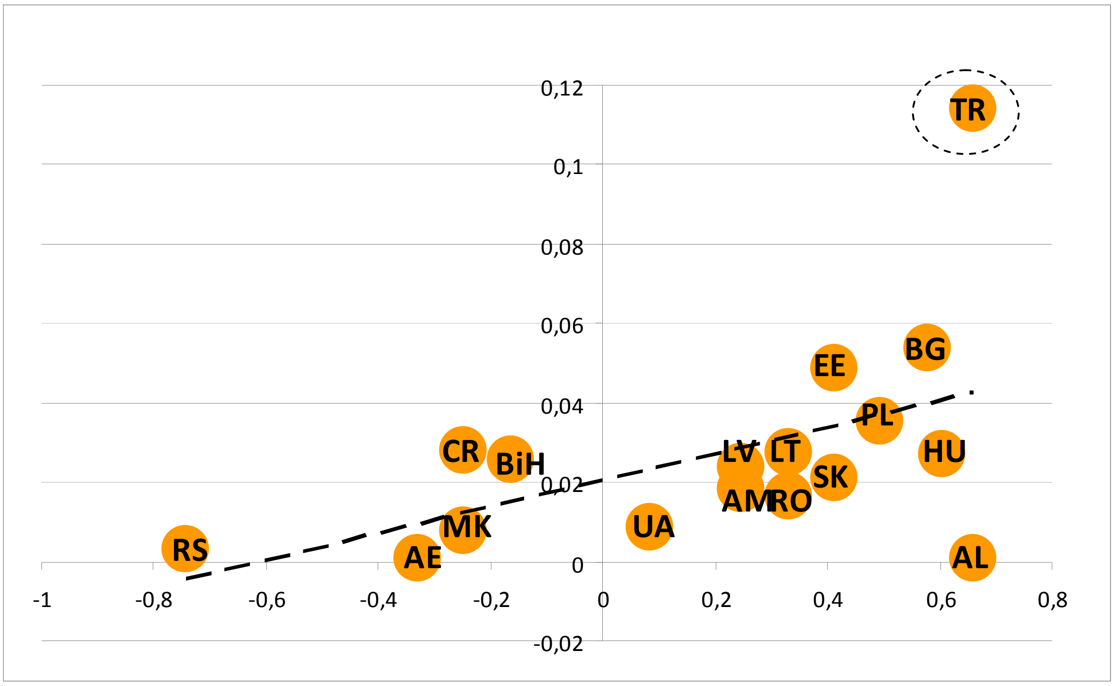


Figure 17: The consistency/credibility/stability (horizontal axis) and the effectiveness indicator (vertical axis) in various countries

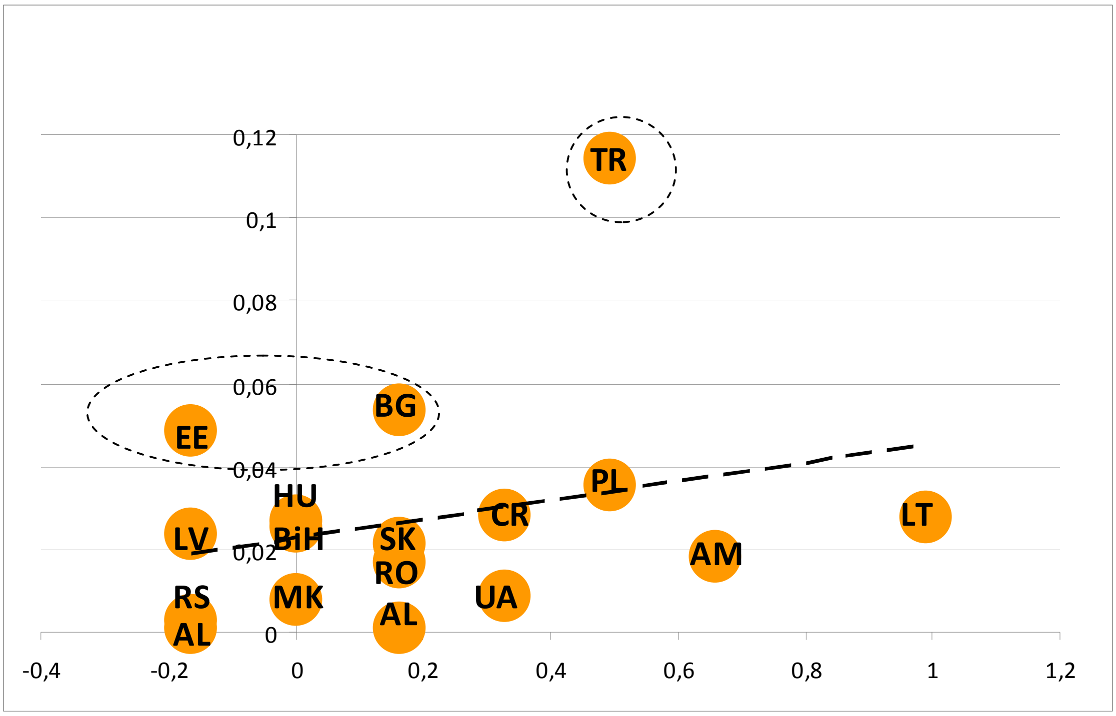


Figure 18: The easy entry/flexibility (horizontal axis) and the effectiveness indicator (vertical axis) in various countries

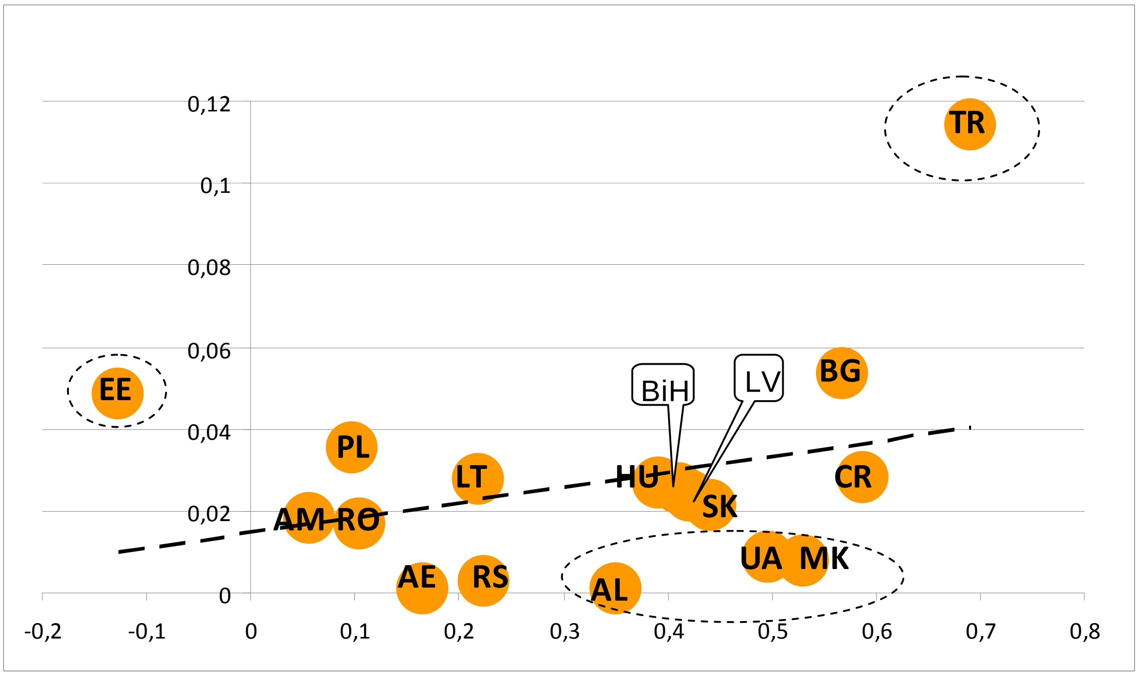
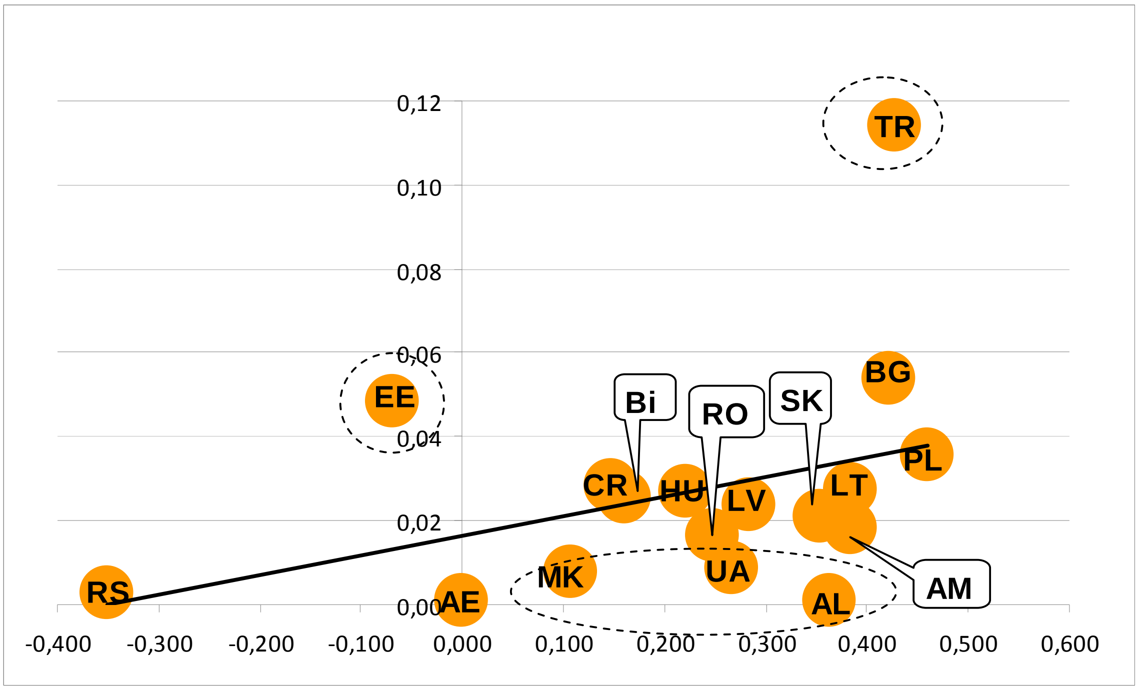


Figure 19: The scores of the overall indicator (horizontal axis) and the effectiveness indicator (vertical axis) in various countries



In sum, countries below the trend lines have smaller penetration, than their regulation practice would imply. Thus other factors, that are not included in the calculated indicators (most probably the attractiveness of the country for foreign investors) would explain their performance. If their policy is to increase their RES-E penetration, the first steps should be taken outside the regulation side. In contrast, countries that are above the line (e.g. Turkey) have their regulatory side underdeveloped compared to their performance. In other words, their development was mainly driven by the abovementioned external factors: investment environment, security of supply considerations etc. In this case improving the regulatory side, wherever the indicators suggest (transparency, consistency or flexibility) would give the opportunity to further enhance their RES-E performance further.

3.6.1. Regression analysis

The soundness of the previously built indicators was only checked intuitively, by visually checking if the positions of the countries in the coordinate system are reasonable or not, whether we could trace a logical pattern in their location. But the validity of these indicators could be further checked with the help of a regression analysis, where the sign and significance level of these variables can be tested in interactions with other explanatory variables.

As the literature suggests, the most important drivers of RES-E investments are the investment environment of the country, the regulation of the RES-E promotion system and the level of support/rate or return given to the various renewable technologies.[25] We have

[25] For a recent paper on the PV investment impact see Lüthi, Wüstenhagen –The price of policy Risk (in: Energy 2011), and Campoccia et al: Comparative analysis of different supporting measures for the production of

tested the linkage between these factors and the penetration level of RES-E technologies with an OLS regression method (Table 11). The dependent variable is the capacity increase of the RES-E technologies of the various member states (CAP_GR) between 2007 and 2010. This time horizon is quite short, but there is no reliable information available on the 2011 values yet, and using earlier years values would not help neither, as many of the ERRA members had no RES-E capacity installed before (with the exception of hydro). Additionally, with one exception (Serbia- which launched support scheme in 2010) RES-E support systems were already in place in all analyzed countries.

For the three drivers mentioned before various alternative variables and models were tested. As the number of observation is limited to 17, in the model we tried to identify the most influential variable for each of the 3 drivers. At this number of observations, including more than three explanatory variables would certainly yield non-significant variables, so we tried to limit the analysis to include only one variable for one driver.

For the regulatory dimension we have tested for the calculated three indicators (transparency, consistency and easy entry) as well as the overall indicator. Amongst them the transparency indicator yielded the highest significance level followed by the compounded indicator but with a smaller significance.

For the investment environment various variables were tested individually: average GDP growth in the period, average annual electricity consumption in the period, the Standard & Poor's sovereign debt rating index (scaled to a 1 to 6 dimensional rank[26]), and the electricity producer prices of the selected countries, as various proxies for the country's attractiveness for investors. Amongst these variables the consumption level and the producer price had the expected sign and were significant, the latter having the highest significance level.

For the feed-in tariff variable, a weighted FIT level was used, where the weights were the share of each technology in the additional capacity installed in the sample countries between 2007 and 2010. It must be noted that premiums were converted to FIT by adding the producer prices of the countries to the premiums for reasons of comparability. In the case of Romania and Poland, where a green certificate systems are in place, the average price of the green certificates were used, as in most period RES-E quota price prices stayed at that level. Another variable, the net present value (NPV) of a unit investment in the given technology (which also considers the eligibility period) was also tried in the tests.

The various levels of RES-E penetrations of the selected 17 ERRA member countries are explained by the following three variables in the statistically most significant model:[27]

- TRANS – the transparency indicator of the previous section,

electrical energy by solar PV and Wind systems: Four representative European cases (in: Solar Energy 2011)

[26] An additional ranking was also checked: 1 for the BBB category, as this is the starting category for investment recommendation, 0 for B and 0.33 for BB, 2,3,4 for the A,AA and AAA categories accordingly.

[27] These are: Albania, Armenia, Bosnia (Federation BiH), Bulgaria, Croatia, Estonia, Hungary, Latvia, Lithuania, Macedonia, Poland, Romania, Serbia, Slovakia, Turkey, Ukraine, United Arab Emirates

- PRODPR –producer price levels of electricity (in EUR). This variable used as a proxy for country attractiveness from investors' point of view.
- FIT_WEIGHT: the FIT levels of the sample countries weighted with the RES-E capacity added in 2007-2010 in these countries i.e. hydro (53 %), wind (42%) and biomass (5%)

Table 11: Output of the regression analysis

Dependent Variable: LOG(CAP_GR)				
Method: Least Squares				
Sample (adjusted): 1 16				
Included observations: 14 after adjustments[28]				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-7.333706	3.377328	-2.171452	0.0550
TRANS	1.097044	0.513469	2.136536	0.0584
LOG(PRODPR)	1.405245	0.296314	4.742422	0.0008
LOG(FIT_WEIGHT)	-0.286652	0.585180	-0.489853	0.6348
R-squared	0.800302	Mean dependent var		-3.991196
Adjusted R-squared	0.740393	S.D. dependent var		1.279444
S.E. of regression	0.651898	Akaike info criterion		2.217100
Sum squared resid	4.249713	Schwarz criterion		2.399688
Log likelihood	-11.51970	F-statistic		13.35854
Durbin-Watson stat	1.947352	Prob(F-statistic)		0.000785

As the results indicate, the Producer Price indicator (PRODPR) and the Transparency indicator (TRANS) are highly significant and show the expected positive sign. FIT level (FIT_WEIGHT) – on the contrary - is not significant and has a negative sign which is the opposite of what one would expect. This result is in line with the FIT analysis in section 3.5, i.e. that FIT levels do not correlate with RES-E penetration levels. Our hypothesis is that as our FIT level variable is a weighted index of the three most important RES-E technologies and the weighting scheme spoils the statistical relationship. We tried to test for individual RES-E technologies as well but the number of observations fell dramatically.

As for the coefficient levels it can be said that the Transparency indicator has a positive coefficient of +1.09, suggesting strong and significant effect. In this case rather the significance level what is of interest for us to check if it keeps its explanatory power and sign in interconnection with the other variables. The Producer Price coefficient (expressed in log-log term) is higher than 1, suggesting strong connection between the Producer Price and RSE-E capacity growth. This variable was used as a proxy for the attractiveness of investment in electricity generation.

[28] Bosnia (Federation BiH), Macedonia and United Arab Emirates were left out by the program due to missing data.

3.6.2. Key messages of the indicator and regression analyses

The RES-E growth analysis and the regression model analysis underline the validity of our Hypothesis 4 suggesting that good regulatory practices play an important role in explaining higher RES-E penetration in the ERRA member states. Both analyses (the indicator and the regression analysis) show positive and significant connection between good regulatory practices and RES-E capacity growth in the examined period of 2007-2010. Amongst the analysed regulatory principles, the transparency principle showed the highest correlation with RES-E growth. This is probably due to the fact that our consistency variable already includes the changes of some EU member states (e.g. Estonia and Bulgaria) that have already started to change their regulatory regime in order to slow down the uptake of certain RES-E technologies, resulting in a more mixed picture along this dimension. Concerning the easy entry/flexibility dimension of our analysis - including the level of support as well - suggests a weaker correlation. As this principle includes tariff level and the regression as well confirmed that tariff level does not explain RES-E growth, our Hypothesis no. 1 does not seem to be supported. This is a strong message from our analysis that higher support levels (FITs or premiums) do not seem to be correlated with higher RES-E penetration, so this price instrument might not be as determining in the region as the literature suggests and as we previously assumed. This linkage will be further explored in the next section.

3.7. Specific regulatory items

3.7.1. Sharing the cost of grid connection

The cost of connecting the RES-E production unit to the grid is an important factor in investment decisions, especially in case of smaller units. The cost of the connection of a new RES-E generator consists of three elements. First, the connection cost that comprises the installation of cables and potential modification of transformer stations, up to the connection point to the power grid. The second element is the reinforcement of the grid to be able to accommodate the increased load. The third cost element is the investment into regulating power plants that increase system flexibility for the massive RES-E uptake such as flexible gas-fired generators or various energy storage facilities (e.g. pumped-hydro plants or compressed air storages).

The sharing of connection and grid update cost depends on the national regulation. A deep cost allocation means that the renewable energy producer covers both the cost of grid connection and any necessary reinforcements to the grid. A shallow cost allocation requires the renewable energy producer to pay for the cost of connection only. In this model – used in most European countries - it is the DSO who pays any grid reinforcements. These costs are often passed on to the consumers in their electricity bills. The major advantage is that it does not constitute a high barrier to entry for the renewable generator and - as connection costs are often 6-10% of the total investment cost – it helps the spreading of this new form of generation (EWEA, 2010). Additionally, connection costs are more transparent and it is easier for the DSOs to develop and apply consistent cost determination rules and guarantee non-discriminatory access to the grid. It, however, does not provide any locational signal to the potential RES investors.

The questionnaire has been compiled on the assumption that ERRA countries are using the shallow cost approach and the aim of question B3Q6 was to see whether cost sharing is based on normative regulation and whether there are variations in applying the shallow cost approach. It is important to note that the actual cost of allocation is as a general rule calculated by the network operator. The majority of the countries analysed (a total of 23 countries answered this question) has rules on cost sharing that apply to all RES-E producers.[29] Bosnia is an exemption (BiH) as it is regulated by the contract between the RES-E producer and the network operator. From the remaining 22 countries 17 requires the connection cost to be paid fully by the producer. In Ukraine and Jordan this cost is covered by the network operator which is quite generous for RES-E producers, on the other hand makes them completely indifferent for its cost (e.g. starting up a unit far from the grid) that will be spread among the electricity consumers.

Some countries give preferential treatment to smaller units. In Poland the producer pays only 50% up to 5MW, above this threshold they pay the full cost of connection to the grid. In Lithuania RES-E developer pays 40% of the cost if the installed capacity is 350 kW or more, 20% between 30 and 350 kW and nothing if capacity is less than 30 kW.

In Hungary, for example, RES-E producers pay 70 % of costs necessary for connection on the public network's side of the connection point designated on the existing network, if the renewable share of the fuel is no less than 70 %, but they pay only 50 % if it's minimum RES content is 90 %. Nevertheless they pay 100 % of costs of necessary network assets of the „generator – connection point" section.

3.7.2. RES-E forecasting and balancing regulation

The analysed countries apply a wide range of practices in RES-E production forecasting. In theory plant operators, TSOs and DSOs could be responsible but this process could also be a shared responsibility of the earlier market participants. As the responses show (we received 24 responses to this question - B3Q9) this responsibility is most often allocated to the TSOs or plant operators (7-7 responses).[30] In Bosnia – as an exception - the DSOs are responsible for RES-E forecasting. Slovakia and Bulgaria use a mixed system. In Slovakia plants above 1 MW capacity do their own forecasting, while under this size the DSO is responsible. In Bulgaria both TSOs and DSOs are involved in this activity. Interestingly, even in the EU the practice is very heterogeneous showing the practical applicability of various methods.

Similarly heterogeneous is the method applied in the handling of the balancing needs (B3Q10). One of the most important factors concerning balancing from the RES-E development point of view is the method of accounting for the deviation of scheduled and

[29] Countries excluded in this analysis are: Montenegro, Azerbaijan, Kazahstan, Kyrgystan, Nigeria and Saudi Arabia.

[30] Countries excluded in the analysis of this question are: Azerbaijan, Kazahstan, Kyrgystan, Kosovo, Montenegro, Nigeria and Saudi Arabia.

real production. As many RES-E technologies cannot follow the load, their deviation could be significant. If this deviation implies a high level of penalties, it could prove an excessive burden on the shoulders of the plant operators, mainly if they are small distributed units. One solution to overcome this problem is to group certain RES-E technologies together and account only for the net deviation of the group, and pay a penalty (if any) only for this net deviation. As the deviation from the schedule from many plants will cancel out important part of the gross deviations, it could significantly reduce the burden of the individual plants. Additionally, applying the net deviation rule does not sacrifice system reliability, as from this point of view the net deviation is what matters.

In spite of this consideration, not all ERRA members apply the net deviation rule for balancing. Out of the 24 respondents only five does so, while nine still applies it on a plant level. Four out of the five countries are EU member states suggesting that EU members are more willing to apply this tool compared to other members. It has to be noted however, that its positive effects apply only if the RES-E portfolio consist of significant number of plants. So applying the rule when the number of producers is limited is less advantageous for the companies.

4. Case study of the RES-E promotion system of the Czech Republic

4.1.Description of the Czech electricity sector

Electricity demand, generation and fuel mix

In the last seven years gross electricity consumption has been fluctuating – in line with economic growth – around 70 TWh while net consumption is around 60 TWh in the Czech Republic (Table 13). According to the NREAP (National Renewable Action Plan) forecasts, electricity consumption is projected to grow on an average 1.9% between 2010-2020.[31]

In 2010 there were 13,301 electricity generation licensees supervised by the energy office, ERU.[32] There are 24 large power plants (>50 MW) and 101 generators with built in capacity between 5 – 50 MW.[33]

Table 12: Installed capacities in the Czech Republic 2008, 2009, 2010 December 31 status, MW[34]

	2008	2009	2010
Thermal power plants	10685	10720	10769
Combined and simple cycled gas turbines	898	935	1024
Nuclear	3760	3830	3900
Hydro	2192	2183	2203
Wind	150	193	218
Solar	39	465	1959
Total	**17724**	**18326**	**20073**

Regarding the ownership structure of the generation portfolio the Czech electricity market is highly concentrated with one majority state-owned company, CEZ, owning almost 60% of the capacities, including all nuclear, more than 50% of the thermal plants, and the majority of the hydro plants. It does not have significant stake in other RES-E generation (PV: 18.9 MW, wind: 0.1 MW, no information on biomass co-firing). Besides CEZ there is no other player with a significant market share (i.e. above 3%). Foreign capital is present in power generation, but due to the small size of investment opportunities, this presence was limited.

[31] The National Renewable Energy Action Plan (NREAP) is a governmental action plan to fulfill the EU RES targets of a given EU member state.
[32] The 2010 report on the activities and finances of the energy regulatory office (p.47)
[33] ERU statistics
[34] ERU statistics

In 2010 total gross electricity generation was 85.9 TWh, and more than half of it was supplied by coal fired thermal power plants. The second most important source is the two nuclear power plants providing almost one-third of gross generation. Natural gas is relatively a less important fuel, while generation of renewable sources – in line with the increasing capacities - has a growing share over time. It amounts to 7.5% of gross generation and 9% of gross consumption in 2010.

Table 13: Electricity mix between 2005 and 2010, GWh[35]

		2005	2006	2007	2008	2009	2010
Gross electricity generation	Coal	N.A.				45 672	46 951
	Natural gas					3 903	4 231
	Nuclear					27 208	27 998
	Hydro					2 983	3 381
	Other RES					2 228	3 062
	Other non-RES					257	287
	Total	**82 579**	**84 361**	**88 198**	**83 518**	**82 250**	**85 910**
Self consumption (incl. consumption of pumped storage)		7 254	7 423	7 378	6 910	7 007	7 240
Net import		-12 634	-12 631	-16 153	-11 469	-13 644	-14 948
Export		24 985	24 097	26 357	19 989	22 230	21 591
Import		12 351	11 466	10 204	8 521	8 586	6 642
Network losses		5027	4885	4915	4662	4487,4	4466,5
Net consumption		**57 664**	**59 421**	**59 753**	**60 478**	**57 112**	**59 255**
Total electricity consumption		**69 945**	**71 729**	**72 046**	**72 050**	**68 606**	**70 962**

Export/import capacities

The Czech Republic is surrounded by five neighbouring systems in four countries.[36] In theory connecting cross border capacities allow the country to export or import around 25 TWh[37] of power, which is 25% of gross domestic consumption. Indeed, thanks to its cheap generation capacities and its geographical position, the Czech Republic is a significant exporter. The usual direction of commercial flows is importing from Poland and exporting towards Austria, Germany and Slovakia. Its net export since 2005 was in the range of approx. 11.5 – 16 TWh which is around 13.7% - 18.3% of gross energy generation (See Table 13). With this export the Czech Republic is the third largest electricity exporter in the EU.

[35] ERU statistics
[36] Germany has two TSOs bordering the Czech Republic.
[37] The Czech Republic's national report on the electricity and gas industries for 2010, July 2011. p. 19.

Transmission and distribution

CEPS is the sole transmission system operator in the Czech Republic and it is controlled by the government. Regarding its relations with other market players, CEPS can be considered as an ownership unbundled TSO. However, it has to be noted that the majority of the largest electricity company, CEZ is also owned by the government. There are three regional distribution network systems, they are directly connected to the transmission network and are controlled by E.ON, PRE (owner: over 70% EnBW, Germany, serving the capital, Prague), and CEZ Distribuce (which distributed almost two-third of all electricity in 2010). To these an additional approx. 297 smaller local DSOs connect. The retail market faces increased competition since 2008, when a number of independent traders also started to compete with the incumbents for consumers on the low voltage level. As a result, around 4% of the consumers switched distributor in 2010.

Wholesale and retail market

The Czech electricity market is fully liberalized since 2006. Electricity price is market based. In 2010 there were 321 entities holding a trading license.[38] Traders can either trade through the electricity exchange –Power Exchange Central Europe (PXE), or through the spot and OTC markets organized by the market operator OTE, and also through bilateral negotiations. Trading possibilities and liquidity is further enhanced by the coupling of the Czech day ahead market with the Slovakian one since September 2009.[39] The overall trading on OTE spot markets has been increasing over the years, currently it accounts for around 10% of domestic demand. The overwhelming majority of the trades are still conducted under bilateral contracts, the value of which amounted to 106.17 TWh in 2010.[40]

In the Czech retail market there are three vertically integrated incumbent companies, PRE, CEZ and E.ON, whose subsidiaries hold a license for both, electricity distribution and trading. There are around 30 active traders that also operate on the retail market, which mainly supply large industrial consumers. Since 2008 some independent traders also started to compete with the incumbents for consumers on the low voltage level, by the end of 2010 their numbers increased to around 20. As a result in 2010 more than 241,000 customers have switched supplier on the low voltage level (of these 184,000 were households) accounting for 4% of all customers connected at this voltage level. Altogether 250,000 customers have switched in 2010. Despite of the increase in supplier switching and

[38] The 2010 report on the activities and finances of the energy regulatory office, p. 47.

[39] Hungary and Poland are also in the process of joining this market coupling process with a proposed date of 2014. According to latest news Romania also expressed its intention to join the process.

[40] The Czech Republic's national report on the electricity and gas industries for 2010, July 2011. p. 23.

competition development, the share of the three incumbent companies among consumers at the low voltage level is still more than 90%.[41]

4.2. RES-E production, the existing policy and opportunities of investments

The Czech Republic showed a hectic RES-E development path in the last four years. Installed RES-E capacity not including hydro in the Czech Republic reached almost 2.5 GW, representing 11.7 % of the total capacities[42]. 2009-2010 saw an unprecedented growth rate in solar PV capacities. In 2010 1.5 GW new PV capacities were installed in the country, with this capacity installation it ranked third amongst the fastest developing national markets on the global PV market in 2010. By 2011, it disappeared from the global PV map, it installed only 10 MW.[43]

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Table 14 Generation of RES-E between 2001 and 2010

Production (GWh)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Hydro*	2054	2492	1383	2019	2380	2550	2089	2024	2429	2791,3
Wind	0,2	1,6	4,6	9,9	21,3	49,4	125,1	244,7	288,1	335,5
Solar	0	0	0	0,1	0,1	0,2	1,8	12,9	88,8	615,7
Biomass**	713	689	497	720	738	927	1202	1459	1857	2171
Geothermal	0	0	0	0	0	0	0	0	0	0

* Including small and large hydro
**Source Enerdata: Biomass based electricity production

Capacity (MW)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Small Hydro*	79,03	105,17	110,49	114,8	115,21	122,44	128,18	131,56	135,39	140,25
Wind	3,39	6,97	8,19	11,49	34,41	44,5	117,52	149,71	192,86	214,78
Solar	0,01	0,01	0,02	0,12	0,15	0,35	3,4	65,74	462,92	1952,7
Biomass**	9	9	160	160	160	160	160	160	160	160
Geothermal	0	0	0	0	0	0	0	0	0	0

* Including Hydro PP under 1 MW
**Source Enerdata: Biomass based electricity production

4.2.1. Description of the Czech FIT - premium market

Major step of CZ FIT - market

A non-obligatory FIT scheme was introduced as early as 2002 in the Czech Republic reflecting the EU legislation (Directive 2001/77/EC). However, before 2004 the Czech RES-E system had been characterized by low RES-E penetration. Act 180/2005 on Renewable Energy Support

[41] The Czech Republic's national report on the electricity and gas industries for 2010, July 2011. p. 6., p. 23-24.
[42] Including the estimated capacity of co-fired biomass
[43] Source: EPIA Market Report 2011

introduced a system with a mix consisting of a feed-in tariff and a green bonus (sometimes called green premium) scheme. For details on the operation of this mixed system see the next section.

In 2008 minor changes took effect in the support scheme, mainly concerning technical parameters for calculating the yearly tariff/bonus levels (e.g. typical lifetime, representative utilization period).

In 2009 the premium system was also extended to the combined heat and power generation, and to secondary sources (e.g. landfill and mine gases).

2010 and 2011 brought more abrupt changes to the system, mainly due to the steep uptake of PV capacities and the resulting pressure on the prices paid by end-consumers. By the end of 2010 PV capacities reached almost 2 GW (representing 10 % of total capacities), generating additional upward pressure on end-user prices. For 2011 the price increase would have reached the level of 578 CZK/MWh (25 €/MWh) due to the RES-E support by 2011, but the actual price increase was capped at 370 CZK/MWh (17€/MWh) as the government intervened, and directed budget funds to the sector.[44] This price increase could be compared to the 3500 CZK/MWh household price of 2011 (see Figure 2 for details).

In 2010 the main RES-E related regulatory changes were the following:

- April 2010: the 5 % limit on the price decrease is no longer valid for investments with a payback period of less than 11 years. (Act 137/2010) This amendment has an effect on investments commissioned in 2011or later.
- November 2010: effective from March 2011, new PV installations are eligible for support only up to a capacity of 30 kW, and only if they are installed on building (on rooftops and external walls). (Act 330/2010, fully in force since 2011 March). FITs/premiums on older installations are not affected.
- December 2010: imposition of an extra tax on solar power plants commissioned in 2009-10, to compensate for the negative impacts on end-consumer prices (Act402/2010) effective from January 2011. The tax rate is 26 % on the FIT paid to solar producers of above 30 kW capacity, and it will be paid in 2011-2013.[45] In July 2011 the Czech Court decided that this tax was unconstitutional. The tax serves as a financial source for the government intervention to reduce the burden on the end-user prices.

[44] Source: ERU 2010 Activity report.

[45] The tax rate is 28 % on the Green Bonuses. (Source: www.mondaq.com) At the same time fossil fired PPs pay 32 % tax on their free CO2 allowances in 2011 and 2012 (on its market value). Additionally higher fees apply to agricultural land used for solar panels.

The present FIT/premium scheme design

The main building blocks of the above described support system design still remain valid for the year 2012, so the mixed FIT and green premium scheme continues to be operated.

In this system the RES-E operator could choose between the following two parallel regimes:

- The operator could either opt for a FIT connected to an obligatory purchase by the TSO. In this case the FIT calculation is based on a 20 years payback period, it is inflation adjusted, and a maximum of 5 % tariff decrease is set as a limit for price reduction.[46] It is not applicable to biomass co-firing.
- The operator could opt for a green premium that is paid above the market price.[47] In this case the RES-E operator had to conclude a contract to sell its power on the market, so the risks of market price volatility are born by the operator, balanced by the achievable higher price. Priority grid connection of RES-E by the DSO is also ensured. This option does not have a long term price guarantee.

The system has the following additional characteristics:

- **Technology differentiation** is almost complete in this system, each category of RES-E (small hydro, biomass, biogas, wind, geothermal and solar) receives differentiated FIT/premium levels set by the regulator. In case of biomass production the support is also differentiated by type of firing. The three categories are the dedicated biomass firing, biomass and fossil co-firing and biomass and fossil fuel parallel firing. In these later two categories only the premium option was available.
- Additional important differentiation comes form the **vintage** structure of the installations. With the exception of geothermal, all technologies receive differentiated FIT/premium according to the year of installation. The reason for this differentiation is to account for the Capex cost reductions.
- **Size differentiation** appears in the case of PV technology, where capacities up to 30 kW size and above received different level of support. From 2012 on, only the smaller size category is eligible for FIT/premium if they installed on buildings, the bigger sized ground mounted capacities are not entitled. In the case of hydro capacities, only installations with less than 10 MW size are eligible.
- **Zone time differentiation** only appears in the case of small hydro power plants, where peak shaving installations receive higher FIT/premium.

The system was flexible in as much as every year (till 30th of November) RES-E operators had the option to decide in which system they wanted to participate in the next year. Tariffs and

[46] In case of small hydro eligibility period for FIT is for 30 years, while for landfill and mine gases it is only 15 years.

[47] In calculating the premium level for the next year, the regulator has to have a projection on the future market price. If prices will be above the projected one, generators are better of, in case of the opposite, they are worse of. This is the reason why market participants choosing this option bear higher market risk.

premiums were set for one year in advance determined by the Energy Regulator (ERU). These tariffs were adjusted every year according to a predetermined methodology, also including a factor connected to the producer price index. Additionally, there was a limit in the reduction of the support level: the regulator was not allowed to reduce the FIT/Bonus further than 5% in any years, with the intention to defend investors from unexpected cutbacks. Concerning grid connections, RES operators had priority connection rights, grid operators had to enter into connection agreement. Although the technical standards and rules were clear, cost of connection was significant and not proportional to the capacity size, which was disadvantageous for smaller plants.[48]

Grid operators are obliged to pay producers the feed-in tariffs or green premiums, and they have to enter into a contract with RES-E producers. The support is paid monthly, based on the renewable production report. The financing method of the FIT/premium system takes place basically through the tariff system, where all end user contribute to finance the RES-E production share through a fee element. For more details on financing see section 2.3.

According to the latest price decision of ERU (no.7/2011) which sets the tariffs and premium for each year, there are more than 40 FIT and green bonus categories, differentiated by technology and vintage (age of the plant). Additionally in the case of small hydro plants the tariffs/bonuses are differentiated according to the flexibility of the power plant. This number is twice as high, as both the FIT and the Green bonuses are set by the regulator. Table A1 in the ANNEX gives the FIT/Bonus ranges (minimum and maximum values) for the various technologies and vintages valid in 2012.

The length of the support period as a general rule is guaranteed for 20 years, except for small hydro where the eligibility period is 30 years. (Annex no. 3 of Regulation No. 475/2005)

The regulator re-calculates FIT and green bonuses every year, but the general aim of this revision had been up till 2010 to account for inflation. Producers were shielded from unexpected regulatory price decisions by the provision that FITs and bonuses for new investments cannot be reduced by more than 5 % a year. Additionally, the technical parameters for such calculations were made available to investors. The provision on the 5 % cap is still in force, however with some exemption: this provision shall not apply to those RES categories, where the actual pay-back time is less than 11 years determined by ERU. The system worked very reliably between 2007 and 2010, until the high uptake of PV capacities urged the regulator and the government to halt further PV penetration.

[48] Source: PV Legal: Reduction of bureaucratic barriers for successful PV deployment in Europe. 2012

Ongoing and future legislation

The new law on Energy Resources was accepted in 31 January 2012 by the Parliament (waiting for the signature of the president), and will become effective from 2013, with some of the provisions already taking effect in 2012.

The main features of the new regulation are the followings: [49]

- The support of renewables will be linked to the National Renewable Energy Action Plan (NREAP). This could serve as an effective cap on RES-E support but the operational details are not yet disclosed.
- There will be an Obligatory Purchaser (OP), so grid operators will be exempted from this role from 2013.
- The new system will prefer Green Bonus to FIT. Producers choosing the green bonus system could offer their RES-E production to the OP who is obliged to buy-out it and pay the difference of GB and FIT.
- An upper capacity limit is established in the FIT scheme (100 kW) and the FIT level will be determined on a 15-years simple return on investment 'rule'. Those producers that are eligible in the present FIT scheme will remain eligible in the future as well. The 5 % maximum degression rule remains for future FIT payments, except for investments having less than 12 years payback period.
- It sets FIT/bonus upper limits for new RES-E investments: as a general values 4500 CZK/MWh (175 €/MWh), but for biomethane 1700 CZK/MWh and for heat from renewable sources 50 CZK/GJ (2€/GJ).
- Biomass and biogas based electricity production will only be eligible for operational support in the case of highly efficient biomass cogeneration. Current support for co-firing will stop at the end 2015 (except highly efficient cogeneration).
- Biomethane (upgraded biogas) injected into natural gas grid will be supported (an EU novelty: green bonus per kWh of biomethane injected, to be financed from regulated cost component of natural gas) and also provides direct support of heat from RES.
- More detailed secondary legislation is expected to be delivered in the course of 2012. A new NREAP target is expected to be approved in the first half of 2012 specifying new RES-E and RES-H targets. It might re-define some technology specific targets (e.g. for PV the targeted 'window' considered is 65 MW annually), but it might also shift biogas target to more RES-H and biomethane.
- There could be also shift in the new RES-E support approach due to the new EU programming period (2014-2020), and, possibly, also in the future national agricultural subsidies (complementary to the official CAP policy).

[49] Source: National expert information on the new Law and http://www.mondaq.com/

- The solar tax will be maintained till the end of 2013 and PV owners will pay regular contribution to cover waste disposal costs.
- The recent announcement of the new director of ERU indicated that further RES-E development may be - at least for a certain period - significantly limited or even stopped.[50] Thus, it cannot be excluded that the president vetoes the new law and will try to influence the opinion of the lower chamber of the Parliament.

In summary the new planned legislation aims to keep future RES-E developments in a predefined 'corridor' aiming to minimize the further impact on the consumer prices.

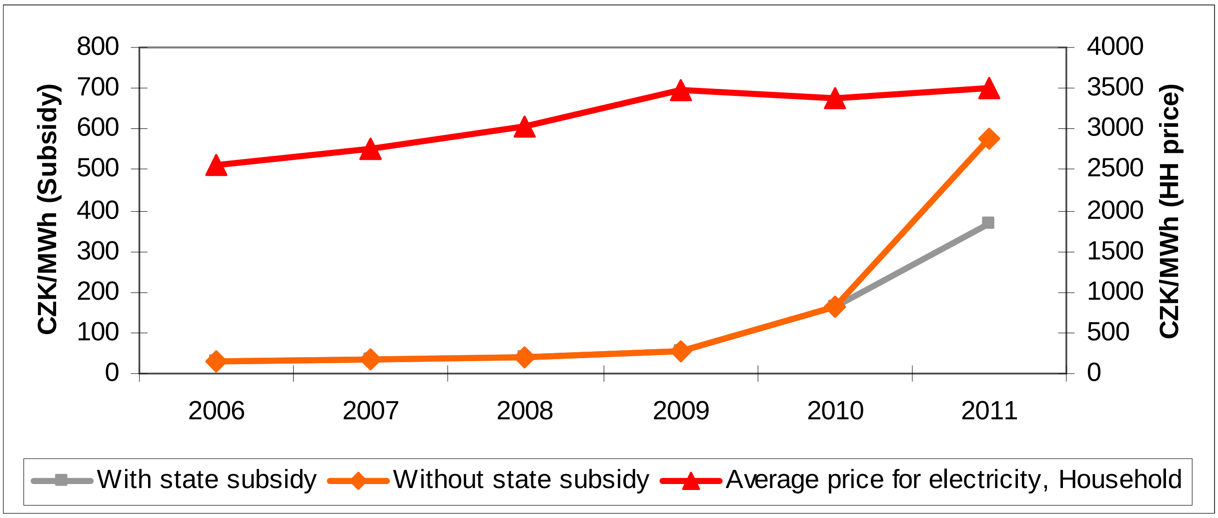
RES-E financing

All energy consumers contribute to the cost of the RES-E promotion system by paying the distribution companies in a form of a uniform fee included in the electricity distribution price.[51] Until 2010 the system was fully financed by this mechanism, however since the introduction of the PV tax, government budget is also a source of financing.

The support for newly built ground mounted PV was discontinued mainly because the rapid penetration of the technology resulted in a steep increase of the final consumer price. Before 2009 RES support represented less than 1.5 % of the residential price (not including VAT), while by 2011 it reached 4.6-5.3% depending on voltage level, and it would have risen to 10.8-14.6%[52] without the state subsidy. Presently, the source of this subsidy is the tax introduced on PV plants, which implies that revenues of the PV plants serve as a basis for this additional price reduction. The following figure illustrates this impact.

[50] http://www.eru.cz/user_data/files/tiskove%20zpravy/2012/TZ%20NAP%20final%2022022012.pdf
[51] Source: ERU 2010 activity report p. 21.
[52] 10.8% on low voltage, 13% on high voltage and 14,6% on EHV electricity supply. Source: ERU 2010 Activity Report

Figure 20: Impact of RES subsidy on end user prices



Source: ERU 2010 Activity report. 2011 values are forecasts in the report.

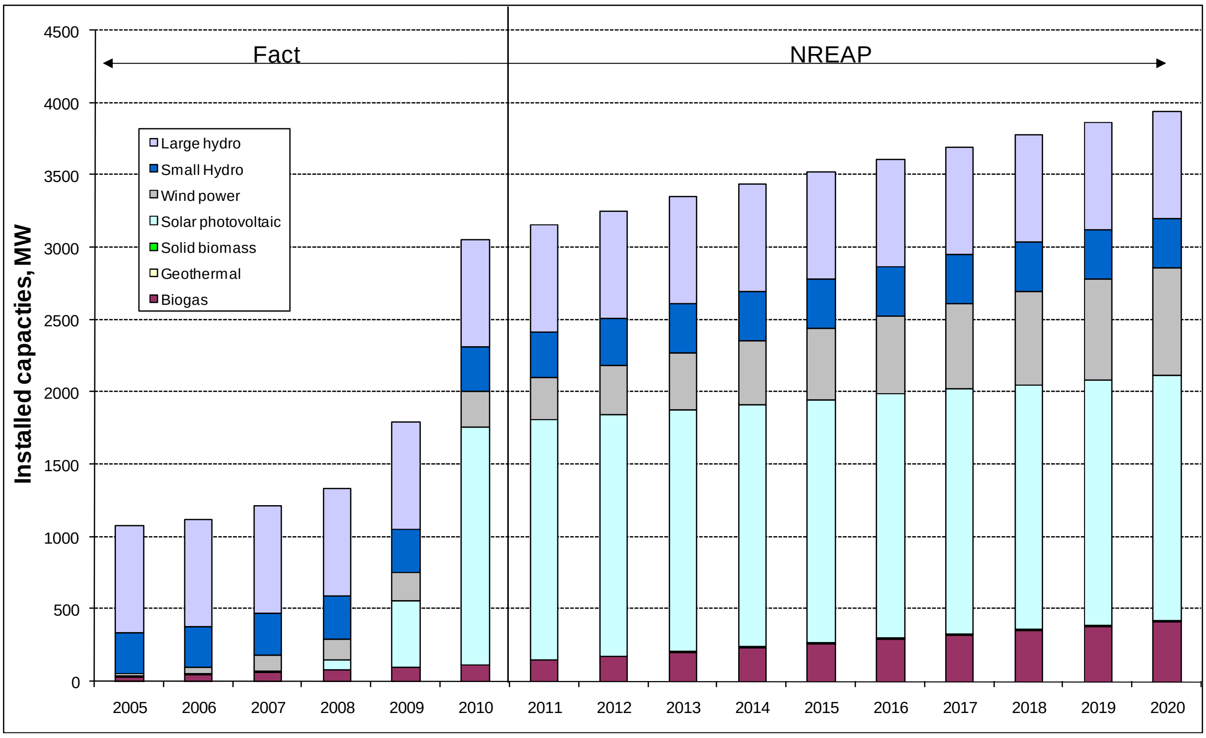
RES-E targets

The 2010 EU RES target of the Czech Republic for 2010 was 8.32 % of the national gross energy consumption.[53] This target was met by the Czech energy system by reaching 8.3% in 2010, according to the latest available data. By realising this target the electricity system reached 7.4 % of RES-E generation. In the NREAP of the country has adopted a RES target of 13.5% of gross energy consumption, and for electricity the planned RES-E share is 14.3%. Figure number 2a and 2b illustrates the planned NREAP path to reach the national target for 2020 in terms of generation and capacity.

The Czech Republic is the country within the CEE region which is closest to be on track to reaching its 2020 RES-E goals as a result of its rapid development of PV capacities in 2009 and 2010. This was mainly due to the flexible and generous RES-E promotion system. However, this development was so rapid that recent policies - including a complete stop of support for ground mounted PV - have been applied trying to mitigate its financial effect on consumers prices. According to the NREAP of the country, future increase in RES-E is foreseen in solid and gaseous biomass based electricity generation, as illustrated by the next figures. Regarding biogas and biomass based generation, their sizes cannot be clearly determined, as in the statistics these are not separated from the capacities of thermal power plants and gas turbines due to dual fuelling. For this reason they are not included in the following figure. According to ERU (the Czech Energy Regulator) in 2010 there were 241 plants with a total capacity of 125.65 MW that had a share of biogas (including landfill gas) and there were 56 plants with 1676.37 MW of total capacity with a share of solid biomass.

[53] transposed to national law by the Act 180/2005

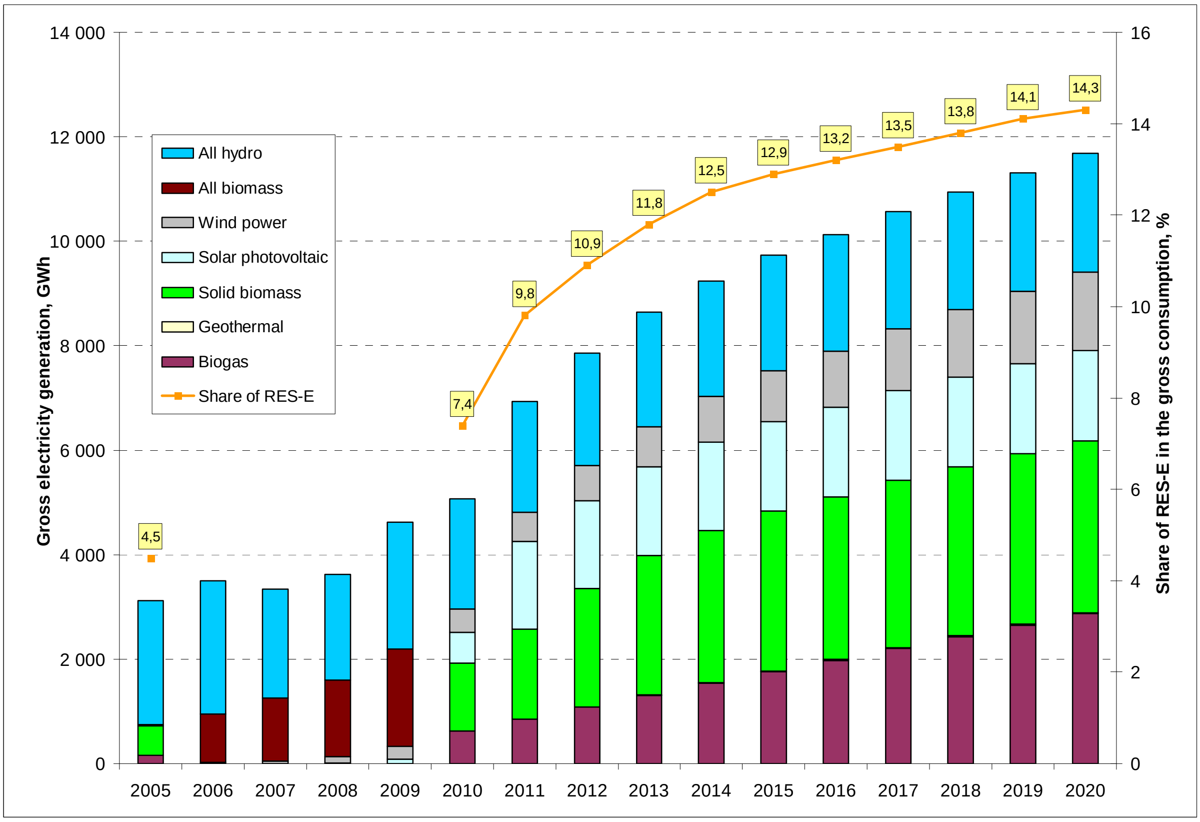
Figure 21: Yearly projected installed RES-E capacity between 2005 and 2020 by technology



This figure aptly illustrates the very steep increase of the PV technologies in 2009 and 2010, but the main message of the figure is that the room for further RES-E investment in the coming years is more limited if the country only wishes to pursue its NREAP target. This limitation is more pronounced if we have a look at the capacity side, while concerning the generation side there is still more room for RES-E developments. The reason for this mixed picture could be traced back in the PV segment, as generally the PV utilisation level is more limited compared to conventional technologies. In other words, the system needs more PV capacities in order to produce one kWh of electricity than in the case of conventional capacities. Additionally there is a one year delay in the generation side, as many new PV capacities were put in operation at the end of 2010.

Most of the remaining increase is expected in biogas and in solid biomass. The already expressed 2012 policy changes indicate the government's intention to put a cap on the further RES-E growth, as will be highlighted in the section on future prospects.

Figure 22: Yearly projected RES-E electricity generation between 2005and 2020 by technology[54]



Other support mechanism promoting RES-E

Apart from the FIT and Green Bonuses scheme the Czech Republic also supports RES-E developments by investment support schemes that also use EU financial resources for the period of 2007-2013[55]:

- National Programme for the Promotion of Energy-Saving Measures and the Use of Renewable Energy Sources;
- Operational Programmes in Business and Innovation (Ministry of Industry and Trade) and the Environment (Ministry of the Environment); In 2008 these programmes allocated 10 billion CZK (386 m€) for RES Energy and 1.6 Billion CZK (64 m€) in 2009, mainly financing small hydro, biomass and biogas developments.
- Green Savings Programme (Ministry of the Environment)

[54] For years 2006-2009, neither the split between small and large scale hydro, nor the split within biomass based production is available. The data for the rest of the years is based on the NREAP.

[55] Source: Report on the fulfilment of the indicative target for energy production from renewable energy resources for 2008. ERU

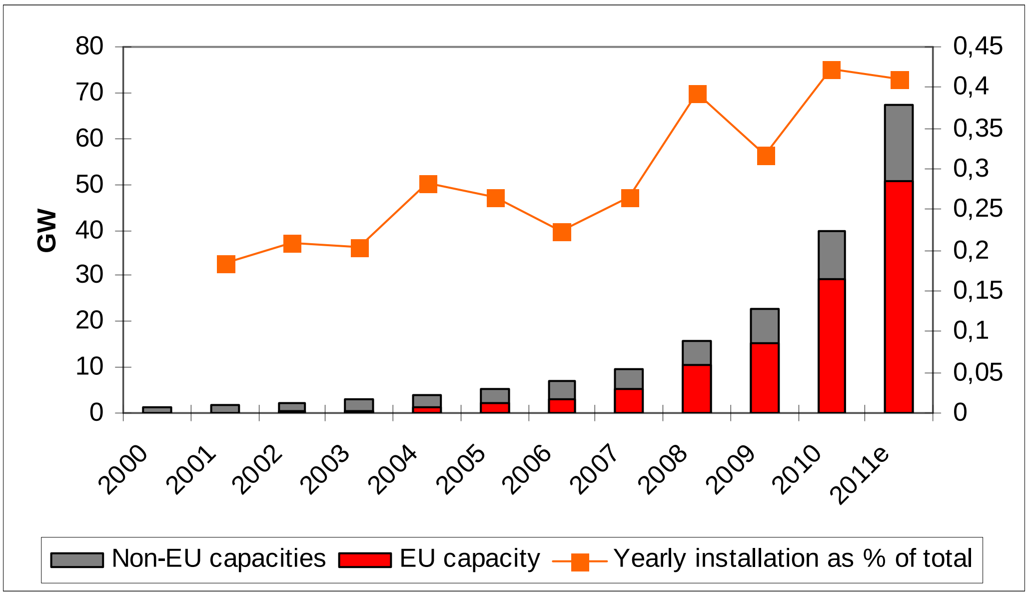
- Rural Development Plan of the CR (Ministry of Agriculture). The scheme promoted mainly biogas plants with an amount of 371 mCZK (15m€) in 2009.

In addition it also supported RES-E developments by a tax exemption scheme, giving 5 years of corporate income tax exemption to all FIT eligible RES investments.[56] This scheme was scrapped by the decision of the government in September 2010.[57]

OUTLOOK: Five country comparison – European 'Rush for PV'

PV capacity penetration shows an impressive upward trend both globally and at European level since 2000. Since 2004 Europe is the leading market for the PV technology on the demand side, it accounts for 75 % of the total installed capacities. Not only the total capacity, but new investments were concentrated in the EU: 67 % of the new capacities were being installed there. The following figure illustrates this exceptional trend.

Figure 23: Cumulative PV capacities at Global and European level (GW)



Source: EPIA market Report 2011

The figure also shows the growth rate of this market segment. In the last four years the growth rate of PV installation oscillated between 30-40 %, its level was around 25 % in the

[56] The only difference is in small hydro: only small plants under 1 MWe are eligible for tax exemption.
[5757] Platts: 0.8.10.2010

preceding period. These numbers demonstrate the exponential growth of the PV market, and the trend also indicates that the technology is still in the initial phase of its 'technological learning'. This phase is characterized by a very fast deployment and at the same time rapidly reducing Capex costs (see Table 15). The table not only indicates the rapidly reducing Capex costs, but also highlights the downward volatility and unpredictability of these costs by the regulator.

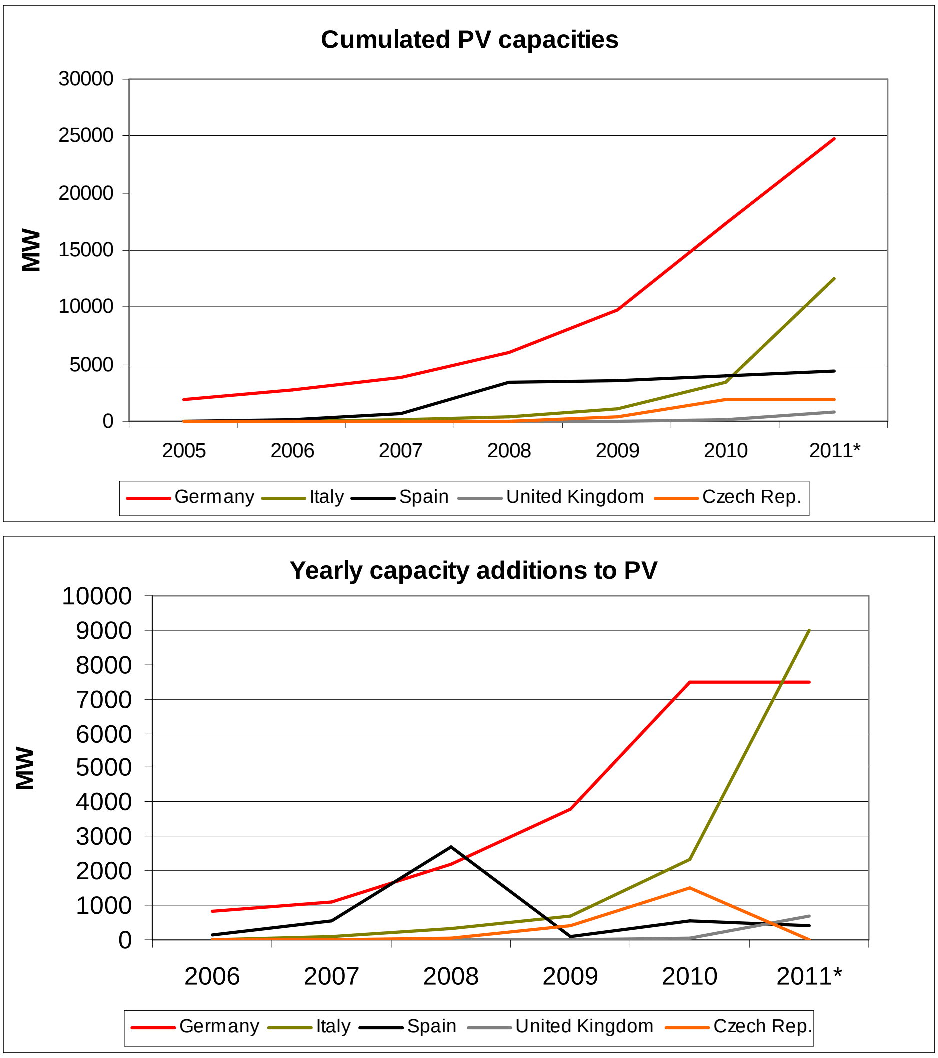
Table 15: Cost decrease in PV technology

		Capital cost estimation 2009 (thousand Euro)			Capital cost estimation 2011 (thousand Euro)			Capital cost estimation 2012 (thousand Euro)	
Type	Size (kW)	2010	2011	2012	2010	2011	2012	2011	2012
Building	5,5	34	30	28	23	20	19	17	12
	20	108	99	89	79	71	64	54	41
	350	1764	1603	1457	1156	1041	936	505	379
Stand alone	200	1008	916	833	661	595	535	288	216

Source: DECC Impact Assessment 2012, converted to Euro

The implications/interaction of these trends with the regulation of this market segment is in the focus of this short analysis, in which five countries: Germany, Italy, Spain, UK and the Czech Republic (later CR) will be included. The first three are the 'big powers' in the PV market, they represent over 61% of the global cumulated capacities. The Czech Republic and the UK are also included, as they give a good example on different regulatory response to the fast PV penetration issue. The following figure depicts the PV capacity uptake in the selected five countries.

Figure 24: PV capacity developments 2005-2011



While at the first glance the cumulated capacity figure shows an uninterrupted growing trend, the yearly capacity additions chart reveals the signs of some specific developments. Namely Spain in 2009 and the Czech Republic in 2010 had a breakpoint in their PV penetration. Additionally the speed of the German increase also stopped in 2011.

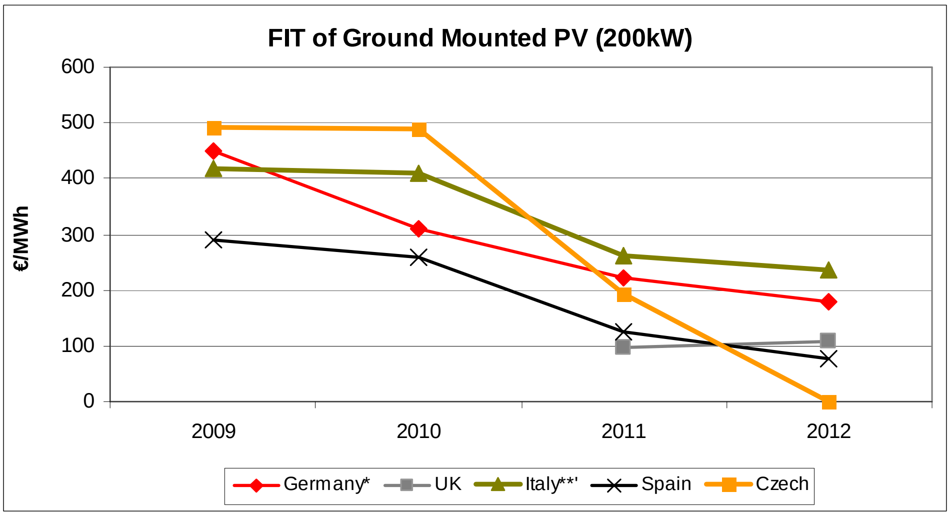
FIT level relationships

If we have a look at the driving forces of the EU PV sector expansion, we would find the recipe of a blend of a generous FIT tariff and a purchase obligation of PV based generation. FIT is used in supporting PV in most European countries, interestingly in those countries as well, where other RES-E technologies are supported by Green Certificate schemes (e.g. Italy[58] and UK).

The Capex cost of the PV technology is fairly equal in all European countries due to the global nature of the PV market. But due to the differences in solar irradiation, the produced electricity per kW capacity installed could differ significantly amongst the analyzed countries, even in the range of 40 %. (See also the map of BOX Figure 5) This relationship would suggest that even with a similar Capex costs, FIT should differ amongst the analyzed countries, being higher in Nordic countries with less hours of operation of the PV capacities.

It is not an easy task to compare FIT regimes of the PV sector in only one dimension, as FITs differ at least by size, by eligibility period and the date of installation. To provide a transparent overview of FITs in the selected countries two technology size/location (20 kW on rooftops and a 200 kW ground mounted) were chosen for newly installed PV panels (for the given year). The following figures show the FIT rates between 2009 and 2012 for the selected countries. It has to be noted however, that the difference in eligibility period has also impact on the rate of return of the PV investments. However in the analysed countries this range is quite narrow, between 20 and 25 years.

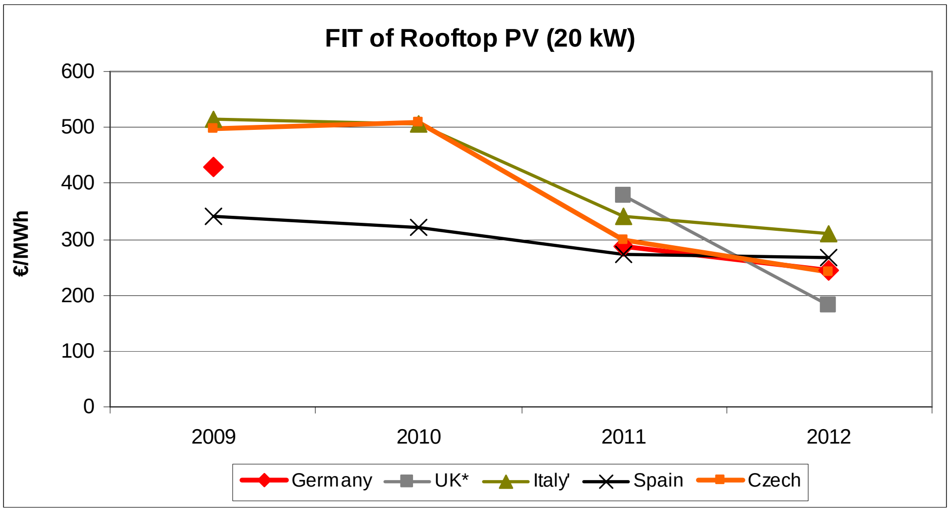
Figure 25: FIT rates in selected European countries 2009-2012, ground mounted 200kW PV (€/kWh) for new entrants[59]



[58] Till 2012, the Italian system was a Feed in Premium system, where the premium was paid on the electricity sales price. From 2013 on it will become a true FIT system.

[59] Not only the level of FIT is a determining factor in the RES-E support, but also the eligibility period has high influence on the NPV of the investment decisions. The eligibility period is 20 years in Germany, Italy, CP, while it is 25 years in Spain and UK.

Figure 26: FIT rates in selected European countries 2009-2012, rooftop 20kW PV (€/kWh)



*UK: the FIT of 2012 is the proposed one by DECC, OFGEM

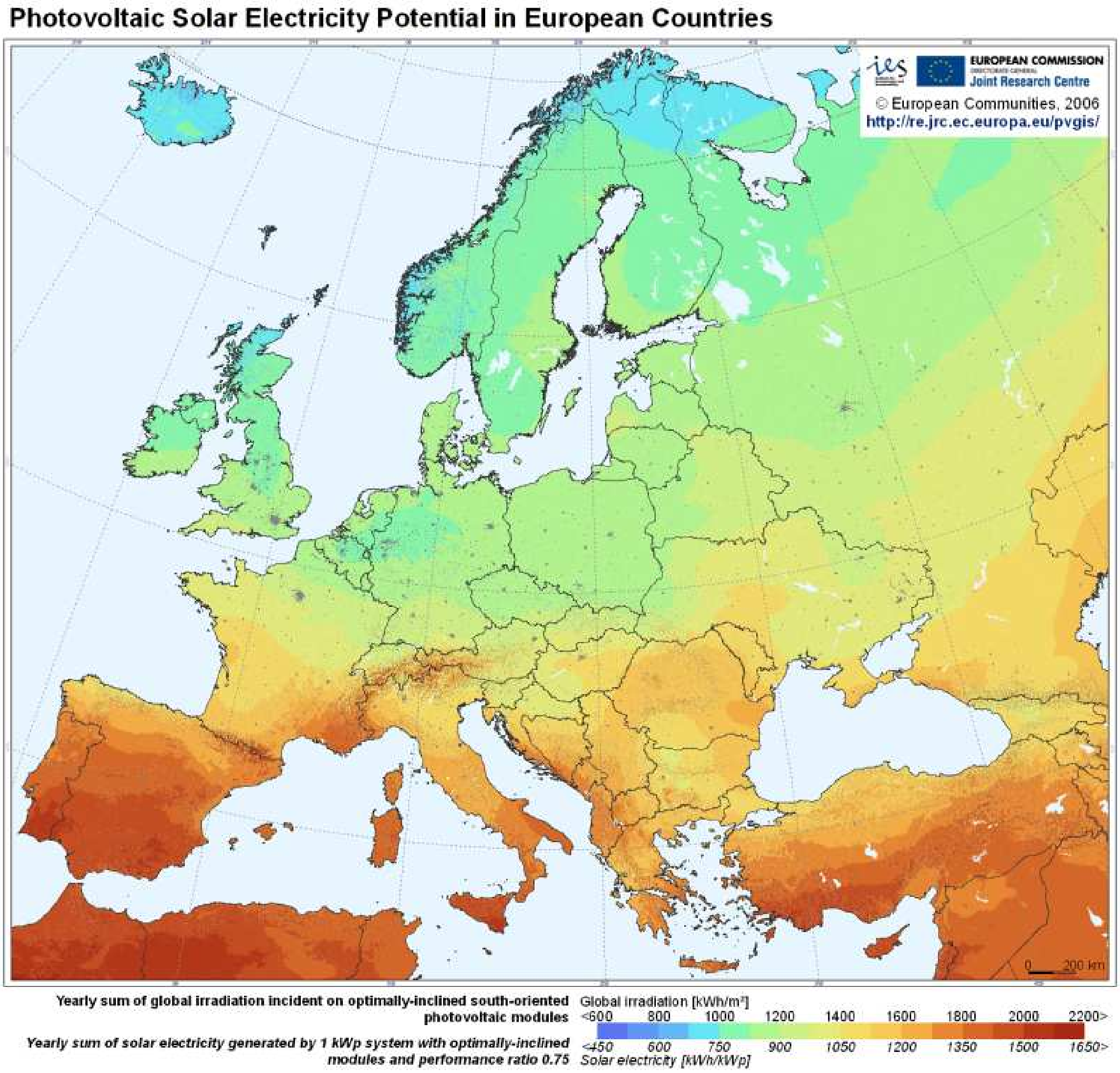
**Italy: FIP augmented by an average yearly market price is shown in the figure

These two figures illustrate the decreasing operational support given to the newly installed PV technologies. In summary the following tendencies could be observed:

- Ground-mounted (bigger size) installations generally receive higher FITs due to the economy of scale effect. Common infrastructure costs in this case are spread over higher capacity number. This differentiation in FIT for different size of PVs is more observable in the years 2011-2012.
- FITs were reduced by 50 to 70 % in the four year period shown on the figures. In the case of the Czech Republic ground mounted installations no longer receive FITs since 2012.
- This reduction is a shared pattern amongst the depicted countries, also the range of subsidy seems to be narrowed amongst them.

The application of these feed-in tariffs means significant extra cost to the electricity system, as during the period wholesale energy prices were in the following ranges: e.g. the average German base load prices were 38.8 and 44.5 €/MWh, peak load prices 46.8 and 51€/MWh in 2009-10. This means that the opportunity cost of the replaced conventional production had a cost between 40 and 60 €/MWh. Thus the EU governments supporting PV technologies in the given years had to subsidize generously the PV penetration, in the range of 250-400 €/MWh in the early period and 50-250 €/MWh in 2012. The result of this generous support is the rapidly growing PV segments in many of the European countries, amongst them in the cited five. Interestingly, this increase is not limited to the countries with higher potential (e.g. in the Mediterranean countries with higher number of hours with sunshine). The significant difference in photovoltaic potential is illustrated on the map of the following figure.

Figure 27: Photovoltaic solar potential in Europe



Budget constraints

According to the analyses, the main reason for these breaking points is the budget constraints faced by the electricity sectors of these countries. As the source of the FIT payments are generally fees covered by the increased end-user prices, usually there is a flexible constraint for the RES-E penetration, in this case for the PV segment. This constraint could be explicit (e.g. in the Netherland), but in many countries it is the government administration and the regulator, who decides on the sustainable level budget for RES-E support, not entailing excessive cost to the consumers.

The following table illustrates the end user price impact of RES-E developments.

Table 16: End user price impacts

2011	MW PV Capacity	PV Bill(1)	RES-e bill (2)	Total Electricity consumption TWh (3)	PV bill/ Tot Cons (€/MWh)	National estimation on end-user price impact all RES-E support % (4)	RES-E bill/Tot Cons (€/MWh)(5)
UK	750	0,16	-	336	0,48	0,3-0,4 %*	-
Germany	24700	8	17,1	531	15,05	13,7%	32,18
Italy	12500	5,1	-	305	16,69	*9,4%**	-
Spain(6)	4200	2,35	6,5	258	9,12	*16,5%**	25,23
Czech R.	1950	0,902	1,3	59	15,22	10-14% (4,6-5,3%)	21,94

(1) In billion Euro: Fit support for all PV

(2) In billion Euro: Fit support for all RES-E technology. UK, Italy applies GC for the rest of the technologies.

(3) As data is not yet available for 2011 electricity consumption, it is the 2010 value.

(4) This column includes Regulators own calculation s on the estimated price impacts.[60] In the case of CR, government intervention through taxing PV installations reduced the impact to around 5% (in brackets).

(5) RES-E bill includes wholesale prices as well.

(6) In Spain the PV share of total RES support is based on the 2012 share. Total fit is 2011, shares from 2012.

*** In case of Italy and Spain are own estimates based on average household prices. In Italy and UK it only includes the PV FIT bill, as other RES-E's are promoted through green obligation schemes.**

The table illustrates the big variation of end user price impacts of varies country by country. Price impacts could reach over 10 % impacts according to the calculations, Regulators report also confirm this range. If calculated on the end user price, the impacts arrive at 20-30 € per MWh, already reaching a considerable amount. The table also indicates that within the RES-E charge, PV could account for high shares, between 40 to 70%.

From RES-E regulatory point of view the above illustrated developments raise other issue as well beside the monetary impact on end user prices. These impacts could be summarized as follows:

- The steeply decreasing cost of PV generation poses a challenge to the regulator to frequently adjust FITs/premium to the rapidly changing costs, as efficient regulation requires regulators to avoid over-subsidization of RES-E capacity investments. In the case of PV the present examples show, that quarterly, or even monthly (Italy) adjusted FITs are necessary in this rapidly changing environment. (See table below on cost reductions from DECC)

- Second, as PV presently receives high level of subsidies, there is a danger of a crowding out effect, as the money spent on PV reduces the available financials sources for other RES-E

[60] ERGEG National Reports 2011

technologies. This crowding out could be explicit, if there is an explicit budget constraint on RES-E promotion, or it can be hidden, if the constraint takes effect through the end user price impact.

Different paths of solutions

This level when governments/regulators intervene can vary country by country, but once this level is reached, the regulator/government will mobilize all available tools to break the unsustainable (from financial point of view) RES-E growth. This might require substantial changes in the regulation in force, as the examples of Spain, the Czech Republic and the ongoing discussion in Germany shows it. The following section summarizes the regulatory actions taken or planned in the selected countries.

Table 17: Regulatory actions in the selected five EU countries

<table>
<tr><th>Country</th><th>Actions taken/planned</th></tr>
<tr><td>Spain</td><td>The 1578/2008 Royal Decree transformed the previous FIT system to a quota system, where the government set levels of yearly PV installation in two categories (PV under 20 kW in agriculture and buildings and above 20 kW on ground), which quotas are divided into four equal quarterly slots. These quotas then are auctioned quarterly, where only those investors could participate, who are inscribed to a list set by the Ministry of Industry, Transport and Commerce (MITyC). Additionally remuneration was also cut from the earlier 44-41€/MWh to 34-32€MWh.
Additionally investors on this list have to pay a guarantee of 500 €/kW for the capacity they want to develop.
MITyC latest change is that it finished further enrolling to the list. Investors presently on the list have sufficient quota till 2015. There are no plans for the later period.</td></tr>
<tr><td>CR</td><td>From 2011 (already applied):
Stopped support for new ground mounted PV installations.
Stopped DSOs to engage in further Grid Connections agreements with new RES-E investors.
Put a 26 % tax on the FIT of PV installations retroactively on the capacities built since 2009.
From 2013 (planned):
Put a cap on the yearly maximum installation, according to the NREAP of the country.
Further reduce FIT supports in most of the RES-E categories.</td></tr>
<tr><td>Germany</td><td>Further reduction of FITs. PV FITs already reduced by over 30 % in the last two years, and additional 20-30 % is planned in March 2012.
Yearly degression of FIT will depend on the capacity growth.
The ‘expansion corridor’ of PV -the PV capacities supported by FIT is reduced compared to the earlier NREAP plans, around 15% of the planned capacities will not receive FIT.</td></tr>
<tr><td>Italy</td><td>The Fourth law on Energy transforms the Feed in premium (FIP) system into real FIT system.
FIPs decreased in 2011 in a monthly basis, in 2012 it decreases on a half-yearly basis.
Between 2011 June till end of 2012 (in 18 month) FIP reductions reach 35 to 50 % depending on categories, being higher cuts in the bigger size categories.</td></tr>
<tr><td>UK</td><td>It has already halved the FIT for 2012 for bigger installations (effective from April 2012)
It also plans more frequent FIT reviews depending on the cost reduction trends, and according to the speed of PV installations in the forthcoming years.</td></tr>
</table>

The abovementioned actions could be broadly classified into three categories:

- Cuts support in certain CV segments, mainly in large scale ground-mounted installations.
- More frequent reviews, in order to keep subsidy levels close to the up-dated Capex costs.
- Introduce upper limits on the yearly investment that is eligible for fit/premium support.

The first tool is a very radical way to limit the pressure on the consumer price increase, and is an efficient way to control further price increases, but at the same time it is it is the least investor 'friendly' way of control. It conveys the message for the investors, that the regulation is not credible and stable, as it could radically change the investment environment. The second and third instruments could also help the regulators/governments to control FIT expenditures, and at the same time allow for smoother intervention, where they can 'fine tune' the PV penetration levels. If applied consistently it would not deteriorate investor's confidence as much as the first instrument. So the latter two actions seem to be an applicable instruments in the case of the PV regulation, where the last years developments demonstrates that the conventional yearly revisions of FIT/premium levels coupled with a limit on the maximum support level reduction could become inadequate due to the very rapidly changing Capex costs. In this situation, if the regulation still want to maintain the efficiency of its support scheme – e.g. to give only the necessary support for RES-E – it might have to consider the application of the latter two instruments.

The UK case is a very remarkable one from another regulatory point of view as well, as it shows an example of an especially pro-active regulator:

- It takes steps already at a level, where the consumer price impact of PV is at 0.4 % level compared to the other countries staying at 8-15%.
- It carries out an impact assessment, with alternative ways to react to the problem.
- And it continuously engaged in stakeholder consultations, where it present the problem and the proposed solutions, so investors receive first hand information even on the planned actions.

4.3. Regulatory lessons

4.3.1. Milestones and Timeline of ERU reactions to the problem

This section presents the most important steps taken either by the ERU or other public bodies involved in shaping the Czech RES-E regulations in the course of 2009-2010 in order to handle the problems caused by the sky-rocketing PV installations in the country:

June 2009: The ERU director warns publicly about the danger of the solar boom in the Czech Republic. He points to the fact that their available instruments to handle the problems are limited, so the regulator will look for legal changes to be able to intervene. At that time it had a possibility to cut support by a maximum of 5 %.

November 2009: In their report, ERU forecasts 250 MW additional capacity in PV for 2009-2010.[61] It already pointed to the problems arising from such a development:

- The massive interest in PV technologies disadvantaging other RES-E technologies (Crowding out)
- Danger of speculative blocking of connection capacities at grid level
- It can cause significant cost in ancillary cost that will arrive to the end consumer prices.

November 2009: Government indicates its will to allow for higher reduction of FIT, but it aims to have this legislation effective only from 2011, as the bill has to pass both houses of parliament.

February 2010: CEPS (the Czech system operator) asks the three Regional Distribution companies not to allow further wind and PV authorization to their networks. According to CEPS there are 3500 MW PV project in the pipeline, which threatens grid and system security. The distribution companies accept the request, and stop authorisation of new projects.

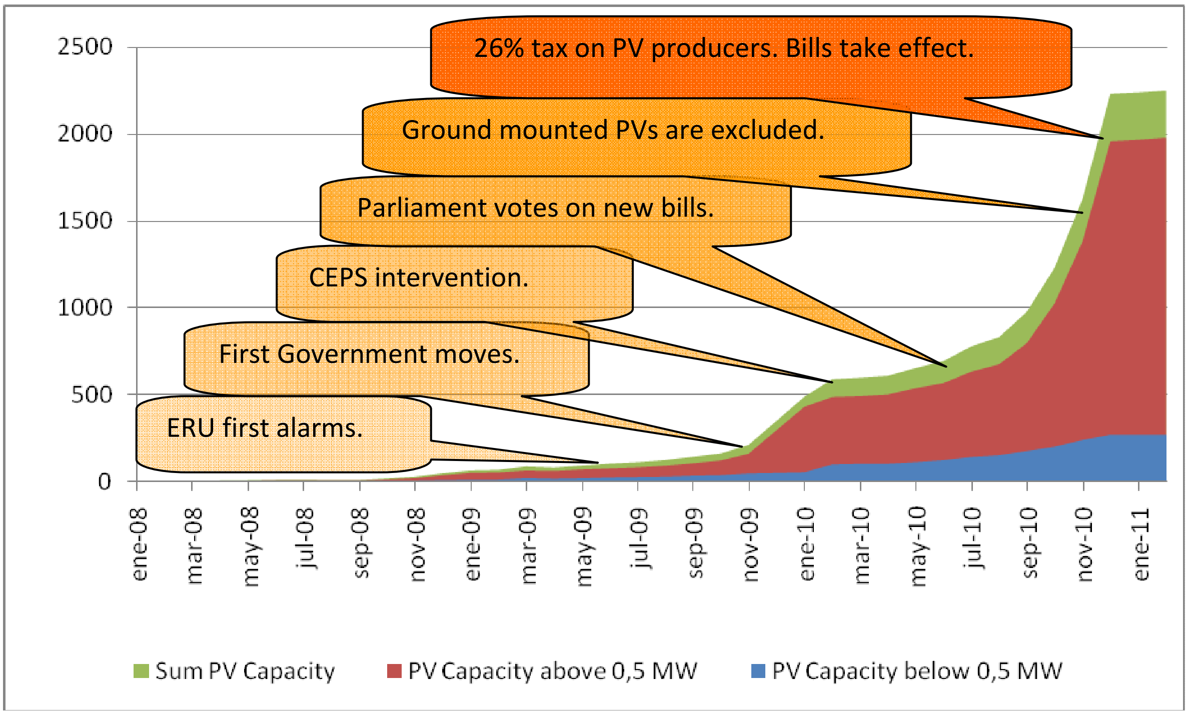
March /April 2010: The Czech lower house accepts the new act revising RES-E support schemes in March, while the Upper House backs it in April. This means, that the maximum 5 % limit of FIT reduction is lifted, in certain cases, further cuts are allowed. But this could be applied only from 2011.

November 2010: Further limits on PV installations are introduced: from 2011 on, only rooftop application up to 30 KW size are eligible for FIT.

[61] In reality it arrived to almost 2 GW by the end of 2010. Source: Report on the Fulfilment of the Indicative Target for Electricity Production from Renewable Energy Sources for 2008. ERU, November 2009

December 2010: 26 % tax on the FIT of PV producers in order to use tax income on lowering consumer price increase.

Figure 28: Regulatory steps taken to handle PV uptake



The chart illustrates well the late response of the public administration of the Czech Republic in dealing with the PV uptake. The following conclusions could be drawn:

- ERU signals the problem quite early, but its hands are tied by the 5% limit. It had no licence to act in this issue. To fulfill its legal obligations it had to employ 19 additional non-permanent staff to deal with the extra licensing burden in 2010.
- ERU role is very limited in the whole process. It can signal, but its role only appears in the yearly FIT setting bounded by the legislation.
- The government reaction time was lengthy, as bills had to be passed by two houses of the parliament. It took almost a year to enact new bills, while additional half a year passes when it becomes effective.
- CEPS (system operator) also intervened, it had a promt impact on the number of installations connected, but its action had only a short-living impact on capacity growth.

4.3.2. Lessons learnt from Czech the RES-E promotion policy

Deficient benchmarking practice

The application of a German type regulation by the Czech government to promote RES-E technologies turned out to be a dangerous decision by the Czech government. The regulation applied the most important elements of the German regulation, amongst them the 'bound decision' principle, which meant that if a developer fulfilled all the required permits, the approval of the ERU was guaranteed, without any cap on the installed capacities. This type of RES-E promotion at that time was meant to be the most suitable one for promoting RES-E, as it provided the most investor-friendly environment. However in the case of the PV technology the development of the last years proved that the regulatory practice has to be not only investor friendly (transparent, consistent and effective) but it also have to be adaptive in a sense, that it has to be able to cope with the fast learning rates of the technology. In the case of the Czech system, this element was completely missing, the regulation was very rigid (e.g. the 5 % maximum reduction limit in FIT, the required changes had to be passed by the two houses of the parliament). In addition this practice was also coupled with a generous level of feed-in tariffs, resulting in a rush for PV developments in the country.

Slow reaction of legislation

The Czech legislative system was not prepared to give a fast response to the issues raised by the very fast PV uptake. The misjudgement of the regulator on the expected amount of PV investment (by the end of 2009, it only forecasted 500 MW capacity increase compared to the real 2000 MW) also contributed to the long reaction time. While e.g. in Italy there were periods of monthly determination of feed-in premium levels in 2011, and the new Germany and UK plans more frequent revision of FITs, the Czech solution shows an another direction, similar to the Spanish one. It curbs any new ground-mounted development, and it also introduces a portfolio of actions (including extra tax on PV developments, reduced FIT levels, and capacity limits) that has probably an even more profound effect on investors than the more frequent FIT revisions.

Effectiveness vs. efficiency

The 2009-2010 Czech RES-E promotion system was undoubtedly effective in a sense that it achieved sky/rocketing levels of RES-E investments. The problem with the system was that through the generous FITs and the rigid regulatory/legislative processes it did not manage to follow the market developments (namely the fast cost/reductions of the PV technology) which resulted in 2 GWs of installed capacities in merely two years, representing 10 % of total installed capacities in the country. The effect of this development was not causing problems in the network operation of the CR - as was announced by CEPS, the system operator – but rather in the financing side. Consumers have and will have to pay for many years the bill of this regulation. In 2011 the end/user price increase due to the PV uptake could have reached 10-15 %, and only government intervention through taxation of PV producers managed to limit this price increase to 5%. This price impact positions the country amongst the highest PV bill payers on a European scale. And additional adverse effect is that the high PV bills crowd out other RES-E developments, in resources/technologies where the country might have stronger potentials.

5. Case study of the RES-E promotion system of Sweden

5.1. The Swedish electricity market

The Swedish electricity market was deregulated in 1996, since then electricity trading and generation have been open to competition, while network operation is retained as a regulated natural monopoly.

Generation capacities

The distribution of Swedish installed electricity capacities can be seen in Table 18. Electricity generation is based primarily on nuclear and hydro power but wind power has a growing share in the generation mix.

Table 18: Installed electricity capacity in Sweden, MW

	2005	2006	2007	2008	2009	2010
Hydropower	16 150	16 180	16 209	16 195	16 203	16 200
Nuclear power	8 961	8 965	9 063	8 938	9 342	9 150
Other thermal power	7 576	8 094	8 005	8 027	8 608	8 187
Wind power	525	580	788	1 021	1 560	2 163
Total	33 212	33 819	34 065	34 181	35 713	35 700

Source: Swedenergy

In 2010 the Swedish state owned 39.8% of the installed generation capacity (via Vattenfall), foreign actors owned 39.6%, Swedish municipalities 12.5% and others roughly 8%.[62]

Electricity balance

The Swedish electricity power balance is shown in Table 19.

[62] The Swedish electricity and natural gas markets, 2010

Table 19: Swedish electricity balance between 2005 and 2010, TWh

		2005	2006	2007	2008	2009	2010
Gross electricity generation	Hydropower	72.0	61.1	65.5	68.4	65.3	66.2
	Nuclear power	69.8	65.0	64.3	61.3	50.0	55.6
	Thermal power	12.3	13.3	13.8	14.3	15.9	19.7
	Wind power	0.9	1.0	1.4	2.0	2.5	3.5
	Total	155.0	140.4	145.0	146.0	133.7	145.0
Gross domestic consumption		147.6	146.3	146.3	144.1	138.3	147.1
Network losses		12.4	11.0	11.9	11.0	10.2	11.0
Import		14.6	20.5	18.5	15.6	16.4	17.6
Export		22.0	14.4	17.2	17.6	11.7	15.6
Net import		-7.4	6.1	1.3	-2.0	4.7	2.0

Source: SCB and Svensk Energy

In 2010 Sweden consumed 147.1 TWh electricity which can be translated into approximately 15.7 MWh electricity per inhabitant that is the second highest in Europe after Finland. The two main energy sources (nuclear and hydro) account for around 90% of total national electricity production. Electricity generation in Sweden is concentrated: the five largest electricity producers accounted for over 85% of total generation in 2010. Vattenfall, E.ON and Fortum together accounted for 80% of total electricity generation in 2010. Sweden has a large amount of physical exchanges due to its central position between the large water resources in Scandinavia, the strong wind resources of Denmark and Germany, and the Polish power system rich in coal.

Grid operation

The TSO is the publicly owned Svenska Kraftnat under the Swedish Electricity Act (1997): it operates the high-voltage grid and its cross border connections to other countries, and it is responsible for maintaining the power balance and operational reliability of the Swedish grid system.

Regional and local grids are regarded as distribution grids. The regional networks transmit electricity from the grid to the local networks, and in some cases to large-scale consumers, such as larger industries. The local networks distribute electricity to the end-users within a certain geographical area. In 2010 5 companies were licensed for regional and 170 for local network operations. Companies operating local distribution systems are monopolies for their specified geographic area.

The wholesale electricity market

The Swedish wholesale power market is part of an integrated Nordic power market which is an important part of the growing European electricity market. The Nord Pool power exchange integrates the Scandinavian countries (except of Iceland).

Nord Pool has a spot market for physical trading (Nord Pool Spot AS owned jointly by the Nordic system operators) and a financial market-place for long-term power contracts (Nord Pool ASA owned by Nasdaq OMX). Nord Pool Spot additionally includes Elspot (hourly contracts are traded for the consecutive 24 hours) and Elbas (an intraday adjustment market for continuous trading in hourly contracts).

The dominant share of physical electricity trading is carried on the spot market (Nord Pool Spot market's share of total consumption was 74% in 2010), the rest is traded via bilateral contracts.

In November 2010 a big step forward towards a common European electricity market was taken when the Nordic electricity market was integrated with the price-coupled electricity markets in continental Europe through "tight volume coupling". In price coupled markets the power exchanges are interconnected in a way that a central algorithm determines the prices for the underlying bidding areas and net flows between them, which will be then adapted by the power exchanges to calculate the winner participants in their own market areas. In tight volume coupling the procedure is similar, however only the determined flows between the bidding areas are adapted by the power exchanges which then calculate the prices for the different market areas separately.

The high level of hydropower generation in the North (and demand concentrated in the South) creates transmission capacity bottleneck in the North-South transport axis. In such periods when transmission capacity between the bidding areas is not enough to a complete convergence of prices, the otherwise single market is divided into different bidding areas by market splitting.

The retail electricity market

The Swedish retail market for electricity, unlike that wholesale power market, is a national market but for several years there has been a political will to establish a common Nordic end-user market by 2015 which would mean that the customers in the Nordic countries would enjoy a free choice of electricity suppliers across national borders. The total number of consumers at the Swedish market was almost four million while the number of electricity supply companies was 121 at the end of 2010.[63]

Each consumer must have an agreement with an electricity trader to be able to buy electricity, and another agreement with a network company for connection to the network. Total consumer costs for electricity comprise energy price, network tariff, energy taxes and VAT. Energy prices and taxes accounts for about 40-40% while network tariffs made up around 20%.

The supplier switching activity among end-users is quite high: almost 1.5 million Swedish consumers (34% of the total end users) were active on the electricity market during 2010, as they either switched supplier or renegotiated their contract with their supplier.

Several authorities work together to monitor the Swedish and Nordic electricity market for the purpose of establishing a smooth-running market and prevent the exercise of market power.

The Energy Market Inspectorate within the Swedish Energy Agency is legally the regulator for electricity networks and the electricity market. The Competition Agency is responsible for applying the rules relating to competition, while the Swedish Financial Supervisory Authority regulates those Swedish actors who operate on the Nord Pool financial market.

5.2. Renewable electricity deployment

Due to its very large hydro resources Sweden is among the EU countries whose share of RES-E is highest (55.5% of gross domestic production in 2010).

NREAP

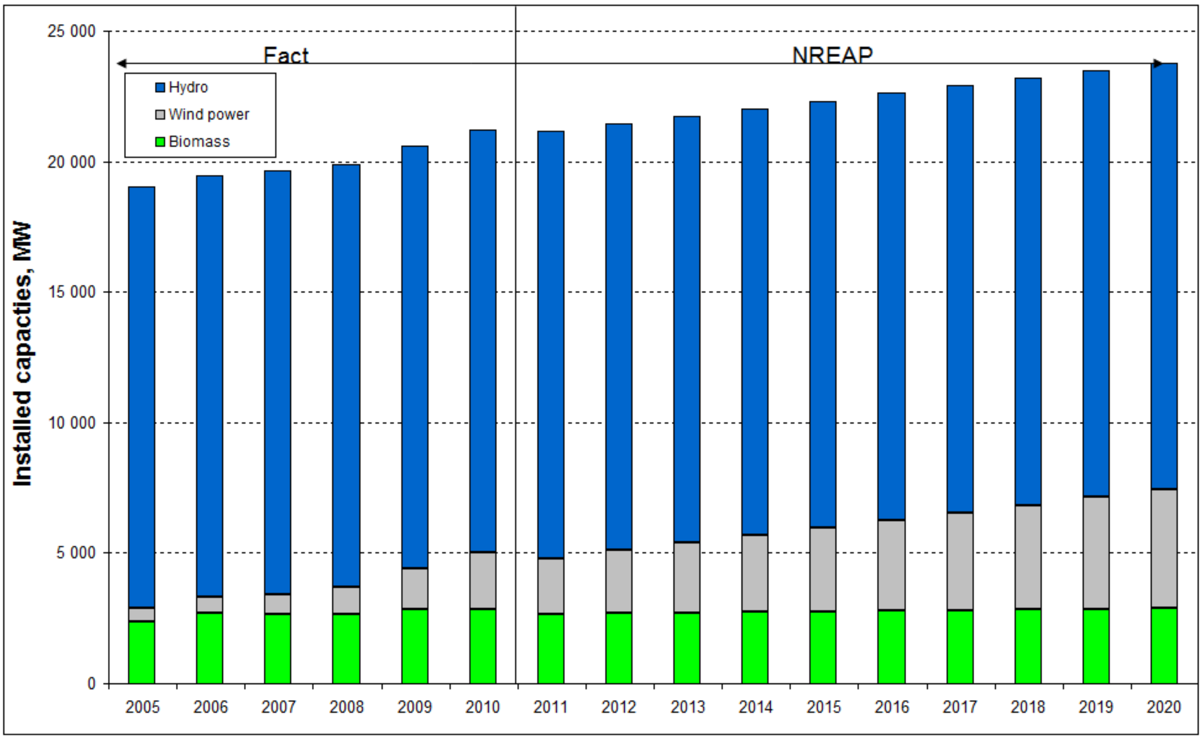
The Renewable Energy Directive (2009/28/EC) requests Member States to prepare their National Renewable Action Plan (NREAP) by 2010. In the Swedish National Renewable Action Plan, the Federal Government estimates the share of renewable energies in gross final energy consumption to be 50.2 % in 2020 meaning that it expects to have an approximately 1.2% surplus above its binding national target (49%).

Concerning electricity sector the Swedish Parliament has adopted a target for increasing the share of renewable energy consumption up to 62.9%. In absolute terms RES-E generation is planned to grow up to 97.3 TWh in 2020, which would mean a total growth of around 20% in a period of ten years (Figure 30). Wind generation is planned to grow by 260% from 2010 to 2020. Solar energy will play a negligible role. In 2009 the Parliament has set a new planning target of 30 TWh of wind power production in 2020, with 20 TWh of this from onshore plant and 10 TWh from offshore plant.

[63] The Swedish electricity and natural gas markets, 2010

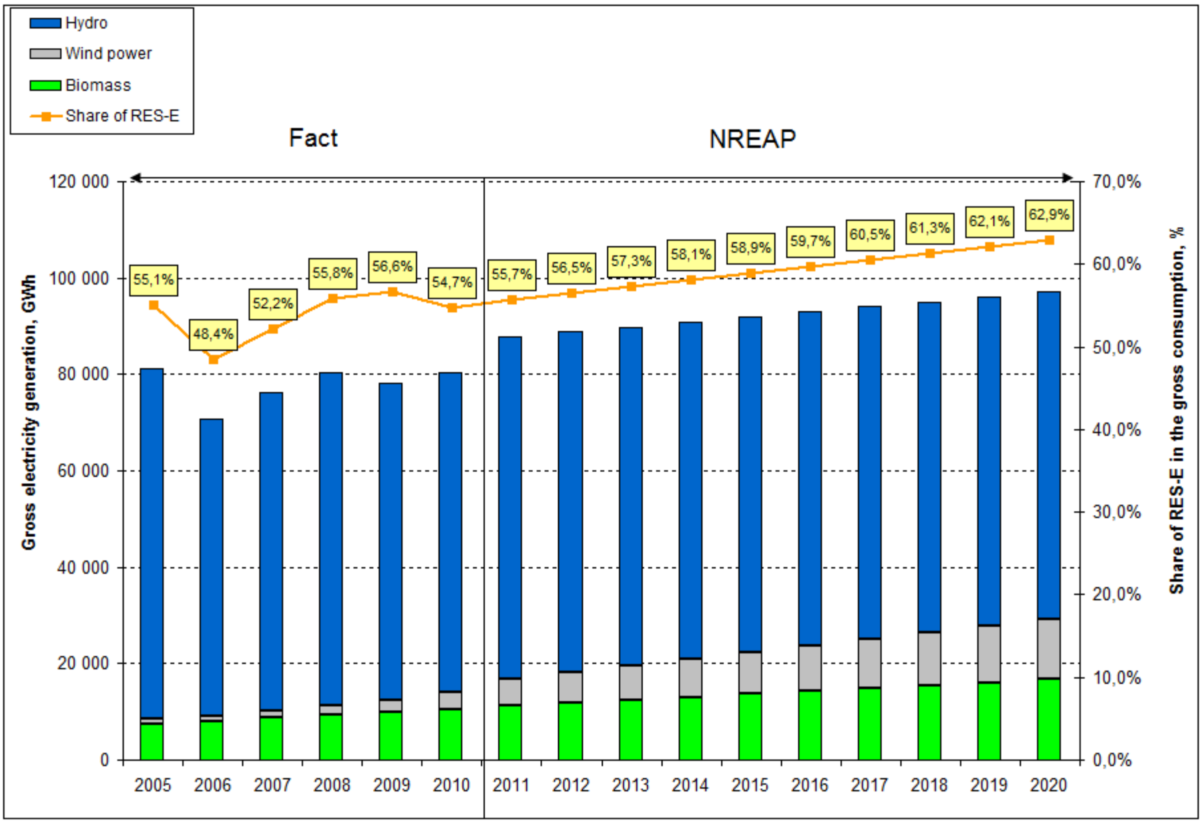
The evolution of generation capacities is shown in Figure 29.

Figure 29: Installed RES-E capacities between 2005-2020, MW



Source: NREAP, Swedenergy

Figure 30: RES-E electricity generation 2005-2020, GWh



Source: NREAP, Swedenergy, Eurostat

As it can be seen the share of intermittent RES resources remains low. However Sweden's storage and balancing capacities can be vital for the integration of large scale of variable renewables in Central Europe. Capacity development plans suggest that biomass potential is largely exploited; further increase in renewable installed capacity is to be expected from wind.

Support schemes before 2003[64]

Until 2003, Sweden did not employ an explicit operation support for renewable electricity generation (feed-in or green certificates) but has had for many years its renewable policy integrated to its overall policy for sustainable development and efficient use of resources.

Long term energy R&D programmes in Sweden started in 1975. The Renewable Energy Investment Support Programme adopted in 1997, for example, supported mainly wind and

[64] http://www.iea.org/Textbase/pm/?mode=re&action=view&country=sweden

biomass investments to make them more viable alternatives to nuclear power and fossil fuels.

Sweden has a complex system of energy and carbon taxation to reduce the environmental impact of energy generation. The present tax structure comprises three elements: energy taxes (since the 1950s), CO_2 tax (since 1991) and sulphur tax.

Small-scaled renewable energy based electricity production is partially or totally exempted from the energy tax. In 1994, an "environmental bonus" (opportunity for deduction of the energy tax) was provided to power producers for every kWh delivered by a wind power plant. The amount of the bonus was different for onshore and offshore wind, and was steadily decreasing until it was phased out in 2008 (onshore wind) and 2009 (offshore wind). In 1997 Sweden introduced guaranteed power purchase contract with local utilities to support small renewable energy projects, according to which local distribution companies must purchase all electricity generated by projects of less than 1500 kW within their service territories. These power purchase contracts were superseded by a green certificate scheme introduced in 2003. In connection with guaranteed purchase contracts from 2000 to 2002 an interim support scheme was applied for these small-scale renewable electricity producers.

In June 2000 the Swedish government introduced an investment support scheme for solar heating. From 2000 to 2007 approximately 75 million SEK was granted for residential premises (then it was prolonged until the end of 2010). Between 2006 and 2010 SEK 10 million per year supplementary solar heating grant was applied for other (commercial and industrial) premises.

Green certificate system (2003-)

Sweden introduced a green certificate scheme in May 2003 in line with the policy trend advocated by the European Commission favouring quota, or 'competition-based' system over price instruments.[65] The expected main advantages of the tradable green electricity certificate system (TGC) are the followings: [66]

- Cost-efficient (both in terms of social costs and cost for the consumers),
- Ensures a stable development towards set goals, and
- Drives innovation and cost reduction through competition in both electricity and certificate markets.

[65] European Commission, 1999 Electricity from Renewable Energy Sources and the Internal Electricity market, Commission Working Paper, SEC (99)470,13 April 1999.

[66] A. Bergek, S. Jacobsson 2010: Are tradable green certificates a cost-efficient policy driving technical change or a rent-generating machine? Lessons from Sweden 2003-2008 in Energy Policy 38 (2010) 1255-1271

The supply of green certificates

The Swedish green certificate system is officially called “tradable electricity certificate system”. It includes peat (when fuelled in CHP) into the eligibility criteria for tradable electricity certificates, but production from this source is not included into renewable production for the EU renewable production target. Peat is not a renewable energy source by definition. The reason for including peat into the certificate system was based on environmental considerations: by making electricity production from the combustion of peat eligible for the receipt of certificates, it would prevent the use of peat being replaced by the use of coal as a fuel in CHP.

Green certificates are supplied by those renewable producers that are entitled for certificates:

- wind, (onshore and offshore)
- solar,
- geothermal,
- wave,
- biofuel: Forestry byproduct, forest industry by products, other wood waste, energy crops and biogas are included, biomass of mixed domestic waste are explicitly excluded from the certificate system[67].
- peat (when fuelled in CHP) and
- hydro: Eligible hydro units are small hydro units which - at the end of April 2003 - had a maximum installed capacity of 1500kW per production unit; new plants; resumed operation from plants that had been closed; increased production capacity from existing plants; plants that no longer operate in an economically viable manner due to decisions by the authorities or to extensive rebuilding.[68]

The producers of renewable energy entitled for certificates receive 1 certificate for each MWh electricity produced and metered. Only grid connected producers possessing hourly metering are eligible for certificates. The revenue of eligible producers derives from the sale of the electricity and the sale of the certificate.

How can regulatory regime change be handled without unexpected adverse effects on investors?

In Sweden renewable based plans that were commissioned before 2003 receive certificates for their production. Biomass, biogas, wind and hydro energy production facilities that came

[67] The first two provide the basis for about 88% of 2010 biofuel based certificate entitled production.

[68] The Parliament in 2011 has proposed to tighten up the eligibility for hydro power plants in the future Source: Swedish Energy Agency (2011a)

into operation prior to 1 May 2003, (and received public support after 1998) are not entitled to electricity certificates after the end of 2014. For all others commissioned before 2003 incl. production facilities using solar or geothermal energy the eligibility period ends at the end of 2012.[69] As according to the regulator this period ensures the recovery of initial investment cost for these plants and since then they can sell electricity on the market without any further subsidy.

According to current regulations in Italy, RES-E power plants constructed before 1999 can choose between two options: they can either terminate their earlier guaranteed feed-in price contracts or switch to the green certificate system or they can retain their existing contracts and sell their electricity to the system operator at a fixed regulated price. In the latter case the system operator possesses their green certificate, tradable on a price set by a government decree. This price is set by the following method: as a starting point, the previous regulated prices are taken into account as a base price and then the regulator calculates the average premium price on which the system operator can sell the electricity to market participants.[70]

For all those plants that were commissioned after the start of the certificate system (2003) the eligibility period for receiving certificates is 15 consecutive years or 2035 whichever is earlier.

The supply of green certificates depends on the scope of eligible producers and their yearly production. This later depends on weather conditions (temperature, wind precipitation).

Uniform versus technology differentiated support

It is common to design the green certificate system in a technology neutral way in order to promote competition between eligible energy technologies. This method is used in Sweden and in the UK where each MWh receives 1 certificate regardless of the renewable source used. In such a technology neutral system the market decides which technologies are preferable to achieve the target encouraging a cost efficient deployment of renewable energy sources. Consequently, more expensive technologies will not appear in the generation side that saves money for the consumers.

More and more countries – however - apply differentiated green certificate systems. In these cases some technologies are preferred in a way that more than one (in some cases less than one) green certificate is allocated to a unit of production. In Romania, the current regulation allocates six green certificates for one MWh of PV electricity, two certificates for new biomass plants, and a half certificate for hydro power plants commissioned before

[69] Lag (2003:113) om elcertifikat §7. at http://www.riksdagen.se/sv/Dokument-Lagar/Lagar/Svenskforfattningssamling/Lag-2003113-om-elcertifikat_sfs-2003-113/

[70] Source: Green Certificates regime as amended by Budget Law 2008; Watson, Farley &Williams

2004. In Italy the number of certificates allocated to the various technologies varies less than in Romania. Onshore wind power plants receive one green certificate, while offshore ones receive one and a half. Biomass plants receive 1.8 certificates, while biogas plants built on wastewater treatment plants get 0.8.
Similarly, Poland plans to introduce a grading system for different RES technologies.[71] Under secondary legislation each technology is given a corrective coefficient, e.g. wind farms above 200 kW receive 25% less support. Photovoltaic projects, which are not well developed in Poland, receive twice as much in subsidies as before the correction. Biomass CHP above 10 MW will receive 10% less.

The demand for green certificates

Electricity suppliers (i.e. network companies distributing electricity to end users) are required to purchase electricity certificates corresponding to a certain proportion of the electricity that they sell, known as their quota obligation. In addition to electricity supply companies, the quota obligation applies also to electricity users importing and/or producing electricity for themselves. Originally the obligation was set on end-users, it has been later transferred to suppliers and those end users that purchase electricity or produce it for their own use.

The yearly quota obligation was set by a Government decree in 2003 with the aim to achieve the renewable electricity production target. In 2003 the quota obligation was 7.4%, then it increases to 17.9% in 2012 and decrease to 13.5% in 2013. The quota obligation would decrease in the second part of the certificate system, due to phasing out of the first plants from the certificate system[72]. The reduction of certificate supply due to the phase-out has to be matched with a comparable demand reduction to maintain the price level of green certificates.

Since 2003 the renewable electricity production target was increased two times (discussed in detail later). The quotas are regularly reviewed and adjusted to the system goals. The last revision of quotas was in 2010, when the Parliament agreed to increase quotas for 2013-2030 and new quotas were introduced (extended the time for the certificate system) until 2035. The second peak in the curve (19.5% in 2020) on Figure 31 is reflecting the increased target set in 2010: 25 TWh additional renewable production by 2020 compared to the baseline of 2002.

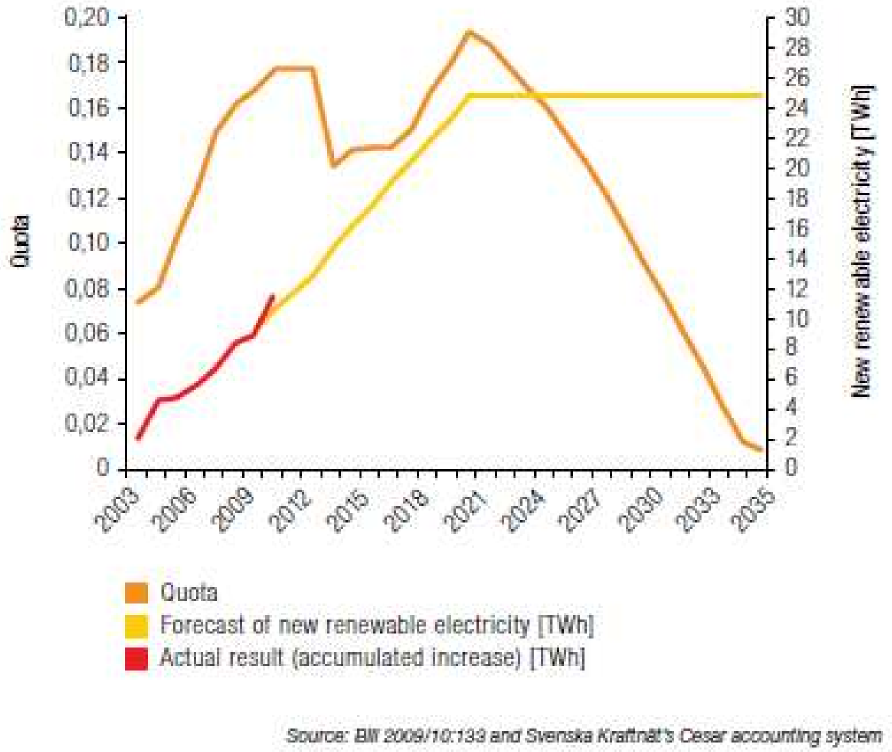
It is expected that after the eligibility period for quota obligation the plants exit the certificate system, but can at that time sell their production on the electricity market and

[71] Platts EIEE issue 235, 9 March 2012
[72] The first plants phase out of the certificate entitled production will take place in 2012 (3884 MW producing about 11223 GWh) and in 2014 (458 MW producing about 1521 GWh) Source: Swedish Energy Agency (2011a), Table 10 and 11.

generate electricity from renewable sources without any further subsidy, and at the same time other newly commissioned plants will receive certificates.

Figure 31 also shows that the green certificate support scheme achieves the planned renewable electricity generation target with a very high predictability.

Figure 31: Quotas (% of electricity consumption) for the period 2003-2035, with forecasted new renewable electricity production and actual renewable electricity production[73]



Ancillary power, transmission and distribution network losses are exempted from quota obligation. To keep the Swedish electricity intensive industry competitive on an international level, the electricity they consume for manufacturing is also exempted from the quota obligation. For the remaining electricity consumption buying certificates is compulsory. Since 2007 a company is defined energy intensive if its use of electricity in the manufacturing process amount to 40 MWh per million SEK of total sales values. In 2010 419 companies were registered as electricity-intensive, exempting a total of about 40 TWh electricity from quota obligation that is almost 30% of total electricity use.[74]

[73] Source: Swedish Energy Agency (2011a)
[74] Source: Swedish Energy Agency (2011a)

The choice of obliged actors

Under a green certificate system it is not obvious that the obligated market participants are the ones who sell electricity to final electricity consumers, like in the present Swedish and UK systems. Previously the Swedish system has placed the purchase obligation on end-users. In the Netherlands demand of renewables is linked to consumer preferences. In Italy obligation is put on the supply side: all producers and importers are obligated to generate/purchase certain amount of energy from renewable sources every year. However, all participants are exempted from this rule for the first 100 GWh of electricity generated (or imported). Participants can comply with their obligations either by building a new power plant which uses renewable energy sources or by purchasing green certificates from another market participant. This system separates the energy delivery from the green certificate system, so producers and importers have to cancel as many green certificates every year as the regulatory authority orders, in relation to their production/import.

Accounting and cancelling of quotas

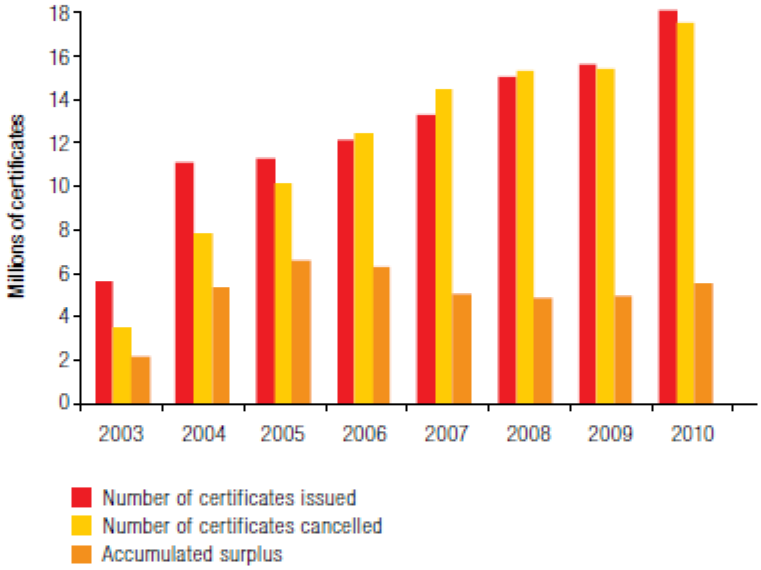
The certificate market is operated by the regulator (Swedish Energy Agency) who approves and registers plants eligible for certificates and the TSO (Svenska Kraftnät), who does the accounting. Certificates exist only in electronic form in the system called Cesar of Svenska Kraftnat and are traded electronically.[75] Each renewable electricity producer that was approved being eligible for certificates by the Swedish Energy Agency has an account in Cesar where the GCs are debited. Except for biomass producers producing electricity in co-firing, the producers get their certificate when electricity has been produced and metered. Biomass producers (producing electricity in co-firing) get certificate only for the part of electricity production that is based on renewable sources. There is a monthly approval of their certificate entitled production, so they receive their certificates in the Cesar system with some time delay. The certificates can be traded any time throughout the year or can be kept for later period, if the producer expects price increase.

Every 1st of March those that have quota obligation have to report to the regulator the electricity they invoiced to their customers or used themselves in the previous year and the corresponding amount of certificates that they have on their account by the TSO. These certificates are cancelled on 1st of April by the TSO. Under a late delivery penalty process, those who do not have enough certificates on their account by 1st of March can buy on the market the necessary amount. Those who did not comply with their quota obligation until 31st of March have to pay a quota obligation charge, amounting to 150% of the average price of certificates, calculated over the period of one year preceding the date of cancellation.

[75] Svenska Kraftnät Cesar Elcertificat (http://elcertifikat.svk.se)

Entities holding a surplus of certificates can save them for future years' needs or can sell them.

Figure 32: Number of certificates issued and cancelled, and the accumulated surplus 2003-2010[76]



Apart from the first years, almost 100% of the certificates issued were cancelled (Figure 32). There is however a surplus in the system that was accumulated in the first three years. The surplus remains at a quite stable level, around 5-5.5 million certificates. This surplus is getting more and more attention, and some analysts[77] even predict a collapse of the system by 2013. However the Swedish Energy Agency argues that the surplus is: (i) good for liquidity on the market (ii) is only temporary as first plants will be out of the system by 2012(iii) with the Norwegian market joined in 2012 it will be partly absorbed (iv) by the planned review of quotas' in 2015 and 2019 it can be addressed, if needed[78].
The surplus can also grow in good weather conditions for renewable production, e.g. in mild winter with less electricity demand. It was the case in 2010, a year that added 0.5 million certificates to the surplus.

The modification of support policy

- The original goal in 2003 was 10 TWh additional renewable electricity production by 2010 (compared to 2002 level). All existing renewable power plants were included in the system and received undifferentiated certificates for their

[76] Source: Swedish Energy Agency (2011a)
[77] F.e.Peter Fritz: http://www.nordicenergyperspectives.org/Fritz080514.pdf
[78] Swedish Energy Agency (2011)

production, 1 certificate for each 1 MWh produced. This technology-neutral allocation was intended to ensure that most cost efficient technologies are realized first. Quota obligation was originally set on the consumers.

- After a first assessment of the Swedish Energy Agency in November 2004, the scheme was revised with regard to both goals and design in 2006.[79] The target was increased to 17 TWh by 2016. The eligibility of existing power plants was limited until 2012 or 2014. Quota obligation was placed on energy suppliers instead of consumers, and on importers and large consumers that brought electricity on the Nordpool. Exemption from the quota obligation was fine tuned for energy intensive industry and brought in line with the tax regulation.
- In June 2009 new quota targets were set for 2013-2030, and the certificate system was extended with quota obligation set for 2031-35 to support the more ambitious target: 25 TWh new renewable electricity generation by 2020 compared to the baseline of 70.3 TWh in 2002 (of which about 90% was generated from large hydro plants).
- A new Electricity Certificate Act came into force on 1st January 2012. Parallel to this, the first international electricity certificate system has started its operation, as Norway has joined the Swedish electricity certificate market. A larger market with a greater number of actors is expected to result in improved competition through increased liquidity and more stable prices. RES-E targets are anticipated to be achievable more cost-efficiently, as investments will be made where conditions are most favorable.

Market structure

Both the demand and supply sides of the Swedish certificate market are concentrated. On the demand side the three largest companies in the system have an obligation amounting to about 34% of the total obligation. Moreover, the demand for certificates is rather inelastic, due to the fact that actors with quota obligations have an incentive to purchase certificates up to a price which is 50% higher than the average certificate price because of their quota obligation charge 150% of the average price. On the supply side there are two different groups of actors: one consists of several small plants and the other of a few plants producing most of the electricity. In 2010 96% of the plants received certificates for production of less than 50 GWh electricity, accounting for about 22% of the total number of certificates issued. On the other hand, there are 3 big players[80] on the Swedish certificate market having about

[79] Swedish Energy Agency (2005a,b)

[80] The same three players are delivering about 80% of all Swedish electricity production. (E.ON, Vattenfall and Fortune)

18% of the certificates entitled production (this is unchanged since the introduction of the quota market).[81] Although certificates have no lifetime limitation (until the end of the green certificate system) most producers sell their quotas (instead of banking) to keep the revenues under control.

Market power

The abovementioned facts show that in the Swedish certificate market a small number of market participants have a large share of supplied or demanded quantity which raise the possibility of abusing their market power. For example in the supply side the dominant players have a possibility to withdraw a significant amount of certificates from the market as they are less dependent on their current sales, and they can afford to wait for higher prices. Due to the fact that the demand is quite inelastic, this kind of behavior can raise the prices of certificates significantly. Moreover, Amundsen and Bergman (2006) argue that as a result of the quota obligation being a percentage requirement of electricity consumption, the withdrawal of a given number of certificates from the market forces a much larger reduction of electricity consumption. Thus relatively modest exercise of market power in this market may have a significant impact on the price of electricity. These kinds of threats of abuse of market power in Sweden can be moderated by the large amount of surplus in the certificate system and the high liquidity of electricity market. However, in a country where the wholesale market of electricity is less liquid, and there are a small number of renewable electricity producers, the possibility of abuse of market power on behalf of a dominant player is worth to be considered when introducing a green certificate system.

Development of RES-E generation eligible under the green certificate system

In 2010 the total installed capacity of the plants eligible for green certificate was 6674 MW, out of which 2381 MW commissioned after 2003. The largest share in the newly commissioned capacity is in wind (1631MW), followed by bioenergy (615 MW) and hydro (134MW), while solar accounts for only 0.549 MW.[82]

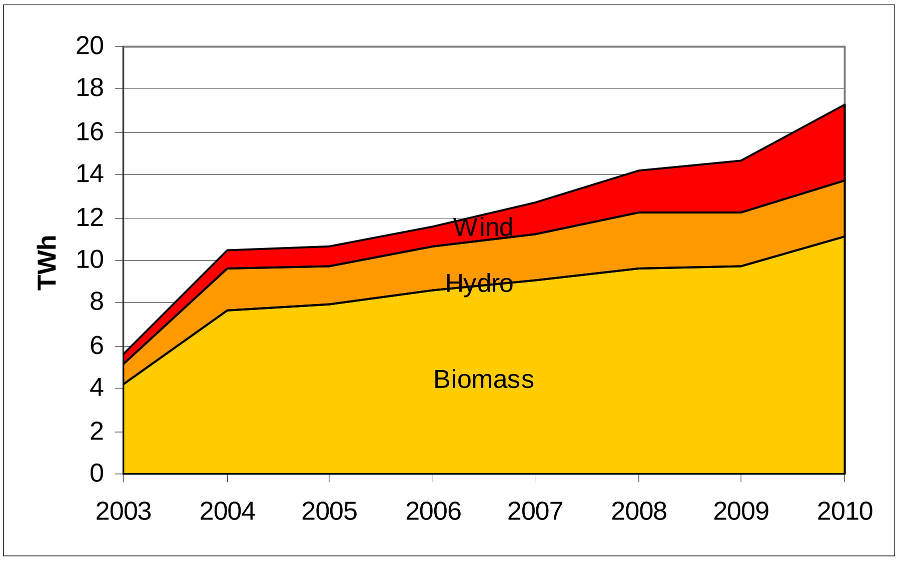
Regarding the fuel of all renewables entitled for certificates in Sweden, 61.8% of the certificates (allocated for the generation of electricity) were issued for biomass plants, 19.3% for wind power producers, 14.5% for hydro power plants and 4,4% for peat in CHPs in 2010. [83] A small number of solar energy plants were approved, and they produced only a few MWh during the year. No wave energy or geothermal energy plants have so far been submitted for approval.

[81] Source: Swedish Energy Agency (2011a)
[82] Swedish Energy Agency (2011a): Table 5.3
[83] Swedish Energy Agency (2011a): Table 5.1

Figure 33 shows that the development of renewable electricity production is based on biomass. Almost all biomass based production takes place in combined heat and power production plants (CHP), which is considered by the regulator to be a very efficient way to convert energy to electricity and heat. More than half of this capacity belongs to industrial back pressure plants, the rest is supplying heat to district heating. The proportion of renewables in the fuel mix of the industrial back pressure CHPs is over 90%, while in district heating CHPs it is only 69%. Biogas fuel has a small share in CHP, as biogas in Sweden is typically used as a motor fuel.

The increase of the production in these biofuel CHP units is a result of using a greater proportion of renewable fuels in the fuel mix (mostly by-products of the forest-industry and by-products from forestry), or of an increase of full load hours or an increase in capacity of existing biofuel plants. On one hand, this shows the efficiency of the system, as that the most cost efficient technology (increasing full load hours, extensions and conversion of existing plants) has been introduced first. These are mature technologies that do not require much innovation. As a consequence of low cost investments new (infant) technologies cannot enter the system.

Figure 33: Development of RES-E generation eligible under the green certificate system by hydro power, wind power and biomass power (excluding peat) in TWh in 2003-2010[84]



Note: biomass excludes peat

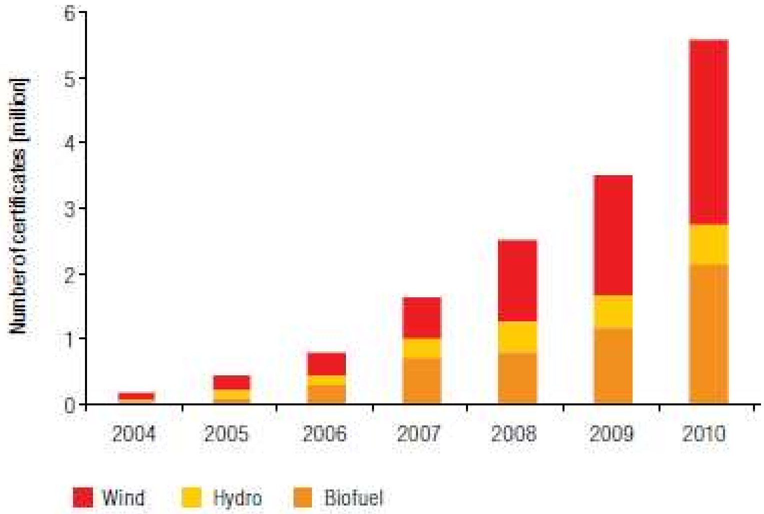
Electricity production of GC eligible renewable sources and peat amounted to 18.1 TWh in 2010[85], which is an increase of 11.6 TWh compared with corresponding production in 2002.

[84] Swedish Energy Agency (2011b): Energy in Sweden 2011 p. 30

[85] The difference between this 18.1 TWh and the 17.3 TWh for 2010 on the chart above comes from peat (0.79TWh) and solar (0.00027TWh).

As Figure 34 shows below, out of the 18.1 million certificates in 2010 only 5.6 million certificates were allocated to plants entering the system after 2003. It is clear that the dominant technology among the new plants is wind power generation. Among hydro plants new plants receive only 10% of certificates, 90% is allocated to older small hydro plants (commissioned before 2003), production increase and restarts.

Figure 34: Number of certificates issued for new plants by type of energy source, 2004-2010[86]



Certificate trading and quota price

Trading takes place bilaterally between producers and those having quota obligation (50% of the amount traded) or can happen through brokers (other 50%) in the Cesar system electronically. The smaller producers typically trade through broker, as they trade usually only a few times in a year. The contracts are spot contracts for immediate delivery or forward contract with delivery for a later date. As the cancellation of certificates takes place every year on 1st of April, it is no surprise that most of the transactions are registered in March. The Cesar price is not necessarily a spot price, it is an average price of spot and forward transactions. This later price are defined in many ways e.g. as a volume weighted average price for a given month.[87] Transactions are registered when certificates are transferred between the accounts of the parties. Information on all transactions (numer of certificates transferred and their price/certificate) is publicly available at "Svenska Kraftnät" website.[88]

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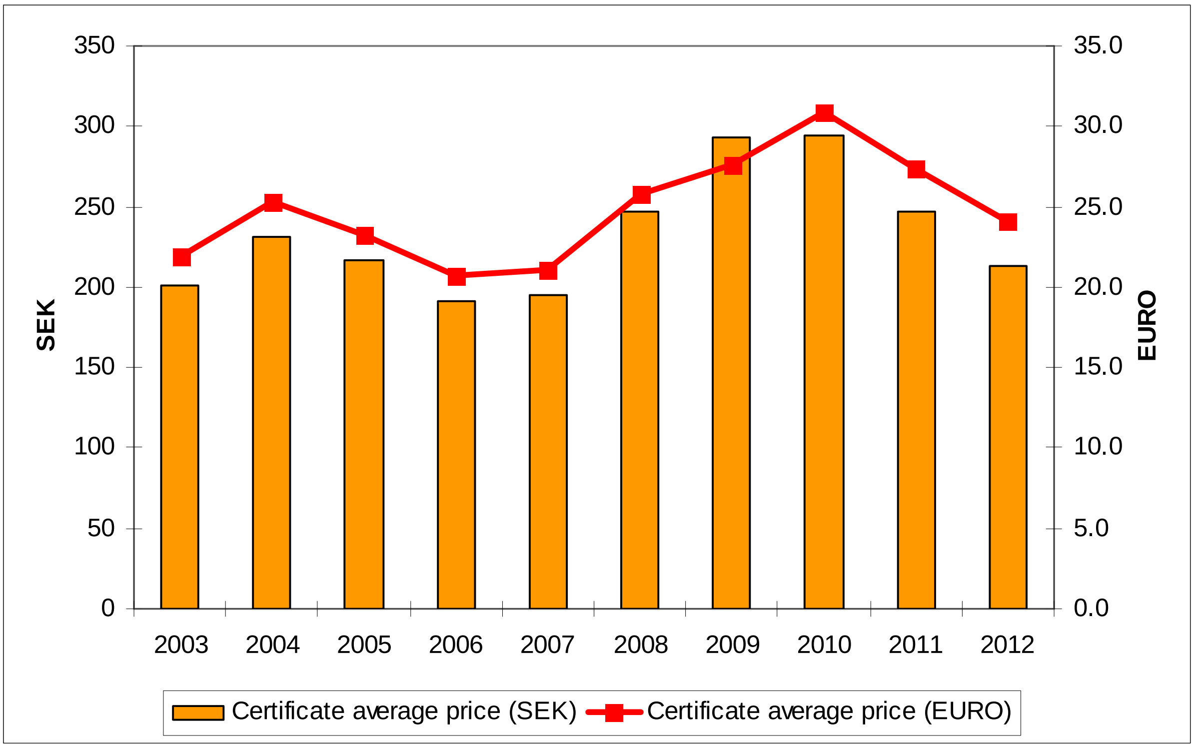
[86] Swedish Energy Agency (2011a)
[87] Swedish Energy Agency (2011a)
[88] Cesar elcertificat https://elcertifikat.svk.se/cmcall.asp?service=CS_Reports.GetCertificates&styleFN=reports/xsl/certificates.xsl&generalpageid=2

Yearly average price of certificates was 27.3 Euro/MWh in 2011. The price for the first two months of 2012 was lower, 24 Euro/MWh (Figure 35).[89] The highest yearly average price in 2010 was 30.9 Euro/MWh, however in SEK it was almost the same as in 2009, only the exchange rate has changed between the two years.

Figure 35: Yearly average certificate price in EUR and SEK[90]



Source: Svenska Kraftnat, Swedish Central Bank

The price for certificates largely depends on the actual supply and the expected amount of extra capacities entering the system. Factors affecting the price include fundamentals such as quota liability, electricity usage and accumulated surplus, as well as the need of the market players for risk hedging and traders belief regarding future prices of electricity certificates. There was a sharp rise in average spot certificate price during the spring of 2008 (close to 400SEK/MWh), when expectations were positive regarding electricity demand growth and a future shortage was expected of certificates The fall-back in electricity consumption due to the financial crisis has brought a decrease also in certificate prices, backed by warm weather conditions at the same time (hence decreasing demand) and very good weather conditions for renewables production (e.g. supply above statistical average) [91].

[89] This is partly because the Swedish crown has strengthened towards the Euro in 2012.
[90] Please note, that 2003 (May-Dec) and 2012 (January-February) are no full years. Exchange rates used for conversion are yearly average exchange rates from the Swedish Cental Bank: www.riksbank.se
[91] Swedish Energy Agency (2011) p. 20.

The cap on the penalty that had to be paid in case of insufficient certificate on the account of an obliged party on 31st of March each year was 175 SEK (19€/MWh) in 2004 and 243 SEK (27€) in 2005. In practice it had the effect of setting price levels and operated as an effective price ceiling for certificates. Since 2006 there is a dynamic limit on it: the penalty is 150% of the average price of certificates, calculated over the period of one year leading up to the date of cancellation. For example in 2010 it was 402 SEK (42 €/MWh)

Price cap and price floor

In almost all European countries where renewable electricity production is supported by a green certificate system, there is a price cap applied on the certification (sometimes called exit price). These are intended to help to control final consumer prices.

In Romania, the maximum price of green certificates is 55 €/MWh, while in Poland the exit price was 267.95 PLN/MWh (67 €/MWh) in 2010.

In Italy there is a more complicated system in place. Prior to the introduction of green certificates, regulated prices were applied to renewable electricity production. These contracts have been taken over by the system operator, meaning that producers formerly selling electricity at a regulated price can continue to do so, but since then selling the electricity to the system operator. This means that the system operator also possesses a certain amount of green certificates. Thus, the system operator acts as a sort of price regulator, since in case of too high green certificate prices, the TSO can sell part or all of its certificates.

In Romania, besides the price cap the regulator also set a price floor i.e. a price on which it buys the certificate and thus guarantees a minimum price for renewable producers. Currently this price is 27 €/MWh.

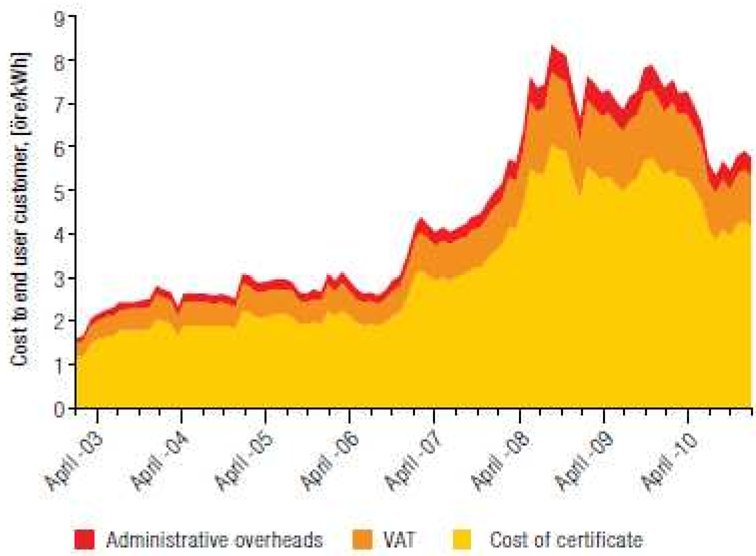
In Sweden there was also a guaranteed price for RES-E producers between 2004 till 2008, when in May and June they had the option to sell their certificates to the state. The guaranteed price was decreasing from 60SEK to 20 SEK between 2003 and 2007, and since then there is no guaranteed price. As in this period the spot price had not really gone below 100 SEK (app.10€), it is no surprise that there was zero certificate has been returned to the state at the guaranteed price[92].

[92] https://elcertifikat.svk.se/cmcall.asp?showrequest=false

Who pays the price of RES-E production?

We must note however that it is the end consumer who will pay for the extra costs of renewables as suppliers charge the consumers. Since 1st January 2007[93], the cost of supplier borne by the mandatory acquisition of certificates is explicitly included in the electricity bills in the form of a fixed-rate tariff[94]. In 2010, the average cost of this element was 63 SEK (6.6 EUR) per MWh.

Figure 36: Cost of certificates to end user costumers 2003-2010 (SEK/kWh)[95]



In 2010, the certificates provided a revenue of about SEK 4.6 billion (482 million €) to the producers of renewable electricity. There are several types of electricity customers who ultimately pay for the certificates. The largest group is that of domestic consumers, who account for about 45% of quota-obligated electricity use. E.g. an owner of a detached house having electric heating and using 20 000 kWh per year paid about SEK 1250 (131 € (including VAT) for electricity certificates in 2010. The service sector used 29% of the quota obliged electricity, while the industry used 17 %. The remaining 9% of renewable electricity was used by transport, agriculture, district heating suppliers etc.

As you can see from Figure 36, about 10% of the costs cover transaction costs of suppliers, such as administration, wages brokers' fees and risk costs. Another few percentages are the VAT paid for the state.

[93] The new approach was introduced in order to improve cost-efficiency and to simplify the bill for consumers in order to make supplier switch (and comparison of prices) easier.

[94]

[95] Swedish Energy Agency (2011a)

Rents in the Swedish electricity certificate system

The largest cost items that end-consumers pay for the green certificate system are the payments to the producers for traded certificates. The revenue from the certificates should cover the extra cost of renewable producers that is not covered by the market price of electricity. However a certain amount of these payments can be considered as a rent rather than "well-earned" compensation for higher production costs. These rents can be generated in plants which are profitable without the extra revenues from selling certificates as well. They can be also derived from the usage of uniform premium which means that the certificate prices correspond to the most expensive technology included, so all technologies which have lower cost receive a rent. As more and more expensive technologies are required to fill the quota obligations (for example offshore wind in Sweden), the more efficient producers receive higher and higher rents. Bergek – Jacobson calculated that between 2003-2008 out of the 14 billion SEK paid for the renewable producers under the certificate system those plants that were already profitable without the certificates revenues (those that were commissioned before 2003 and have for the conversion already received subsidy) had a "windfall profit" of about 7.7 billion SEK i.e. more than 50% of the total cost.[96] When including also those plants that have "easily accessible" production increase[97] (e.g. increasing their full-load hours only or conversion from fossil fuel to biomass) the rents constitute up to 79% of the total payment to electricity producers. This very high proportion is likely to decrease over time (down to 22-28% of the total costs) as plants commissioned before 2003 phase out of the system after 2012 or 2014.[98]

The common Swedish and Norwegian tradable electricity certificate market

Sweden and Norway have agreed to establish a common tradable electricity certificate market, which is the first experiment so far to have an international renewable support scheme. A binding agreement on a joint electricity certificate market was signed in 2011 and the market started to operate on the 1st of January 2012.

Norway and Sweden has a common goal to increase power generation from renewable energy sources with 26.4 TWh before 2020. The common electricity certificate market is a politically determined instrument to reach that goal. Each country finances 13.2 TWh through the quota obligation.

[96] Bergek – Jacobsson (2010) p.1262 Table 3

[97] Bergek and Jacobsson estimated in their calculation an extra cost (in relation to electricity price) for this production increase in these CHPs (average 40SEK/MWh)

[98] The calculation was based on the certificate system in 2008. At that time a lower target and shorter certificate period (till 2030) was set. The total rents for the whole period was estimated to be around 22-28% of the total payment to producers.

It is expected that a larger market with more players will ensure competition and will attract investment to the place where it is economically more viable.

The common market is based on two national markets with national legislation in both countries. It is a common market in the sense that Swedish producers can sell their certificates also to Norwegian buyers, and quota obligation of Swedish entities can be fulfilled by buying certificates in Norway and vice versa. There are however national characteristics that differ in the two systems: for example eligibility of producers for certificates differ: peat is eligible in Sweden but not in Norway, new producers are eligible in Sweden after 2020 but not in Norway, mixed waste is eligible in Norway but not in Sweden.[99]

Norwegian accounts are registered by the Norwegian TSO (Statnett), in a system called NECS. At present all trade has to be registered in Norwegian crowns but from summer 2012 EUR, SEK and NEK denominations will be all possible.

For the calendar year 2012 the quota obligation is 3% in Norway. The quota obligation increases to 18.3 % in 2020, and will decrease again until the end of 2035.

The distribution system operators report production data to Statnett on a weekly basis. Based on these data Statnett issues certificates to the entitled producers (or their account holder) in NECS.

At the time of writing this issue paper there is not much experience, but the first certificates were accounted already in NECS and the first international transaction were registered. In Norway the average quota price in the first 3 month was below the Swedish one. We assume that the price difference is due to the fact that the Swedish monthly average price includes forward contract prices as well (where the price is set months before when the amount was contracted), but registered only when the transfer of certificates between the accounts of the Cesar system occurs, while most probably the Norwegian transactions were spot trading. Trading volume was also much smaller, but we must keep in mind that it is only the start of the system. In the long run prices shall converge to avoid arbitrage.

[99] Swedish Energy Agency 2012: En svensk-norsk elcertifikatsmarknad

Table 20: Monthly average price of certificates in the common Swedish-Norwegian electricity certificate market in 2012 (Jan-March)

	Average price of 1 certificate in Norway in SEK[100] (in Euro)	Average price of 1 certificate in Sweden in SEK (in Euro)
January 2012	150.0 (17.0 EUR)	176 (19.9 EUR)
February 2012	145.3 (16.5 EUR)	160 (18.1 EUR)
March 2012	147.6 (16.5 EUR)	221 (24.7 EUR)

Source: Cesar, NECS

Exported certificates to Norway from Sweden from 01.01.2012. to 20.03.2012. were 127 002, while import was only 56002. Trade has started but we cannot draw any conclusions on these small amounts yet. It must be taken into account that the first Norwegian certificates were issued only in February.

Planned checkpoint reviews of the joint electricity certificate system will be carried out by the Swedish regulator and the Norwegian Water Resources and Energy Directorate no later than 2015 and 2019 with the aim to decide whether the quota size needs to be adjusted in response to changes in the market and the development of the surplus.

Other support schemes

In addition to the certificates for renewable electricity production there are tax exemptions and subsidy programs in Sweden.

Electricity generated from wind energy is eligible for tax privileges consisting in a reduction of the real estate tax and a reduction of the energy tax. Sweden also grants subsidies for R&D in the field of wind energy and assists municipalities in planning wind energy projects. Since 2007 municipalities and regional bodies have been able to apply for aids for planning initiatives for wind power. From 2003 to December 2012 aid for wind pilot projects is provided in order to reduce establishing costs (however presently is not possible to apply for grants, since the limitation has been already reached).

5.3. Lessons learned from the Swedish tradable green electricity certificate system

To limit the burden on consumers and in order to prevent commercially viable older plants from exploiting the certificate system and creating unjustifiably higher costs for electricity consumers, it is important to limit the eligibility time period for those renewable plants that

[100] 100 SEK = 85.35 NOK as of 20 March 2012, http://www.norges-bank.no/en/price-stability/exchange-rates/daily-exchange-rates/

can receive certificates. This eligibility period can be differentiated or set equal to all producers, as it is in Sweden 15 years. Having the time period undifferentiated for technologies, the more economical ones are preferred.

Costs for the consumers have so far greatly exceeded the originally calculated levels. The present 0.06 SEK/kWh in 2010 that consumers have to pay should be compared to the expected level of 0.006 – 0.015 SEK/kWh the policymakers considered reasonable beforehand as Bergek quotes a government report from 2001.[101] The original assumption that green certificate systems keep consumers cost low was not fulfilled, although social costs were kept moderate, as indeed the most economical technologies entered the system. Estimation of GC systems consumer cost can differ from expectations, the strength of the GC system lies in the good predictability of the amount of RES-E production.

Until the target was at its original level at 10 TWh increase in RES-E generation compared to the base year, the system has performed well for the relatively smaller additional renewable generation. However, the target has been increased substantially two times in a few years, and the new targets could not have been achieved by only extensions and conversion of existing plant. More expensive technologies had to enter the system, that increased the overall cost and through the increase of certificate price it generated (unjustified and not planned) rents for the cheaper technologies. Bergek (2010) argues that too much increase in the target should follow the overview of the support schemes' original goals and their evaluation.

Supported RES-E production crowds out conventional technologies. However the most expensive conventional units will be replaced by the most economical renewable technologies. Thus in addition to the system cost increase arising from the higher RES-E penetration, there are significant cost reductions as well from excluding expensive conventional units from the steeper part of the load curve.

Regular reviews of the quota could happen, since technological development can not be foreseen for the whole time horizon of the certificate system. However unnecessary intervention is to be avoided as it reduces trust and credibility in the system. As the quota system regulates the quantity of supported RES-E, rather than the tariff levels, the bias caused by unforeseen technological development is less problematic in this system compared to the FIT support.

[101] Bergek –Jacobson (2010) p.1260

All support system has its transaction costs, independent if it is market based or not. The Swedish consumers pay a substantial amount for renewable generation and about 5-10% of these payments do not reach the producers. Increasing the market size (Norway joining it) might help to decrease the per capita cost of the system.

6. Conclusions and recommendations

ERRA members represent a very heterogeneous group of countries according to their economic development, electricity market structure and availability of domestic energy resources, both conventional and renewable. Similarly, they show a wide range of practices of RES-E promotion. RES-E capacity growth is potentially linked to many factors. Amongst these the transparent and consistent regulation, investor friendly environment and sufficient level of subsidies are usually identified in the literature as the main drivers in RES-E development.

Concerning the abovementioned drivers of higher RES-E penetration, the main question is whether ERRA member states confirm the importance of these assumed drivers. Our analysis tried to answer this question (implied in our hypotheses) and identified the following main relationships in the ERRA region:

- One of the most important precursors is a transparent and credible regulatory practice. Consequently, if an ERRA country aims to pursue further RES-E growth, it should - as a first step - improve its regulatory practice, make it more transparent, credible and allow for easy entry for investors. While in our analysis there were outliers in this respect in both directions - having higher RES-E penetration than the regulatory practice would imply (e.g. Turkey, Estonia) and countries having less RES-E capacity growth (Ukraine, Albania, Serbia) - the underlying connection between the two dimensions was confirmed.
- The relationship between RES-E support levels and RES-E capacity growth levels in the period of 2007-2010 is less straightforward. Our analysis shows that a high nominal level of RES-E support is not a pre-condition for dynamic RES-E penetration levels. This could also be demonstrated by examples of some ERRA member states e.g. by the Turkish and Hungarian RES-E achievements. In Turkey the main driving force was the political commitment to use RES-E capacities in order to reduce the dependency of the country from foreign fossil resources and the supporting general economic environment and growth. In Hungary the driver is rather to fulfil the EU commitments of the country to comply with the tighter air pollution standards and converting coal plants to biomass co-firing. The common feature of these two countries is that they do not apply high level subsidies to promote RES-E technologies. On the other hand higher support levels (e.g. in Latvia and Croatia) do not necessary lead to higher RES-E penetration, as

our analysis shows. The main conclusion is that high level of production support alone is not sufficient to drive RES-E investments.

- The investment environment has also important impact on the RES-E penetration levels. Countries with better credit rating scores perform better in attracting RES-E investors into their electricity markets. While this country characteristic cannot be influenced by energy regulators, some aspects of the investment environment, e.g. electricity price and justified earnings on production and distribution or the transparency and efficiency of regulation, is to some extent in their control.

Beside these factors RES-E policy manifested in ambitious RES-E target is an important catalyst in the RES-E development. Ambitious targets make RES-E promotion policy credible for investors. In addition, targets make progress in RES-E developments measurable and regulators accountable for its effective implementation. EU membership in this respect is decisive, as targets and progress made toward these targets are monitored by the European Commission. Governments of EU member states have to plan their policy and regulatory tools well in advance to achieve the pre-set targets of 2020.

The Czech case study points to the following main conclusions. Generous FIT levels, rigid regulation (a maximum of 5% degression rate in FIT and premium) and slowly reacting political environment resulted in an overshooting in solar capacities during 2010-2011, when close to 2 GW of ground-mounted PV capacities were installed and connected to the grid. This very rapid RES-E market development had many adverse effects:

- it put high pressure on end-consumer prices,
- it crowded out cheaper RES-E technologies, thus deteriorating the efficiency of the regulation in a sense, that not the most cost-efficient solution had been promoted.
- it has invited non-planned regulatory changes, thus deteriorating the long term investment environment of the country's electricity market.

The lesson from this case study for the ERRA member states is to choose carefully their promotion strategy toward more expensive RES-E technologies. In case of expensive RES-E technologies - e.g. PV where the technological learning is still very rapid - countries characterised by lower income and electricity prices should wait till the technology costs get closer to grid parity, even if their resource potential might be more suitable for this technology than many leading European countries. According to the latest forecast of the German government, by 2017 PV will be in grid parity in Germany meaning that such investment will be economically viable without any state support. This stage is likely to arrive a few years later in countries with lower electricity producer prices.

The Swedish case study suggest, that applying a Green Certificate system as well is a viable tool to promote RES-E developments but in the case of very ambitious targets implying that more expensive technologies have to enter the system, GC systems would increase the rents paid to low-cost RES-E producers. On the other hand, undifferentiated green certificates (by technology and by eligibility period) help to achieve targets by the cheapest technologies, thus increasing the efficiency of the support scheme. Differentiation should be left to those countries that perceive some strategic economic advantage in promoting certain segments of the RES-E technology matrix. The creation of transboundary green certificate market (Sweden and Norway) can overcome the problems caused by the limited number of buyers and sellers on the national green certificate market (market power and liquidity).

Some member states in the survey indicated the planned capacity additions in their country for the coming years. In many countries, e.g. Mongolia, Ukraine, Romania, Armenia these capacity additions stand at very high level compared to the present RES-E capacities. It indicates that many of the ERRA countries – and not only the EU member states – are facing significant increases in their RES-E capacities in the coming years. As the final year of our analysis was 2010 due to data availability, the signalled amount of incoming capacities in 2011 and 2012 could easily change the picture of the RES-E markets of these countries. This suggests to closely monitor the RES-E markets of the ERRA countries, and if necessary, carry out a focused, but periodical analysis of this dynamic market segment.

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8. ANNEXES

8.1.Indicator analysis scores

Table 21: Scores in the indicator analysis of the regulatory practices and RES-E capacity growth

	Transparency	Consistency/ Credibility/ Stability	Easy entry/ Flexibility	RES-E capacity growth (2010-2007)/2007
Bulgaria	0,578	0,165	0,568	0,0536
Estonia	0,413	-0,165	-0,127	0,0485
Hungary	0,605	0,000	0,391	0,0268
Latvia	0,248	-0,165	0,422	0,0236
Lithuania	0,330	0,990	0,218	0,0275
Poland	0,495	0,495	0,098	0,0355
Romania	0,330	0,165	0,105	0,0165
Slovakia	0,413	0,165	0,442	0,0211
Albania	0,660	0,165	0,351	0,0007
Bosnia (Federation BiH)*	-0,165	0,000	0,411	0,0254
Bosnia (Republika Srpska)	-0,083	0,330	0,414	na
Croatia	-0,248	0,330	0,589	0,0281
Kosovo UNMIK	0,330	0,165	0,495	na
Macedonia	-0,248	0,000	0,530	0,0078
Montenegro	na	na	na	na
Serbia	-0,743	-0,165	0,224	0,0029
Moldova	na	na	0,330	na
Russia	na	na	na	na
Ukraine	0,083	0,330	0,498	0,0085
Armenia	0,248	0,660	0,057	0,0181
Azerbaijan	na	na	na	na
Georgia	na	0,495	0,165	na
Kazahstan	na	na	na	na
Kyrgyz Republic	na	na	na	na
Turkey	0,660	0,495	0,691	0,1140
Mongolia	0,000	0,660	-0,202	na
Jordan	na	0,330	0,825	na
Nigeria	na	0,000	0,330	na
Saudi Arabia	na	na	na	na
United Arab Emirates	-0,330	-0,165	0,165	0,0007

*RES capacity growth data is for BIH and RS

8.2. The questionnaire

Dear Sir/Madam,

In the following questionnaire we would like to ask you for information about different regulatory aspects of renewable electricity generation (RES-E) in your country. Special focus is given to the RES-E support tools you might apply. The questionnaire is structured into five blocks. The first block asks information on the general issues of your RES-E regulation. The second block asks questions on the licensing and certification issues, while the third one on grid connection issues. All these blocks are uniform and compulsory parts for all participants to the questionnaire. After some common questions, the fourth block includes two parts that are alternatives to each other: Block 4A is for those countries where a feed-in tariff or regulated premium scheme is applied for RES-E promotion, while Block 4B is for those who have quota obligation/green certificate trading schemes in place. If you have any form of a hybrid system, please try to fill in both parts according to your system in place. Finally, block five asks a few open closing questions.

Some questions ask you to specify your answer or to give some details or to add an extra table. In this cases please add extra lines/tables to the questionnaire where needed.

THANK YOU FOR YOUR TIME AND COOPERATION!

If you encounter any problems or have any questions when filling the questionnaire, please contact us (in English):

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Block 1.: General questions

1. **Please indicate your country and regulatory agency: ………………………………………………….**

2. **Please fill in the following table:**

Source of renewable electricity generation	Installed capacity end of 2009 (MWe)	Installed capacity end of 2010 (MWe)	Electricity delivered to the grid in 2010 (GWh)	Capacity licensed but not yet in operation (MWe)	Capacity applied for license/grid connection (MWe)
Wind power					
Solar PV					
Solar thermal electricity					
Small hydropower (below 5 MWe)					
Medium-sized hydropower (between 5 and 10 MWe)					
Large hydropower (above 10 MWe)					
Solid biomass					
Biogas					
Geothermal					
Waste (only if that is considered as renewable resource according to national regulation)					
Other, please specify:					
Total renewable					
Source of conventional electricity generation					
Coal, lignite					
Gas					
Oil					
Nuclear					
Other, please specify:					
Total (renewable and conventional)					
Net export, Gwh, 2010 (negative in case of net import position)					

3. **Please indicate the total installed renewable electricity generating capacity at the end of each of the following years (MWe)**

2002	2003	2004	2005	2006	2007	2008	2009	2010	2011

4. **Has your country introduced a support mechanism to encourage renewable electricity generation?**
   - ☐ Yes, in ………… (year) for the first time
   - ☐ No

Renewable energy utilization targets

5. **Has energy policy set an overall target for renewable energy source utilization as part of the future energy supply in your country?** [1]
   - ☐ Yes
   - ☐ No
6. **Has energy policy set a target (aggregate or by technology) for renewable electricity utilization as part of the future electricity supply in your country?**
   - ☐ Yes -
   - ☐ No – Jump to Question no. 1
7. **Please provide details about your national renewable energy source utilization target by year. Please indicate target values in PJ or % of total final energy consumption (which is relevant in your country)**

Target year				
Target value, PJ				
Target value, %				

8. **How is your national renewable electricity utilization target set?**
   - ☐ As an overall renewable electricity generation target
   - ☐ Specific targets are set for different technologies

9. **Please give details about your national renewable electricity utilization target by year. Please indicate target values in GWh or in % of electricity generation (which is relevant in your country). If the target values are differentiated please specify them by technologies by adding additional lines to the tables below.**

Aggregate target:

Target year[2]	2012	2015	2020	2050
Target value, GWh				
Target value, %				

e.g. Wind target:[3]

Target year	2012	2015	2020	2050

[1] E.g. the renewable energy source utilization target for Hungary is 14.3 % of the total final energy consumption by 2020.
[2] If you have other target years, please include them in the table.
[3] Insert further tables for each technology, if needed.

Target value, GWh				
Target value, %				

Block 2: Licensing, certification

Licensing of RES-E by the energy regulator

1. **What is the capacity threshold for licensing RES-E generation by the energy regulator (below this threshold no licensing is required)?**

   ………… MWe

2. **Do you have any special (simplified) licensing procedure for RES-E producers?**

   - ☐ No
   - ☐ Yes

3. **Is there any other simplification for RES-E licensing compared to conventional generation (e.g. reduced licensing fee or administrative deadlines, etc.)?**

   - ☐ No
   - ☐ Yes – please specify……

4. **Is there an official deadline to make a regulatory decision on a RES-E license application?**

   - ☐ No
   - ☐ Yes, ……… days

5. **What has been the average time requirement of issuing a license for RES-E producers by the energy regulator in the last two years?**

   - ☐ 1 - 30 days
   - ☐ 30 – 120 days
   - ☐ 120 – 365 days
   - ☐ more than 365 days

6. **What is the administrative charge the RES-E producer has to pay to get a license from the energy regulator?**

   - ☐ ……… (in national currency units)

The overall RES-E authorization process[4]

7. **What is the average number of authorities involved in the RES-E licensing/permitting procedure (number of licenses or permissions to be obtained by investor)?**

   - ☐ 0-5
   - ☐ 5-15
   - ☐ Above 15

[4] In this section we would like to receive information on the overall RES-E authorization process, including e.g. construction permits as well. If your organization has no knowledge on the exact number, please provide with your expert estimates on question number 7 and 9.

8. Is there a central agency assigned the task of coordinating the authorization/permitting/licensing procedure? (Is one-stop-shopping possible?)

- ☐ No
- ☐ Yes, please specify which agency: ………………………………………………………………

9. What is the average lead time for the (overall) RES-E authorization procedure (including grid connection)?

- ☐ Below 9 months
- ☐ 9-24 months
- ☐ Above 24 months

10. Is the licensing procedure differentiated by technology and/or installed capacity?

- ☐ No
- ☐ Yes, please specify: ……………………………………………………………………………………

10.1 If so then provide us the duration of the shortest and the lengthiest procedure! (e.g. 1 month for PV and 50 month for offshore wind)

- ☐ **………**

11. What is the legal remedy for disputes over the licensing procedure?

- ☐ Appeal to energy authority
- ☐ Appeal to ministry
- ☐ Appeal to court
- ☐ Other, please specify

Certification

12. Do you have a certification of origin scheme in place for RES-E production?

- ☐ Yes,
- ☐ No - **Jump to Block 3!**

13. Who is the responsible authority for issuing RES-E certificates?

- ☐ Energy regulator
- ☐ Ministry
- ☐ Independent issuing body;
- ☐ Other, please specify……………………………………………………………………………………

14. Is it obligatory to issue RES-E certificates for each MWh of renewable electricity production?

- ☐ Yes,
- ☐ No, only at the request of the RES-E producer
- ☐ There are no RES-E certificates issued

15. What is the purpose of issuing the certificates?

- ☐ It serves only verification purposes for the feed-in tariff system;
- ☐ It serves only verification purposes for a quota obligation system;
- ☐ Serves as a basis for a green certificate trading system;
- ☐ Other, please specify.

Block 3: Grid integration issues

1. **Do RES-E generators have priority network access in your country meaning that, as a rule, the grid operator(s) is mandated to take over their production whenever they are producing?**
   - ☐ Yes
   - ☐ No

2. **Is there an organization or company obliged to purchase renewable electricity from RES-E producers in your country?**
   - ☐ Yes
   - ☐ No

   - ☐ **If yes, who is obliged to purchase renewable electricity in your country?**
     - ☐ The transmission system operator
     - ☐ The grid operator(s) to which the RES-E producer is connected to
     - ☐ A specific Renewable Balancing Entity
     - ☐ Other, please specify:………………………………………………………………………..

3. **To whom can RES-E generators sell the electricity they produce (tick all applicable)?**
   - ☐ The transmission system operator
   - ☐ The integrated utility
   - ☐ The grid operator(s) to which the RES-E producer is connected to
   - ☐ A specific Renewable Balancing Entity
   - ☐ Final customers
   - ☐ Traders, suppliers
   - ☐ They can export
   - ☐ Other, please specify:………………………………………………………………………..

4. **How are the general rules and conditions for RES-E grid connection determined?**
   - ☐ No general rules for RES-E connection exist
   - ☐ Rules established or approved by the energy regulator.
   - ☐ The grid operator sets the rules for RES-E connection.
   - ☐ Negotiated on a case by case basis between grid operator and RES-E producers.
   - ☐ Other rules apply, please specify………………………….

5. **Who decides about the cost of connection?**
   - ☐ Regulated or approved by the energy regulator
   - ☐ Negotiated between grid operator and RES-E developer
   - ☐ Decided by grid operator
   - ☐ Determined by an open tender
   - ☐ Other, please specify

6. **Who pays for the direct network connection cost of a RES-E generator?**
   - ☐ The RES-E developer pays ……….% of the cost of connection to the grid substation
   - ☐ The network operator pays ………..% of the cost of connection to the grid substation
   - ☐ Other ways, please specify………………………………..

7. **Do you have technical standards in the Grid Codes or in other regulatory documents that RES – E producers have to meet with regard to grid connection and access?**

 - ☐ Yes, we have technical standards for RES-E producers in the Grid Code approved by the energy regulator.
 - ☐ We have technical standards for the connection of RES-E production, that are laid down in the following document: ………………………………………………………………………………
 - ☐ The technical standards are agreed between the developers and the network company on a case by case basis.

8. **How do you allocate RES-E connection opportunities (licenses) among competing developers in case of scarce grid connection capacity?**

 - ☐ On a first come first serve basis
 - ☐ By competitive tendering
 - ☐ Not regulated.
 - ☐ Other, please specify…………..

9. **Who is in charge of RES-E production forecasting and scheduling?**

 - ☐ The Transmission System Operator
 - ☐ The Distribution System Operator
 - ☐ The renewable electricity plant operator
 - ☐ Other, please specify……………

10. **Please compare the balancing regimes of renewable and conventional electricity producers in your country!**

	Available for/applicable to RES-E producers	Available for/applicable to conventional electricity producers
10.1 Who is responsible for preparing the production schedule?	☐ the plant operator ☐ the system operator ☐ the balance group operator ☐ other, specify ☐ no schedule required	☐ the plant operator ☐ the system operator ☐ the balance group operator ☐ other, specify ☐ no schedule required
9.1. How is deviation from production schedule calculated?	☐ plant by plant, ☐ net of total deviation within the group of renewable plants ☐ other, specify	☐ plant by plant, ☐ net of total deviation within the balancing group ☐ other, specify
9.2. How much penalty is payable at the end of 2010 for an upward deviation of 1 MWh? (enter 0 if there is no penalty payable)	……………… national currency units / MWh	……………… national currency units / MWh
9.3. How much penalty is payable at the end of 2010 for an downward deviation	……………… currency units / MWh	……………… currency units / MWh

of 1 MWh? (enter 0 if there is no penalty payable)		

11. Do you handle the balancing needs of renewable electricity producers in a special way?[5]

- ☐ Yes
- ☐ No

If yes, can you describe your practice briefly?

[5] E.g. wind producers in some European countries are allowed to modify their schedule up to four hours before gate closure time without any penalty. This allows for more reliable planning of schedule for wind producers.

Block 4: Support schemes for renewable electricity

General questions: for all respondents!

1. **Please fill in the following table indicating which RES-E support schemes are used in your country for the various technologies (tick all available support schemes if applicable)!**

		Wind	Solar PV	Solar thermal electricity	Small hydro power	Geothermal	Solid biomass	Biogas	Waste	Other
INVESTMENT SUPPORT SCHEMES	investment grant									
	supported investment credits									
	investment tax credit									
PRICE SUPPORT SCHEMES	feed-in tariff									
	regulated premium									
QUOTA SUPPORT SCHEMES	RES-E quota obligation, non-tradable									
	tradable RES-E certificate									
	Tendering or bidding system									
	Other, please specify:									

2. **Do RES-E developers receive long term power purchase agreements?**
   - ☐ No
   - ☐ Yes – in this case, who is the contracting party on the purchasing side? Please specify:………

3. **If your country has an investment support scheme in place, how is the scheme financed? (tick all applicable)**
   - ☐ Central state budget
   - ☐ International funds (i.e. EU, EBRD)
   - ☐ System charges payable by electricity system users
   - ☐ Other, please specify
   - ☐ Non applicable

4. **If your country has a <u>price</u> support scheme (feed-in-tariff or regulated premium) in place, how is the scheme financed? (tick all applicable)**
   - ☐ Central state budget
   - ☐ International funds (i.e. EU, EBRD)
   - ☐ System charges payable by electricity system users
   - ☐ Other, please specify
   - ☐ Non applicable

Block 4A: Questions for those respondents having a <u>feed-in tariff or regulated premium</u> scheme

5. **Who is authorized to set feed-in tariffs or regulated premiums in your country?**
   - ☐ Parliament
   - ☐ Government
   - ☐ Ministry
   - ☐ Energy regulator
   - ☐ Other, please specify…………………………………………………………………………..

6. **In the attachment to this questionnaire you can find the actual feed-in tariffs for Hungary. Please provide a similar table with your feed-in tariffs or regulated premiums as of December 31, 2011 in your national currency! Please indicate in your table (or in explanatory text) if the price support (feed-in tariff or regulated premium) scheme is differentiated along any of the following aspects so that different RES-electricity producers receive different tariffs?**

   - ☐ Energy source/technology (i.e.: wind vs. hydro vs. PV)
   - ☐ Plant capacity (i.e. small vs. large hydro)
   - ☐ Vintage of plant investment (e.g. depending on the year of investment completed)
   - ☐ Location (i.e. off-shore vs. on-shore)
   - ☐ Time of the day/week (i.e. peak vs. off-peak hours)
   - ☐ Domestic/non-domestic component of the investment
   - ☐ Other, please specify.

7. **What is the primary method for setting feed-in tariffs in your country?**
   - ☐ The cost plus (or rate of return) method
   - ☐ International benchmarking
   - ☐ The estimation of avoided damage by RES-E
   - ☐ Other; please specify…………………………………………………………………………………………….
   - ☐ Non applicable

8. **Is there a cap on the total annual budget for the price support scheme exists in your country?**
   - ☐ Yes
   - ☐ No
   - ☐ Non applicable

9. **Do you use some kind of periodical adjustment of feed-in tariffs or regulated premiums to account for inflation?**

Feed-in tariff	Feed-in premium
☐ Yes, with consumer price index	☐ Yes, with consumer price index
☐ Yes, (please specify):	☐ Yes, (please specify):
☐ No	☐ No

10. Is the feed-in tariff or the regulated premium decreased annually by some kind of efficiency factor?

Feed-in tariff	Feed-in premium
☐ Yes	☐ Yes
☐ No	☐ No

11. Does your RES-E regulation specify the eligibility period for support?

- ☐ Yes, it specifies a uniform eligibility period for all RES-E producers in …………years
- ☐ Yes, it specifies the eligibility period differentiated by ……………………………………..
- ☐ It is decided on a case-by-case basis

12. Is the feed-in tariff or the regulated premium subject to regular review by the regulatory authority, the responsible ministry or the government?

Feed-in tariff	Feed-in premium
☐ Yes	☐ Yes
☐ No	☐ No

☐ **If yes, what is the frequency of this regular review?**

☐ …………………………………..(time period. e.g. yearly, biannually)

☐ **Did it ever happen that your feed-in tariff or regulated premium system was revised in a non-planned manner?**

Feed-in tariff	Feed-in premium
☐ Yes	☐ Yes
☐ No	☐ No

If yes, why? (please explain)……………………………………………………………………………….

☐ **About how many times in the last two years it happened that your feed-in tariff or regulated premium system was revised in a non-planned manner?**

Feed-in tariff	Feed-in premium
☐ …….times	☐ …….times

13. Are there any restrictions on the amount of installed capacity for some supported RES-E technologies?

- ☐ No
- ☐ Yes – please specify: …………

14. In case of having a feed-in tariff (or regulated premium) system and capacity development restrictions at the same time, how do you allocate capacity development possibilities (or licenses) among competing developers?

- ☐ On a first come first served basis
- ☐ Through tenders
- ☐ Auctioning
- ☐ Other, specify…………………………………………………………………
- ☐ Non applicable

⟹ **<u>Please continue with Block 5: Closing questions on the last page!</u>**

Block 4B: Questions for those respondents having a quota obligation scheme

15. Who is authorized to set the target for the total amount of quota obligation/green certificates?

- ☐ Parliament
- ☐ Government
- ☐ Ministry
- ☐ Energy regulator
- ☐ Other, please specify……………………………………………………………………………..

16. Is the obligation target subject to regular review?

- ☐ Yes
- ☐ No

17. If yes, what is the frequency of review?

- ☐ ………………………………..(time period. e.g. yearly, biannually)

18. If your country has a quota obligation/green certificate trading scheme, please give a short description or a summary table describing the scheme, including the following information:

- o If your country has uniform green certificates for RES-E production, or different RES-E technologies receive different number of certificates?
- o If the certification of 1 MWh RES electricity producers is differentiated according to other factors, e.g.:
  - by capacity size: (e.g. small vs. large hydro),
  - if capacity is renovated (e.g. in the case of hydro),
  - vintage of plant investment (e.g. depending on the year of investment completed)
  - location (i.e. off-shore vs. on-shore)
  - time of the day/week (i.e. peak vs. off-peak hours)
  - domestic/non-domestic components of the investment
  - other, please specify
- o Please also indicate, if your country has minimum and maximum certificate price limits applied in the scheme.

Please, insert the description table/text here

19. Who is the responsible agency for issuing and verifying green certificates?

Issuing agent	**Verifying agent**
☐ Energy regulator	☐ Energy regulator
☐ Independent agency	☐ Independent agency
☐ Ministry	☐ Ministry
☐ Other, please specify	☐ Other, please specify

20. Who is required to fulfill the quota obligation/green certificate target?

- ☐ End customers;
- ☐ Electricity providers/traders;

- ☐ Distribution companies;
- ☐ Producers;
- ☐ Other, please specify

Block 5: Closing questions

1. Could you please recall the most important event of the last five years that improved the prospect for renewable electricity generation significantly in your country (e.g. substantial change in regulation, appearance of a sizeable investor etc.)? Please describe it.

2. Please describe the most important obstacles to further development of renewable electricity generation in your country!

3. Please provide examples of success with regard to RES-E regulation and/or investment in your country (if any)!

Attachment

Table 1: Feed in tariffs in Hungary (for 2011)

Power category			From 1st January 2011			From 1st July 2011		
			Peak[2]	Valley[2]	Deep valley[2]	Peak[2]	Valley[2]	Deep valley[2]
Produced from renewable energy sources	**Based on resolution of Hungarian Energy Office** (**HEO**) if it was adopted or the application was **received before 01. 01. 2008.** [except hydro **p**ower **s**tation **u**nits (**PSU**) >5 MW] *[GD 4. § (1)]*	**Solar, Wind** *[GD Suppl. Nr. 1. pt.1. b)]*	30.71	30.71	30.71	30.71	30.71	30.71
		Other than Solar and Wind *[GD Suppl. Nr. 1. pt. 1. a)]*	34.31	30.72	12.54	34.31	30.72	12.54
	Based on resolution of HEO[6] adopted after 01. 01. 2008. (except hydro PSU >5 MW, other PSU > 50 MW) *[GD 4. § (2)-(3), (6)]*	**Solar** *[GD Suppl. Nr. 1. pt. 2. b)]*	29.84	29.84	29.84	29.84	29.84	29.84
		Produced by **PSU of 20 MW or less** (except Solar) *[GD Suppl. Nr. 1. pt. 2. a)]*	33.35	29.84	12.18	33.35	29.84	12.18
		Produced by **PSU of >20 MW - max. 50 MW** (except Wind from 30th Nov. 2008, Solar) *[GD Suppl. Nr. 1. pt. 3. a)]*	26.67	23.88	9.74	26.67	23.88	9.74
		Produced by Wind PSU of >20 MW - max. 50 MW from 30th Nov. 2008 *[GD Suppl. Nr. 1. pt. 3. b)]*	33.35	29.84	12.18	33.35	29.84	12.18
		Produced **by PSU comprising used equipment[3]** *[GD Suppl. Nr. 1. pt. 4]*	20.74	13.27	13.27	20.74	13.27	13.27
	Produced by **hydro PSU > 5 MW, other PSU >50 MW** *[GD 4. § (4), Suppl. Nr.1. pt. 4]*		20,74	13.27	13.27	20.74	13.27	13.27
Produced from waste	*[GD 4. § (5), Suppl. Nr.1. pt. 5]*		31,28	21.55	11.25	31.28	21.55	11.25