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The support of electricity from renewable energy sources

Accompanying document to the

Proposal for a

DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

on the promotion of the use of energy from renewable sources

{COM(2008) 19 final}

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Summary

In 2005, in accordance with directive 2001/77/EC on the promotion of renewable electricity, the European Commission reported on the application and coexistence of the different support mechanisms for electricity from renewable energy sources (COM(2005)627). The report found that in general the effectiveness and efficiency of support schemes differ widely across the Member States. It also found that the different support schemes are characterised by different levels of maturity and that policy schemes in some countries – in particular quota obligation systems – are fairly young systems and still in a transitional phase. The report also found that there is scope for greater cooperation between member States and optimisation of individual support schemes. Whilst harmonisation of support schemes was considered a long term objective, persisting barriers to the development of renewable electricity and the low level of competition in the electricity market implied that such harmonisation would be premature. The report concluded that the Commission should closely monitor support schemes and report again in 2007. This report fulfils that commitment.

This report presents an updated review of the performance of support schemes using the same indicators presented in the 2005 report. It finds that, as in 2005, *well-adapted* feed in tariff regimes are generally the most efficient and effective support schemes for promoting renewable electricity.

This report also examines the relationship between support schemes and the internal electricity market, including current policy proposals to increase competition, the application of rules on the free movement of goods. The report underlines the need to improve the competitive situation on the internal electricity market, and recalls the need for implementing the Commission proposals regarding unbundling, improved regulatory oversight and cooperation, network cooperation and transparency. These proposals are vital in order to improve the market access for renewable electricity. It also concludes that it is important that the design of support systems is compatible with a competitive internal electricity market. If the renewable electricity is traded on the electricity market, it can contribute to the development of a more competitive market through for example a more diversified supply structure. Member States' efforts to coordinate and optimise their support regimes are then examined. Several Member States have adapted their support schemes to optimise or improve their effectiveness and there have been some efforts to coordinate between Member States.

Administrative, grid and market barriers are also discussed as these can have an important impact on the performance of support schemes.

COMMUNICATION FROM THE COMMISSION

The support of electricity from renewable energy sources

1. INTRODUCTION

To achieve energy policy goals of sustainability, security of supply and improved competitiveness, the production of renewable energy is promoted across Europe. On the Community level, Directive 2001/77/EC introduced indicative national targets for the promotion of *electricity* from renewable energy ("renewable electricity"), established a guarantee of origin regime, and addressed barriers to market entry faced by renewable electricity. It has provided an important framework for national support schemes. Partly induced by this legislation, Member States have put in place a range of support measures for promoting renewable electricity, market based instruments that compensate for the various market failures that leave renewable energy at a competitive disadvantage compared to conventional energy, in particular the negative externalities of fossil fuels and security of energy supply.

Currently, 27 Member States operate 27 different national support schemes. These different, national, support schemes have developed partly because support has been linked to other national priorities, such as employment and regional development and because national electricity markets themselves still show very different characteristics and remain nationally segmented, despite the market opening foreseen by Directive 2003/54/EC. There are physical, administrative and commercial barriers to cross border trade in electricity, which are only slowly being overcome.

Article 4 of Directive 2001/77/EC required the Commission to present a report on the mechanisms for supporting renewable electricity in 2005. This was the Commission's Communication "The support of renewable electricity", COM(2005)627, which assessed national support schemes on the basis of a set of performance indicators. The report concluded that rather than immediate harmonisation, a coordinated approach to support schemes for renewable energy was more appropriate, based on cooperation between countries and optimisation of the support schemes. The report in 2005 concluded that the Commission would closely monitor the state of play in the EU renewable energy policy and present a new report on the level of Member States systems for promoting renewable electricity by December 2007.

This report also addresses support schemes and internal market issues as well as administrative, grid and market barriers.

2. ASSESSMENT OF SUPPORT SCHEMES

2.1. OVERVIEW OF SUPPORT SCHEMES

There is a great range of market-based instruments governments use to subsidise renewable electricity. These can be divided between investment support (capital grants, tax exemptions or reductions on the purchase of goods) and operating support (price subsidies, green certificates, tender schemes and tax exemptions or reductions on the production of electricity).

In overall terms, operating support - support per MWh – for renewable electricity is far more important than investment support. Market-based instruments providing operating support can be

divided in instruments that fix a quantity of renewable electricity to be produced and in instruments that fix a price to be paid for renewable electricity[1]. Economic theory has shown that under ideal conditions, quantity-based instruments and price-based instruments have the same economic efficiency.[2]

Quantity-based market instruments

Quota **obligations** are used in seven Member States. Under a quota obligation, governments impose an obligation on consumers, suppliers or producers to source a certain percentage of their electricity from renewable energy. This obligation is usually facilitated by tradable green certificates (TGC)[3]. Accordingly, renewable electricity producers sell the electricity at the market price, but can also sell green **certificates**, which prove the renewable source of the electricity. Suppliers prove that they reach their obligation by buying these green certificates, or they pay a penalty to the government.

Under **tendering**, used in the past in three Member States on a broader scale, a tender is announced for the provision of a certain amount of electricity from a certain technology source, and the bidding should ensure the cheapest offer is accepted. Denmark has recently decided to use tendering for the development of off-shore wind projects.

Price-based market instruments

Feed-in tariffs and premiums are used in 18 Member States. Feed-in tariffs and premiums are granted to operators of eligible domestic renewable electricity plants for the electricity they feed into the grid. The preferential, technology-specific feed-in tariffs and premiums paid to producers are regulated by the government. Feed-in tariffs take the form of a total price per unit of electricity paid to the producers whereas the premiums (bonuses) are paid to the producer on top of the electricity market price. An important difference between the feed-in tariff and the premium payment is that the latter introduces competition between producers in the electricity market. The cost for the grid operator is normally covered through the tariff structure. The tariff respectively the premium is normally guaranteed for a period of 10 – 20 years. In addition to the level of the tariff respectively the premium, the guaranteed duration provides a strong long term degree of certainty which lowers the market risk faced by investors. Both feed-in tariffs and premiums can be structured to encourage specific technology promotion and cost reductions (the latter through stepped reductions in tariff/premiums). Three Member States offer the choice between feed-in fixed prices and premiums, and one Member State offers a pure premium payment.

Fiscal incentives, such as tax exemptions or reductions, are used as the main support scheme in two Member States and as supplementary instruments in others. Producers of renewable electricity are exempted from certain taxes (e.g. carbon taxes) in order to compensate for the unfair competition they face due to external costs in the conventional energy sector. Directive 2003/96/EC[4] explicitly allows for such fiscal incentives in its Article 15. The effectiveness of such fiscal incentives depends on the applicable tax rate. In the Nordic countries, which apply high energy taxes, these tax exemptions can be sufficient to stimulate the use of renewable electricity; in countries with lower energy tax rates, they need to be accompanied by other measures.

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1 See Green paper on market-based instruments for environment and related policy purposes - COM(2007) 140, p. 3.

2 See M. Weitzman, Prices vs. Quantities, Review of Economic Studies, 1974, vol. 41, issue 4, pages 477-91.

3 The Latvian Government sets an obligation to install a certain installed capacity of renewable electricity since 2002, however does not require the use tradable green certificates to prove compliance with this obligation.

4 Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity (OJ L 283, 31.10.2003, p. 51).

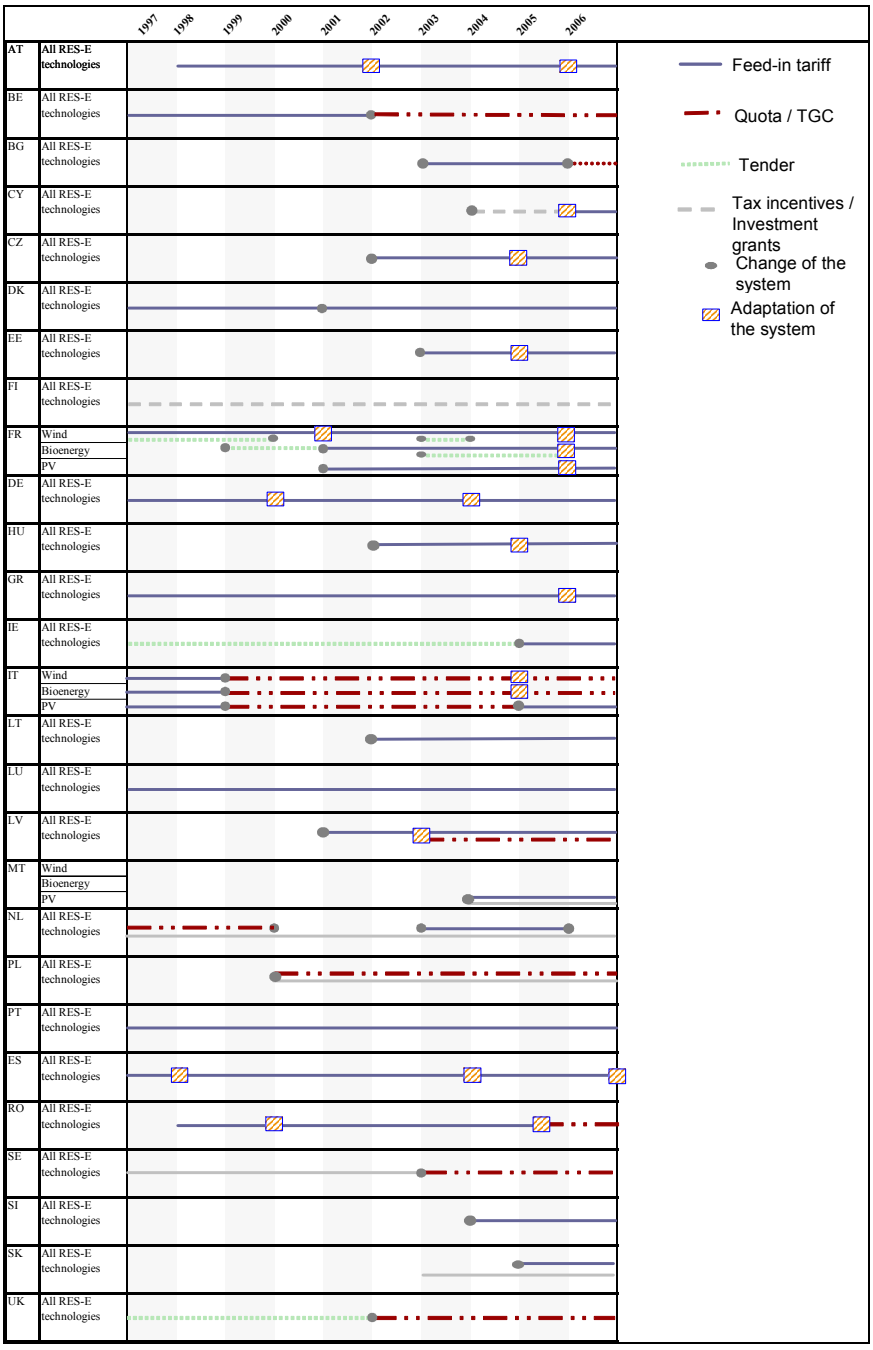
Due to different resource potentials and differences in renewable technology costs, a single support instrument is seldom sufficient to develop a full spectrum of renewable energy sources available in one country. In most cases, Member States apply a combination of support schemes to realise renewable energy investments. A common combination of support schemes is to have investments subsides or soft loans in addition to the main support scheme, such as feed-in tariffs or quota obligations.

2.2. REFINEMENT OF SUPPORT SCHEMES OVER TIME

The majority of Member States have opted for feed-in tariff regimes as the main support mechanism, whereas a handful of Member States have opted for quota regimes. As can be seen from the table below, Member States are continuously fine-tuning existing policy measures with the aim of improving the performance of these measures.

In fact, since the last report in 2005, ten countries have adapted their support schemes, striving to adopt beset practice or otherwise optimise the efficiency of the system.

Table 1: Recent and current support schemes in Member States[5]



Source: OPTRES, 2007 (modified by DG TREN)

5 Quota obligations are usually coupled with tradable green certificate markets (TGC). For Netherlands, TGCs were introduced with a tax exemption. For Latvia, renewable obligation exists without the use of tradable green certificates. For Denmark, high and successful feed-in tariffs were abolished in 2000/2001 and premiums were introduced in 2003, after a transitional period. The framework for a tendering system for offshore was established in 1999. However, the political decision to implement was taken in 2004 and the tender was conducted in 2005.
A change in the system represents a major policy change in the promotion of renewable electricity, i.e. change in support scheme. An adaptation of the system represents modifications to existing support schemes, such as the introduction of tariff degression or technology specific tariffs.

2.3. THE PERFORMANCE OF SUPPORT SCHEMES

In COM (2005) 627, the Commission presented its assessment of the support schemes using two main criteria; one criterion measuring effectiveness (i.e. ability to deliver an increase of the share of renewable electricity consumed) and the other criterion measuring efficiency (i.e. comparison of the total amount of support received and the generation cost). In addition, the effectiveness of a policy was correlated with the average expected profit from investments in renewable electricity using the same policy. Correlating these gives an indication as to whether the success of a specific policy is primarily based on high financial incentives, or whether other aspects have a crucial impact on market diffusion. Other important but non quantified criteria were compatibility with the internal market for electricity, the rules on free movement of goods, and EC state aid law. These criteria have again been used to assess the performance of support schemes in this report.

Comparing the two main types of support schemes, namely quota obligations and feed-in tariffs, historic observations from EU Member States suggest that feed-in tariffs achieve greater renewable energy penetration, and do so at lower costs for consumers. Technology specific details of the analysis are contained in annex 3; the compatibility of support schemes with the internal market for electricity and the rules on free movement of goods are assessed in chapter 3.

The main conclusions on the effectiveness and efficiency of the support schemes, and the observed effectiveness of the different support schemes compared with the level of financial support as seen from the perspective of an investor, can be summarised as follows:

Effectiveness:

The effectiveness indicator shows the increase of electricity generation compared to the additional realisable mid-term potential to 2020 for a specific technology.

- The effectiveness of policies promoting wind energy, biogas and photovoltaics technologies has been highest in countries using feed-in tariffs as their main support scheme. However, not all feed-in schemes implemented in Member States have been equally successful. For onshore wind energy, Denmark, Germany and Spain are showing the highest effectiveness indictors for the period 1998-2006. High investment security coupled with low administrative and regulatory barriers in these countries has stimulated a strong and continuous growth of wind energy over the last decade. Compared to 2005, important improvements can also be seen in other feed-in tariff countries like Ireland and Portugal. Portugal increased its installed capacity by more than 50% in 2006. The effectiveness of support to onshore wind in Belgium and the UK has grown more strongly in 2005 and 2006 but is still comparatively low compared to the above-mentioned countries with feed-in tariffs. The effectiveness indicators for the new Member States show that progress has been generally much lower, with the exception of Hungary and Latvia. Latvia showed the highest relative growth in the period considered, followed by Hungary for the case of onshore wind.

- In general, the effectiveness indicator shows biogas and PV technologies have low performance levels. For biogas, the highest growth can be seen in Austria, Denmark, Germany, Greece and Luxembourg, all using feed-in tariff systems, and the UK, using a tender until 2003 followed by a quota obligation with tradable green certificates. For PV the strongest growth in recent years can be seen in Germany, followed by Spain, Italy and Greece.

- The effectiveness of low cost options in the overall renewable electricity portfolio, such as sewage gas and certain types of biomass has been particularly high in countries with non-

technology specific support schemes. However, some feed-in tariff systems have also been successful at developing these options.

- The tendering system in Ireland, which in 2006 was replaced by feed-in tariffs, showed moderate effectiveness before the year 2004. In France, the tenders for wind and biogas have been less effective. The new tendering scheme in Denmark for offshore has been until now been the most effective scheme to support this technology in Europe.

- Other support mechanisms, such as investment grants and tax rebates are difficult to measure as these mechanisms are usually used as additional policy tools. The combination of investment grants and tax rebates have proved to be very successful for the development of solid biomass in Finland, but less effective for the development of wind.

Efficiency:

The efficiency indicator compares the total amount received for renewable energy (level of support) to the generation cost. The closer the level of support is to the generation cost, the more efficient a support mechanism is in terms of covering the actual costs. If the level of support is below the generation cost, which is the case in many of the Member States, it is not effective as it is too low to trigger substantial investments in renewable electricity generation.

How well the level of support is adapted to the generation costs varies between Member States and also between technologies. These results are illustrated and explained in Annex 3.

- Two thirds of the Member States are considered to have a level of support which is considered sufficient to cover generation costs for both onshore wind and solid biomass. This implies an improvement as only around 50% of the Member States were considered to provide adequate support to these technologies in the Commission's report in 2005. Increased levels of support can be observed in the Czech Republic, Estonia, Greece, Portugal, Slovakia and Slovenia.

- For small hydro, two third of the Member States are considered to provide sufficient support.

- For biogas, the level of support is considered to be either insufficient to cover generation costs, or at the lower end of the cost range in more than half of the Member States. Accordingly, the picture has not changed much since the previous report. Although some Member States have improved their level of support, it is still considered to low to successfully develop new generation.

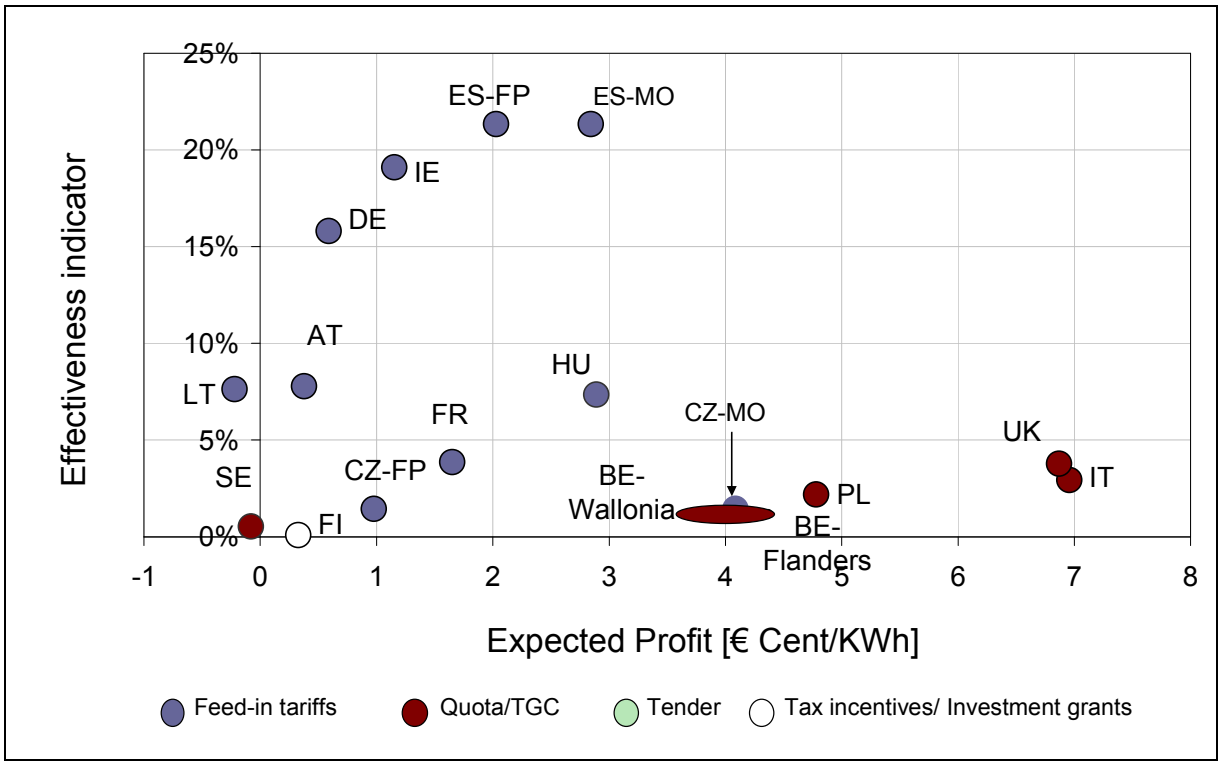
- Although there has been a significant cost reduction in photovoltaic electricity, this technology is generally poorly subsidised across the EU, with the exception of Germany, Luxembourg, Netherlands, Italy, Spain, the Czech and Austria.

Investor attractiveness:

Another way of reflecting efficiency is to consider the expected profit (revenue minus expenses) per kWh. Comparing the effectiveness of a policy promoting renewables with the expected profit of the renewable investment gives an indication of whether the success of a policy is based on high financial incentives, or whether other aspects (such as stability, lower investment risk or market access) have a bigger impact on market diffusion.

The figure below shows that the observed effectiveness of a promotion policy for onshore wind compared with the expected profit[6].

Figure 1: Historically observed efficiency of support for onshore wind: Effectiveness indicator compared to the expected profit for the year 2006



Source: OPTRES, 2007

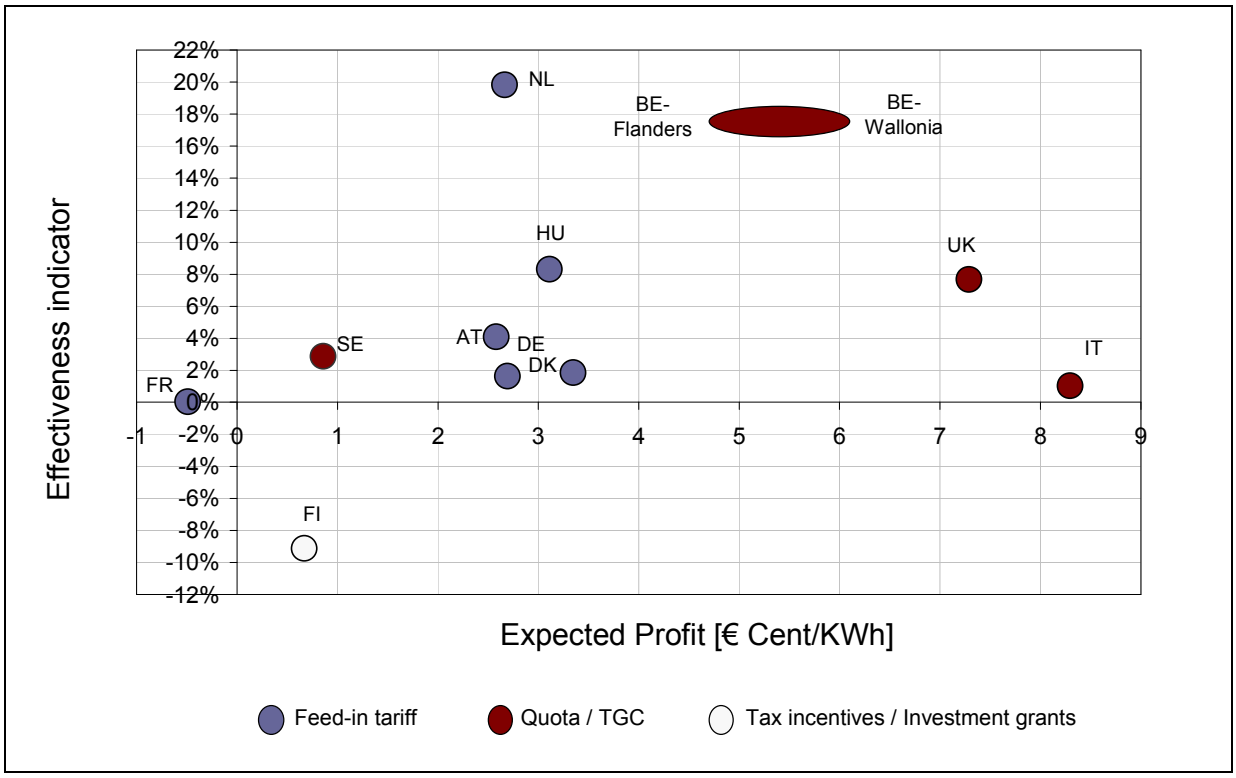
As a general conclusion it can be stated that for onshore wind in 2006 *well-adapted* feed-in tariff systems are typically more effective at a relatively low producer profit. France, with persistent administrative barriers preventing the development of wind energy, is an exception to this general rule. In contrast, it can be observed that the quota systems achieve a rather low effectiveness at comparably higher profit margins for onshore wind, However, it should however be mentioned that quota systems are relatively new instruments, and there is at present little knowledge of how the certificate prices will develop over time[7].

The same analysis has been carried out for electricity generated from forestry biomass.

Figure 2: Historically observed efficiency of support for forestry biomass: Effectiveness indicator compared to the expected profit for the year 2005

6 In order to give an illustration of the main differences between support schemes, this comparison has only been carried out for a limited number of Member States. It should be mentioned that some Member States offer different options for onshore wind. In Belgium, there are different quota schemes in Flanders and Wallonia. In addition, the Czech Republic and Spain offer different tariff options: a fixed price option and a market based option with premiums.

7 The high profits in Belgium, Italy and the UK results in particular from the extrapolation of the presently observed certificate prices. This assumption may be questionable because certificate prices may fall as the certificate markets in those countries mature.



Source: OPTRES, 2007

Taking into account that the high effectiveness of the quota regime in Belgium was exceptional for 2005, it can be observed from this analysis for biomass that feed-in regimes generally achieve a low to moderate effectiveness at a lower profit compared to quota systems. Finland which uses tax incentives as the main support schemes has generally performed best in terms of effectiveness and efficiency, however, shows a rather poor growth result in 2005. This is presumably due to relatively higher prices for biomass compared to other fuel sources for co-firing in 2005.

3. INTERNAL MARKET AND STATE AID ASPECTS

Support schemes for renewable electricity, in addition to being effective in the promotion of renewable electricity and efficient with respect to amount of public money spent, also need to comply with rules on the internal market for electricity, on the free movement of goods and on state aid. Whilst support is granted as part of a Member State's efforts to offer environmental protection, increase security of supply and promote regional development, it should be proportionate and minimise any market distortion.

3.1. SUPPORT SCHEMES AND THE INTERNAL ELECTRICITY MARKET

The creation of the Single European Market is legally founded in the Treaty and Directive 2003/54/EC establishes the specific rules and conditions for the electricity market. Whilst a great deal has been done to open up the electricity market, structural failings remain. For example, the current rules on the separation of sometimes monopolistic network activities from the supply and production of energy do not effectively prevent a large number of network operators from discriminating against new users of the network. Consequently, new companies, including a growing number of producers of renewable electricity, find it difficult to enter the market, due to

discriminatory access conditions, lack of available network capacity, lack of transparency on network data and low investment levels. The system that grew up with large, centralised monopolistic conventional fuel-based energy producers still needs to adapt to facilitate the participation of smaller, decentralised renewable energy producers, often with variable resources.

For this reason further changes to improve the situation have been proposed by the Commission[8]. Detailed measures proposed cover unbundling of transmission activities from supply and generation, regulatory oversight and cooperation, network cooperation and transparency.

On the other hand, renewable electricity is part of the internal electricity market and needs to comply with the single market rules currently in Directive 2003/54/EC. Article 3 § 2 of this directive allows Member States to impose on undertakings operating in the electricity sector public service obligations which may relate to security, including security of supply, regularity, quality and price of supplies and environmental protection, including energy efficiency and climate protection.

Support schemes differ with regard to their compatibility with the principles of the internal market. With premiums, quota/TGC schemes, tendering schemes, tax exemptions and investment support, renewable electricity is normally traded in the electricity market and subject to market prices and conditions. The support is therefore remuneration on top of the electricity price. Since the electricity is sold in the market, the producers participate on the regular electricity market in competition with other producers and this supply will have an influence on the price.

With feed-in tariffs, the renewable electricity is not sold directly in the market. The electricity is paid for through a purchase obligation which is normally put on the system operator. This electricity is shared among the customers and paid for through a fee included in the network tariff. Although renewable electricity which receives a feed-in tariff is not sold directly in the market, this additional supply will have an indirect impact on the market price.

The degree of competition in the internal market has major implications for renewable electricity, not least because of the new ambitious targets that are being established, of a 20% renewable energy share by 2020. The large number and small scale of most renewable electricity producers mean that easy and transparent grid access, not designed for and dominated by large incumbents, is crucial. The electricity market needs to become more transparent and competitive, with independent transmission system operators to improve infrastructure access and balancing rules for renewable electricity. With the development of regional and European energy markets, it is important that the rules regarding renewables are objective, transparent and non-discriminatory.

In conclusion, the planned improvements to the internal electricity market are expected to facilitate the deployment of renewable electricity. However, when the single electricity market becomes competitive and new entrants producing renewable electricity can participate on a level playing field, certain design features of renewable electricity support schemes will have to be reviewed.

3.2. SUPPORT SCHEMES AND FREE MOVEMENT OF GOODS

According to EU case law, electricity is a good, covered by the Treaty provisions on the free movement of goods. In some Member States, support schemes foresee a purchase obligation, which obliges suppliers to purchase all renewable electricity produced in a certain region at a fixed price. In *PreussenElektra*, the European Court of Justice held that such a purchase obligation constitutes a

8 COM(2007) 528 and COM(2007) 531.

restriction to the free movement of goods in the sense of Article 28 of the Treaty. At the same time, it decided that in the concrete case, this restriction was justified, as it was proportionate and necessary for fulfilling the general objective of environmental protection contained in Articles 6 and 174 of the Treaty. In *PreussenElektra*, the Court pointed also out that the necessity and proportionality of such restrictions had to be assessed in the light of progress achieved with respect to the opening of electricity markets and to the harmonisation of support schemes.[9] Since the judgement, the electricity markets in the EU have been further liberalised.

A question closely related to the free movement of goods is the respect of Articles 25 and 90 of the Treaty, which outlaw import and export taxes and measures having equivalent effect. The Commission has in the past verified the respect of Articles 25 and 90 at the same time as verifying the respect of state aid rules.

3.3. SUPPORT SCHEMES AND EC STATE AID RULES

Support schemes may entail granting of state aid in the sense of Article 87 (1) EC Treaty, and are subject to state aid control,[10] except for support schemes where one or more of the State aid criteria is not fulfilled[11] Many of the support schemes currently in place *do* constitute state aid in the sense of Article 87 (1). Annex 4 gives a non-exhaustive list of cases in which the Commission has assessed support schemes under state aid rules.

4. CO-EXISTANCE OR HARMONISATION

Currently, the 27 Member States have 27 different support schemes. This multitude of support schemes raises a concern from the perspective of the single market, as discussed in 3.1. Investors are confronted with different criteria for and levels of support as well as administrative procedures and grid access conditions, all of which could influence their production site location decisions. The harmonisation of support schemes could simplify the regulatory environment, allow industrial growth and boost economies of scale, and provide a clearer framework for the efficient exploitation of renewable energy across the Union.

However the Commission's report of December 2005[12] considered that harmonisation of support schemes would be premature, as the internal electricity market is not functioning properly, greater interconnector capacity is needed, national support to conventional electricity producers continue to distort the market and there has not been sufficient experience accumulated to determine the best choice of support scheme. Instead the Commission recommended that Member States cooperate more and improve ("optimise") their existing support schemes. The Commission specified that such optimisation included increasing legislative stability and reducing investment risk, reducing administrative barriers, addressing grid issues and encouraging technological diversity[13].

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9 Case C-379/98.

10 See Directive 2001/77/EC, cited above, recital 12 and Article 4.

11 Judgment of the Court of 13 March 2001, PreussenElektra, case C-379/98.

12 COM(2005) 627.

13 Increasing legislative stability and reducing investment risk includes avoiding stop-and-go support systems, and otherwise reducing uncertainty through long term policy stability. Reducing of administrative barriers, includes streamlining of administrative procedures and conditions, providing clear guidelines, one-stop authorisation agencies and pre-planning mechanisms. Addressing grid issues includes planning transmission reinforcement conditions, transparency in cost bearing and sharing, grid infrastructure development and fair

4.1. Cooperation

Following the Commission's 2005 recommendations there have been several efforts to cooperate, such as the German, Spanish and Slovenian feed-in cooperation[14], which aims to promote the use of feed-in regimes through the exchange of information and experiences, and the Norwegian-Swedish attempt to establish a bilateral green certificate regime.

4.2. Optimisation

Member States' efforts to improve or optimise their own support schemes have yielded significant benefits, with the exchange of best practice. Although the basic nature of the existing support schemes in place varies between Member States as does the level of support to different technologies, there are clear signs that a degree of convergence of important properties of the policy measures is emerging. Several Member States[15] have reformed their support schemes to differentiate between technologies to encourage technological diversity, such as giving higher support to emerging technologies like offshore wind, which in the future could significantly contribute to reaching the 20% renewable energy target in 2020. Offshore wind remains under-developed as a result of, not only higher costs, but also of additional risks and barriers. These issues will be dealt with in a forthcoming Action plan on offshore and coastal water wind energy development. Support schemes have also been reformed to introduce market signals through the incorporation of market prices using premiums rather than feed-in tariffs, thus improving the compatibility of the support with internal market rules and adjustments of tariffs to reflect decreasing production costs. This results in both an improvement of the existing measures and a gradual increase in the effectiveness and efficiency of support to promote renewable electricity

As a result of incorporating elements of the different schemes, the clear distinctions between the different support schemes are fading and their known problems diminishing: technology specific obligations or green certificates can ensure that such regimes no longer develop only the current cheapest technology; greater use of feed in premiums can ensure that producers have stronger incentives to minimise costs. Thus in general, it is clear that Member States are aware of and learning from the failings of their own support schemes and the best practice in other Member States.

4.3 Harmonisation

The Commission considers that it is currently inappropriate to harmonise European support schemes for four reasons:

- The experience with quantity-based and price-based instruments does not allow picking a "winner", as both kinds of instruments have the same economic efficiency[16] and can be designed

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and transparent pricing for electricity throughout the network. Encouraging technology diversity means providing additional support for technologies that are not yet fully competitive.

14 The International Feed-in Cooperation was initiated by the governments of Spain and Germany at the International Conference for Renewable Energies in Bonn in June 2004 in order to promote the exchange of experiences so as to improve the feed-in system design in each country. A joint declaration between both governments was signed on 6 October 2005 in Madrid. Slovenia joined the cooperation upon signing a declaration on 29 January 2007.

15 Spain, UK

16 It is well-established in microeconomic theory that there are two market-based instruments for fixing a market failure, namely price-setting (e.g. through a tax) or quantity-setting (e.g. through a permit scheme).16 If the regulator has perfect information, both instruments have the same economic efficiency. For support schemes

in conformity with the rules on the internal market for electricity, the free movement of goods and EC State aid rules.

- The introduction of one harmonised system would create a lot of uncertainty and disruption in the market for renewables, as it would abolish well-established national support schemes.

- In a harmonised system, it might be difficult to differentiate between different costs for different technologies in different countries. If this is the case, additional support measures would be needed for technologies which are still relatively far from producing renewable electricity at market price.

- National support schemes are often designed so that they also promote regional development, for example the use of small biomass in Austria and Germany or the promotion of biowaste energy as part of a national waste strategy. Harmonisation might oblige Member States to find other ways to promote regional development.

This does not, of course, preclude Member States from taking measures to harmonise support schemes from the "bottom-up", such as by linking up their green certificate regimes or developing common feed in schemes.

A reduction in the number of different support schemes could generate substantial economies of scale, simplify the regulatory environment and increase transparency for investors, and hence allow a more cost-effective achievement of the renewable targets.

5. ADMINISTRATIVE BARRIERS

However good a support scheme is, its effectiveness is hindered by a host of non cost barriers. The major role that administrative, physical, social and financial barriers play in discouraging the development of renewable energy is well known. Article 6 of Directive 2001/77/EC highlights several key barriers and exhorts Member States to take action to reduce them. COM(2006)627 assessed the (inadequate) progress made in reducing these barriers in most Member States and made five precise recommendations. These were for Member States to establish:

– One-stop authorisation agencies to take charge of processing authorisation applications and providing assistance to applicants.

– Clear guidelines for authorization procedures with a clear attribution of responsibilities. As the case law of the Court of Justice states, authorisation procedures must be based on objective, non-

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for renewables, this means that price-setting by the regulator through a feed-in tariff is equally efficient as quantity-setting by the regulator through a green certificate scheme. For the harmonisation of renewable support schemes, the question is which, if any of the two options, performs better under real world settings. There is substantial academic research on this question, which can be summarised as follows: "If the abatement costs are uncertain, a tax should be preferred if and only if the marginal abatement cost curve is steeper than the marginal environmental benefit curve."16 Applied to the case of renewable electricity, it can be said that the marginal abatement cost curve is formed by the different renewable energy sources at different locations, whereas the marginal environmental benefit curve is formed by the marginal benefit of CO2 reductions. At first sight, it would seem that the marginal benefit of CO2 reductions is relatively constant, whereas the abatement costs, i.e. the production costs for electricity from renewable energy sources vary considerably depending on the location of the plant and the energy source used. This tends to suggest that a price instrument (feed-in tariff) will be more economically efficient than a quantity-instrument (green certificate). At the same time, in a real world setting, several other factors have to be taken into account, such as investment risks, vulnerability to lobbying.

discriminatory criteria which are known in advance to the undertakings concerned, in such a way as to circumscribe the exercise of the national authorities' discretion, so that it is not used arbitrarily.

- Pre-planning mechanisms in which regions and municipalities are required to assign locations for the different renewable energies.

- Lighter procedures for small projects.

- Guidance on the relationship with European environmental legislation.

In most Member States, little progress has been made to date. The effectiveness of support schemes are affected by the existence of administrative barriers. Member States should therefore continue to implement measures to reduce these barriers.

6. GRID ACCESS ISSUES

The electricity grid is a highly capital intensive natural monopoly. In most Member States it has been developed under public ownership over decades, for the conventional energy sector. It is therefore not surprising that access to the grid for new, private sector renewable energy producers is problematic. Grid access reforms are difficult to agree. Article 7 of Directive 2001/77/EC addressed the legal framework for facilitates the integration of renewable electricity into the grid. The provisions in the directive require guaranteed access, rules for sharing and bearing of the cost of various grid investments (connections, reinforcements and extensions) necessary to integrate renewable electricity into the grid, and the use of system charges. Member States may also give priority access to networks. This is the case in Germany, Spain and Denmark, countries with high shares of wind power. However, it remains important for the functioning of the electricity market that the renewable electricity is traded on the market, so that renewable operators meet and respond to the price signals.

Renewable energy is generally connected to network infrastructure as any other form of production. In particular big wind farms are very dependent on adequate transmission capacity, as they are often situated further away from consumption centres. Thus adequate development of network infrastructure is a precondition for the development of renewable electricity.

In spite of the requirements in the Directive 2001/77/EC, project developers still face different grid-related barriers. These are for a large part related to insufficient grid capacity available, non-objective and non-transparent procedures for grid connection, high grid connection costs as well as long lead times to obtain authorisation for grid connections.

Novel concepts and applications for large-scale integration of renewable energies based on Information and Communication Technologies are under development in European and National programmes. Early exploitation of these solutions shows their ability to facilitate and support "real-time" energy balancing and pricing schemes of consuming/producing power by renewable energies as well as the onlie settlement of contract between owners of renewable energy installations and third parties. Further development of such solutions should be encouraged.

7. CONCLUSIONS

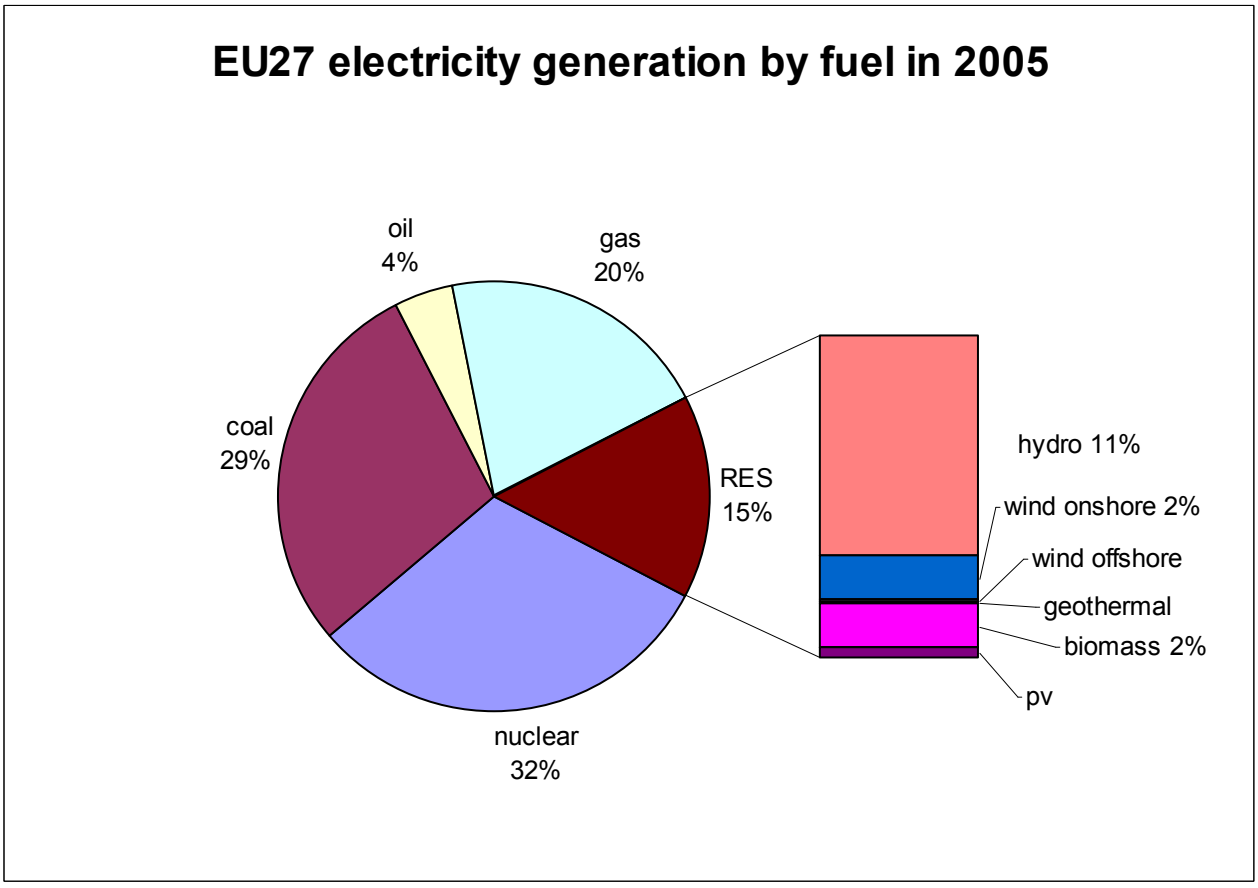
The analysis of COM(2005)627 and of this report show that despite the requirements of directive 2001/77/EC and the efforts of Member States, major barriers to the growth and integration of renewable electricity remain. The report also explains that the harmonisation of support schemes remain a long term goal on economic efficiency, single market and state aid grounds, but that harmonisation in the short term is not appropriate.

By adopting best practices or combining national support schemes Member States can continue to reform, optimise and coordinate their efforts to support renewable electricity. The analysis further suggests that a high priority should be given to removing administrative barriers and improving grid access for renewable energy producers.

Annex 1 – Current share of electricity from renewable energy sources

The EU aims at having renewable sources provide for 21% of the electricity generated in its 27 Member States by 2010. The starting point was 13.9% in 1997[17]. Hydro power, large and small, is still the largest renewable energy source in the electricity sector. Total electricity generation from renewable energy sources was around 440 TWh in 2005, corresponding to a share of 15%. The renewable share of electricity generation has remained relatively stable in the last few years. There are two important reasons for this. Firstly, there has been a higher than expected level of overall electricity consumption in Europe. In the EU, electricity consumption is growing at 2% per year. And secondly, in recent years Europe has experienced dryer weather with less rainfall and precipitation than normal.

Figure 1: Breakdown of electricity generation by fuel in EU27 in 2005

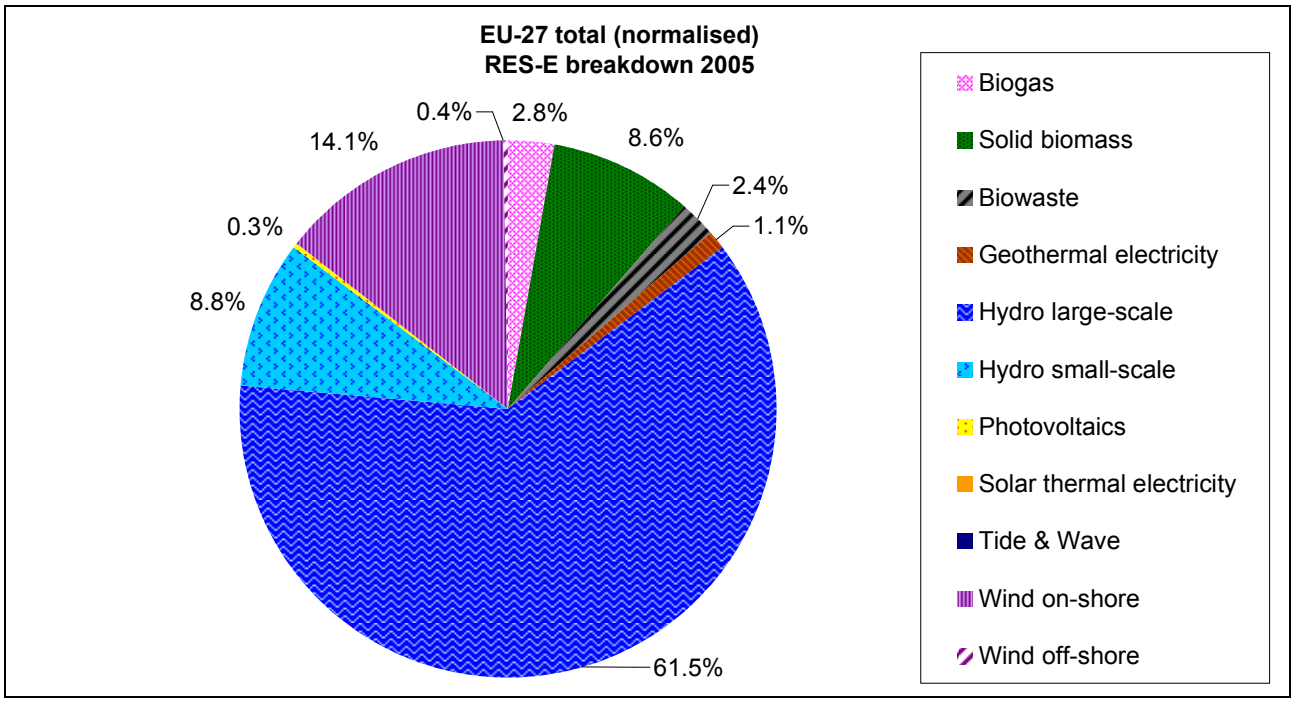


Source: Eurostat and OPTRES, 2007

Since hydropower is heavily dependant on variations in rainfall and precipitation, normalised data can be used to avoid the influence of climatic conditions (e.g. drought or high amounts of rainfall). Figure 2 provides an overview of the normalised breakdown of renewable electricity generation according to sources. Hydropower remains the dominant source accounting for over 70% of the share of renewable electricity in 2005. The second most important renewable electricity source is onshore wind with a share of 14% in 2005, followed by solid biomass with a share of 9%. Other important sources of electricity generation from renewables are geothermal, photovoltaics, tide, wave and wind offshore.

[17] This was the reference year for the EU15 at the time of the adoption of the RES-E directive in 2001.

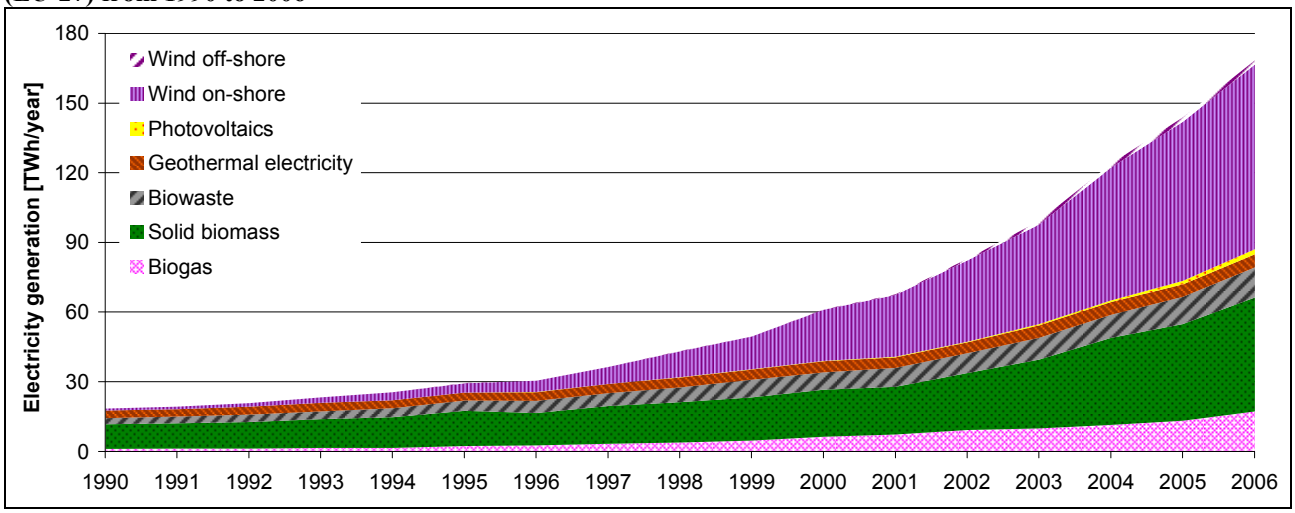
Figure 2: Breakdown of renewable electricity in 2005 (normalised) for the EU-27



Source: OPTRES, 2007

Hydro power is heavily dependant on yearly rainfall and precipitation. It is therefore worthy to look at the increase in renewable electricity generation from new renewable energies. Since the renewable electricity directive was adopted in 2001, its provisions of targets and support measures have set an important framework for advancing the production of renewable electricity. Since 2000, wind power capacity has increased by more than 150% in the EU. Total wind installed capacity of 40,455 MW produced 82 TWh in 2005. Electricity from biomass was 70 TWh in 2005, and has gone from a yearly growth rate of 7% in previous years to 13% in 2003 and 23% in 2005.

Figure 3: Historical development of electricity generation from 'new' renewable electricity in the European Union (EU-27) from 1990 to 2006



Source: OPTRES, 2007

Annex 2 – Inventory of current support systems

Overview of the main policies for renewable electricity in EU

Country	Main electricity support schemes	Comments
Austria	Feed-in tariffs combined with regional investment incentives.	Until December 2004 feed-in tariffs were guaranteed for 13 years. From 2006 onwards full feed-in tariffs for new renewable electricity generation are available for 10 years, 75% and 50% available for year 11 and 12 respectively. The new feed-in tariffs are announced annually and support is granted on a first-come, first-serve basis. From May 2006 there has been a smaller government budget for renewable electricity support.
Belgium	Quota obligation system / TGC[18] combined with minimum prices for electricity from RES.	The Federal government has set minimum prices for electricity from RES. Flanders and Wallonia have introduced a quota obligation system (based on TGCs) with the obligation on electricity suppliers. In Brussels no support scheme has been implemented yet. Wind offshore is supported at federal level. The scheme is qualified as a public service obligation.
Bulgaria	Combination of feed-in tariffs, tax incentives and purchase obligation.	Relatively low levels of incentive make penetration of renewables especially difficult as the current commodity prices for electricity are still relatively low. A green certificate system to support renewable electricity developments has been proposed. Bulgaria recently agreed upon an indicative target for renewable electricity, which is expected to provide a good incentive for further promotion of renewable support schemes.
Cyprus	Feed-in tariffs (since 2006), supported by investment grant scheme for promotion of RES.	Enhanced Grant Scheme introduced in January 2006 to provide financial incentives for all renewable energy in the form of government grants worth 30-55% of investment. Feed-in tariffs with long-term contracts (15 years) also introduced in 2006.
Czech Republic	Feed-in tariffs (since 2002), supported by investment grants	Relatively high feed-in tariffs with 15-year guaranteed support. Producer can choose between a fixed feed-in tariff or a premium payment (green bonus). For biomass cogeneration, only green bonus applies. Feed-in tariff levels are announced annually.
Denmark	Premium feed-in tariffs (environmental adder).Tender schemes for wind offshore.	Duration of support varies from 10-20 years depending on the technology and scheme applied. The tariff level is generally rather low compared to the previously high feed-in tariffs. A net metering approach is taken for photovoltaics
Estonia	Feed-in tariff system	Feed-in tariffs paid for 7 -12 years but not beyond 2015. Single feed-in tariff level for all technologies. Relatively low feed-in tariffs make new renewable investments very difficult.
Finland	Energy tax exemption combined with investment incentives.	Tax refund and investment incentives of up to 40% for wind, and up to 30% for electricity generation from other RES.
France	Feed-in tariffs plus tenders for large projects.	For power plants < 12 MW feed-in tariffs are guaranteed for 15 years or 20 years (wind onshore, hydro and PV). From July 2005 feed-in tariff for wind is reserved for new installations within special wind energy development zones. For power plants > 12 MW (except wind) a tendering scheme is in place. The scheme is qualified as a public service obligation
Germany	Feed-in tariffs.	Feed-in tariffs are guaranteed for 20 years (Renewable Energy Act). Furthermore soft loans are available.

[18] TGC = tradable green certificates.

Greece	Feed-in tariffs combined with investment incentives.	Feed-in tariffs are guaranteed for 12 years with the possibility of extension up to 20 years. Investment incentives up to 40%.
Hungary	Feed-in tariff (since January 2003, amended in 2005) combined with purchase obligation and grants	Fixed feed-in tariffs recently increased and differentiated by renewable electricity technology. No time limit for support defined by law, so in theory guaranteed for the lifetime of the installation. Plans to develop a TGC system.
Ireland	Feed-in tariff schemes introduced in October 2006, replacing a tendering scheme.	New premium feed-in tariffs for biomass, hydropower and wind introduced in October 2006. These tariffs are guaranteed for up to 15 years. Purchase price of electricity from the generator is negotiated between generators and suppliers. However, support may not be extended beyond 2024, so guaranteed premiums payments should start no later than 2009.
Italy	Quota obligation system / TGC. Feed-in tariff system for photovoltaic (introduced in August 2005).	Obligation (based on TGCs) on electricity producers and importers. Certificates are only issued for renewable electricity capacity during the first 12 years of operation, except biomass which receives certificates for 100% of electricity production for first 8 years of operation and 60% for next 4 years. Separate fixed feed-in tariff for PV, differentiated by size and building integrated. Guaranteed for 20 years. Increases annually in line with retail price index.
Latvia	Quota obligation system (since 2002) combined with feed-in tariffs.	Frequent policy changes and the short duration of guaranteed feed-in tariffs have resulted in high investment uncertainty. Main policy instrument reformed in 2007, maintaining the basic structure of the scheme. At national level there are yearly quotas and a mandatory purchase framework is set up for RES-E (combined with tendering for wind). Quantity of RES-E sold under the scheme is limited. Quota system (without TGC) typically defines small RES-E amounts to be installed. High feed-in tariff scheme for wind and small hydropower plants (less than 2 MW) was phased out in January 2003.
Lithuania	Feed-in tariffs combined with a purchase obligation	Relatively high fixed feed-in tariffs for hydro (<10 MW), wind, biomass, guaranteed for 10 years. Closure of the Ignalina nuclear plant which currently supplies majority of electricity in Lithuania will strongly affect electricity prices and thus the competitive position of renewables as well as renewable support. Investment programmes limited to companies registered in Lithuania.
Luxembourg	Feed-in tariffs.	Feed-in tariffs guaranteed for 10 years (for PV for 20 years). Investment incentives are also available. The scheme is qualified as a public service obligation
Malta	Low VAT rate and very low feed-in tariff for solar.	Very little attention to renewable electricity support so far. Very low feed-in tariff for PV is a transitional measure.
Netherlands	Premiums payments (abruptly abolished in August 2006).	Premiums guaranteed for 10 years were in place from July 2003. For each MWh renewable electricity generated, producers received a green certificate [GO] from the issuing body, which was redeemed for the premium payment. Government put all premium renewable electricity support at zero for new installations from August 2006 as it was believed that the renewable electricity target would be achieved in advance of 2010. Premium for biogas (<2MWe) immediately reinstated. The Netherlands aims to introduce a new support scheme as early as possible in 2008. The preferred support policy option is currently improved premium payments. Fiscal incentives for investments in RES are available.
Poland	Quota obligation system. TGCs introduced from end 2005 plus renewables are exempted from the (small) excise tax	Obligation on electricity suppliers with targets specified from 2005 to 2010. Penalties for non-compliance were defined in 2004, but were not sufficiently enforced until end of 2005. It has been indicated that from 2006 on the penalty will be enforced.

Portugal	Feed-in tariffs combined with investment incentives	Fixed feed-in tariffs guaranteed for 15 years. Level dependent on time of electricity generation (peak / off peak), renewable electricity technology, resource, and corrected monthly for inflation. Investment incentives up to 40%.
Romania	Quota obligation with TGC since May 2005.	A system of Green Certificates is in place, including a purchase obligation for distribution companies and the obligation to fulfil an annual quota of purchased green electricity. Quota obligation increase from 0.7% in 2005 to 8.3% in 2010. For the period 2005-2012, the annual maximum and minimum value for Green Certificates trading is 24 Euro/certificate, respective 42 Euro/certificate
Slovak Republic	Programme supporting RES and energy efficiency, including feed-in tariffs and tax incentives	Fixed feed-in tariff for renewable electricity was introduced in 2005. Prices are set so that a rate of return on the investment is 12 years when drawing a commercial loan. Low support, lack of funding and lack of longer-term certainty in the past have made investors very reluctant.
Slovenia	Feed-in system and premium, CO_2 taxation and public funds for environmental investments	Renewable electricity producers can choose between fixed feed-in tariff and premium feed in tariff. Tariff levels are defined annually by Slovenian Government (but have been unchanged since 2004). Tariff guaranteed for 5 years, and then reduced by 5%. After 10 years reduced by 10% (compared to original level). Relatively stable tariffs combined with long term guaranteed contracts makes system quite attractive to investors.
Spain	Feed-in tariffs and premium	Electricity producers can choose a fixed feed-in tariff or a premium on top of the conventional electricity price. No time limit, but fixed tariffs are reduced after either 15, 20 or 25 years depending on technology. Transparent system. Soft loans, tax incentives and regional investment incentives are available.
Sweden	Quota obligation system with TGC.	Obligation (based on TGCs) on electricity consumers. For wind energy, investment incentives and a small environmental bonus are available.
UK	Quota obligation system with TGC.	Obligation (based on TGCs) on electricity suppliers. Obligation target increases to 2015 and guaranteed to stay at least at that level until 2027. Electricity suppliers which do not comply with the obligation have to pay a buy-out penalty. Buy-out fund is recycled back to suppliers in proportion to the number of TGCs they hold. UK is currently considering introducing technology banding by differentiating certificates awarded to renewable electricity technologies. A tax exemption for electricity generated from RES is available (Levy Exemption Certificates which give exemption from the Climate Change Levy).

Source: OPTRES, 2007

Annex 3 - Evolution of efficiency and effectiveness of current support schemes

All Member States have introduced support schemes to promote renewable electricity. These support schemes have triggered a significant increase in electricity generated from renewable energy sources over the last decade. The current level of support varies significantly among the Member States, due to country-specific cost-resources conditions as well as principal differences in the support instruments applied. The performance of national support schemes have been assessed in this report using the same indicators that were presented in the previous Commission report on "The support of electricity from renewable energy sources", COM (2005) 627. These are as follows:

Effectiveness: The effectiveness of a support scheme refers to its ability to deliver renewable electricity. In this report, this indicator is defined as the ratio of the change in the normalised electricity generation during a given period of time and the additional realisable mid-term potential until 2020 for a specific technology, where the exact definition of effectiveness reads as follows:

$$E_n^i = \frac{G_n^i - G_{n-1}^i}{ADD - POT_{n-1}^i}$$

E_n^i Effectiveness Indicator for RES technology i for the year n

G_n^i Electricity generation potential by RES technology i in year n

$ADD - POT_n^i$ Additional generation potential of RES technology i in year n until 2020

This definition has the advantage of giving an unbiased indicator with regard to the available potentials of a specific country for individual technologies.

Efficiency: The efficient level of support is determined by comparing the total support received for renewable electricity with the generation cost[19]. The closer the level of support is to the generation cost, the more cost-efficient the support mechanism is.

In order to compare costs and support levels among the countries, it is necessary to ensure that quantities are comparable. In particular, the support level in each country needs to be normalised according to the duration of support in each country, e.g. the duration of green certificates in Italy is only eight years compared to 20 years for guaranteed feed-in tariffs in Germany. The support level under each instrument has therefore been normalised to a common duration of 15 years. The conversion between the country-specific duration and the harmonised support duration of 15 years is performed assuming a 6.6% interest rate.

The effectiveness and efficiency indicators are shown for the sectors wind onshore, solid biomass, biogas, small hydro and photovoltaic electricity generation. The effectiveness indicators are presented as an average indicator over the period 1998-2006 for onshore wind, biogas and photovoltaic electricity generation. For solid biomass and small hydro, the period for calculating the average effectiveness indicator is 1998-2005. In addition, the figures present an indicator for the last

[19] Maximum generation costs are not included in the figures as minimum to average generation cost range typically contains presently realisable potentials which investors would normally deploy in order to generate electricity at minimum costs. Furthermore, the maximum generation costs can be very high in each country so that showing the upper cost range for renewable electricity would affect the readability of the graphs.

year of the period used.

Wind energy

The indicators for onshore wind are presented in figures 1 and 2.

The level of support for onshore wind energy is insufficient to cover generation costs, or in the lower end of the cost range, in at least five Member States. Generation costs differ within Member States and between Member States depending on the wind conditions and the size of the wind farm built. Spain, Germany and Denmark continue to have the highest annual effectiveness when averaged over the period considered. In addition to providing a high investment security with long term feed-in tariffs, these countries also provide a framework with low administrative and regulative barriers as well as relatively favourable grid access conditions. In Denmark, the low effectiveness has decreased substantially in recent years due to the abolishment of the formerly high and successful feed-in tariffs.

Ireland is considered to have some of the best wind potential in the EU. Effectiveness has improved dramatically during the last two years partially due to the change from a tendering system to feed-in tariffs in 2006. The tendering system became more effective during the last years of its operation. The new feed-in tariffs, which seem to be tailored to the generation costs have further improved the uptake of wind energy. However, grid capacity is still a barrier for further developments in wind energy.

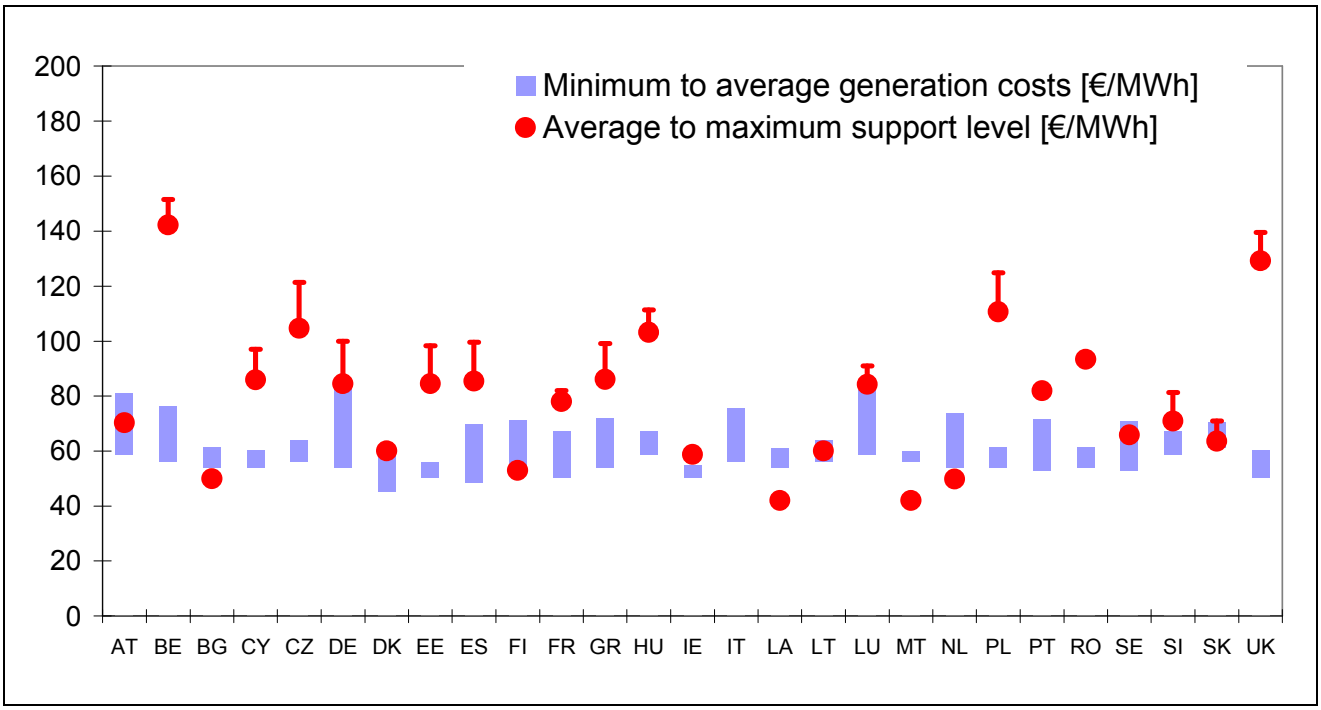
Sufficient levels of feed-in tariffs are not sufficient to increased deployment of wind energy. As can be observed in countries like France and Greece, high administrative barriers can significantly hamper the development of wind energy even under a stable policy environment combined with reasonably high feed-in tariffs.

The Swedish quota system with tradable green certificates has until now not been successful in developing wind energy. This is not surprising as the quota obligation with green certificates aims to bring in the cheaper solutions first followed by the more expensive solutions. Switching from conventional energy sources to biomass in existing plants is considered the cheapest solution to increase the deployment of renewable energy in Sweden.

Tax incentives in Finland have been too low to trigger wind development.

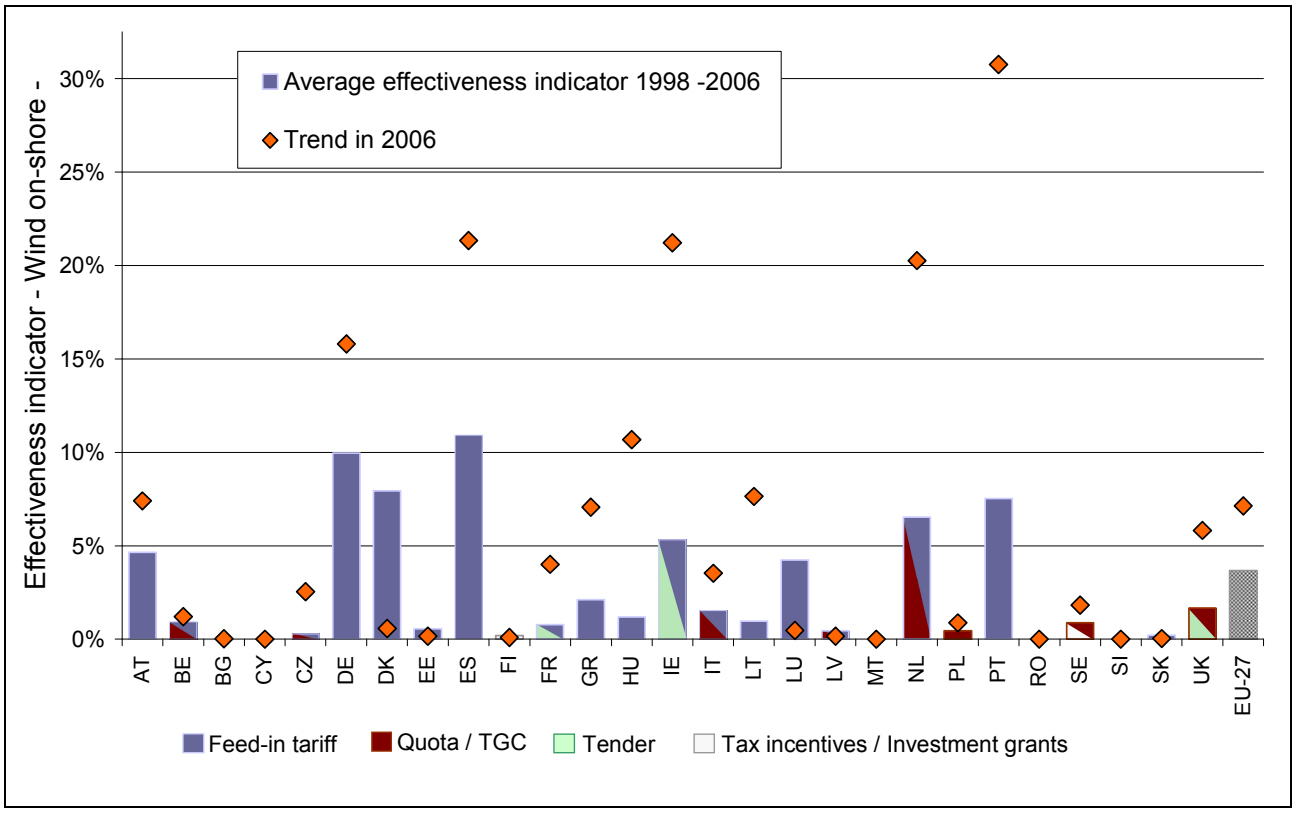
Developments in wind energy remain low in the new Member States despite the fact that the majority of the new Member States offer a generous support level.

Figure 1: Price ranges (average to maximum support) for direct support of wind onshore in EU27 (average tariffs are indicative) compared to long-term marginal generation costs (minimum to average costs). Support schemes are normalised to 15 years.



Source: OPTRES, 2007

Figure 2: Effectiveness indicator for <u>onshore wind</u> in the period 1998 – 2006, including trend for 2006.



Source: OPTRES, 2007

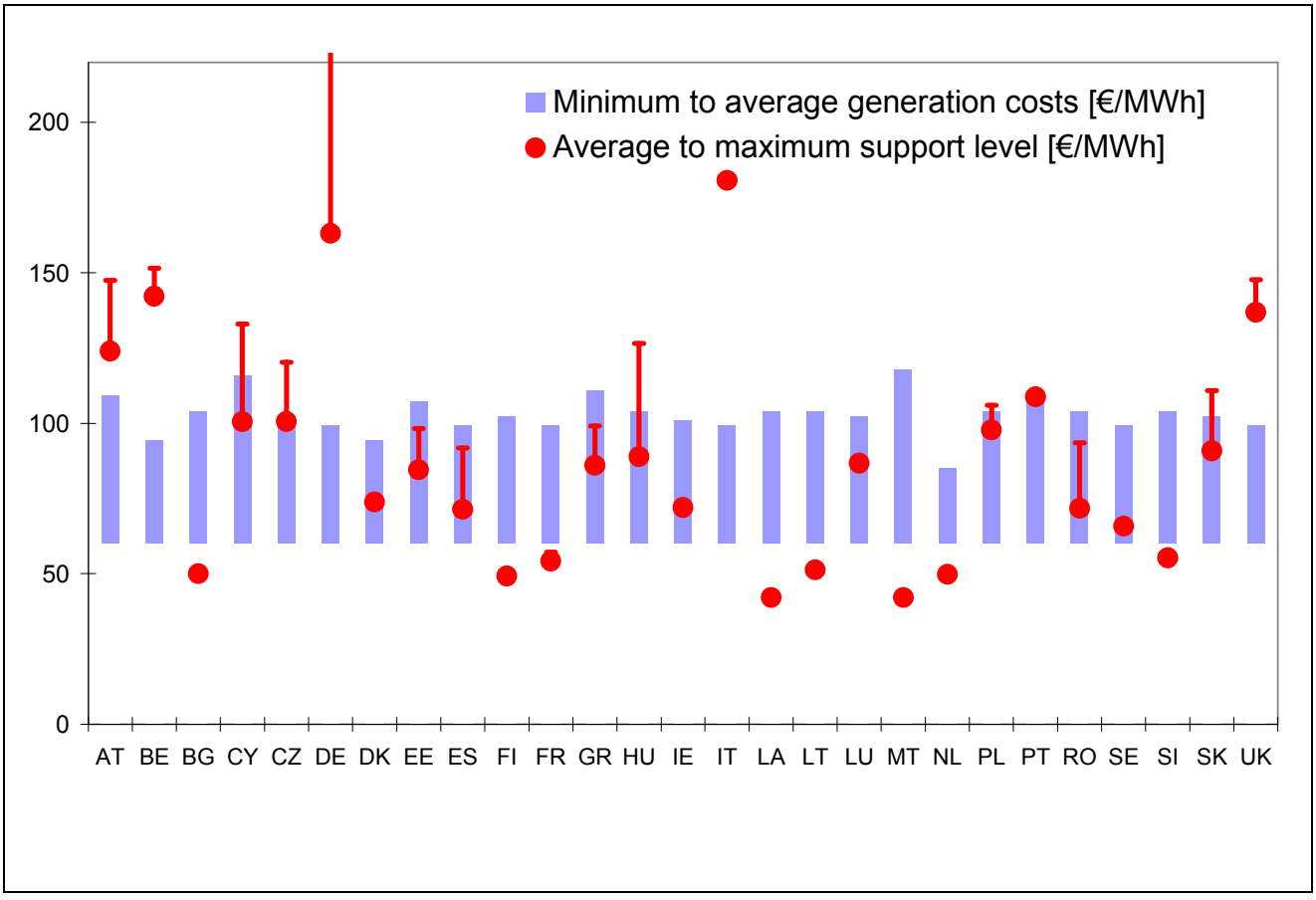
Biogas

The indicators for biogas electricity are presented in figures 3 and 4.

Biogas electricity, which can mainly be divided into agricultural biogas, landfill gas and sewage gas has had an overall relatively low development over the period 1997 – 2006. The level of support is considered to be either insufficient to cover generation costs, or at the lower end of the cost range in more than two thirds of the Member States.

Several countries have a large range in the tariffs offered. This applies to countries offering feed-in tariffs, such as Austria, Cyprus, Germany, Hungary, Luxembourg, and also countries with quota obligations, such as Belgium and Romania. In most of these countries the remuneration for electricity from biogas varies according to plant size, fuel type, and type of biogas used. In Austria, the tariffs (paid for plants authorised until end of 2004 and installed until end of 2007) are relatively high since the aim is to support small scale agricultural applications as compared to centralised plants. A similar argument holds for Germany. In addition to the Austrian and German feed-in tariff system, the quota systems with tradable green certificates in Belgium, Italy and UK are among the most expensive. A few countries have support levels well adapted to the generation costs.

Figure 3: Price ranges (average to maximum support) for direct support of biogas electricity in EU27 (average tariffs are indicative) compared to long-term marginal generation costs (minimum to average costs). Support schemes are normalised to 15 years.

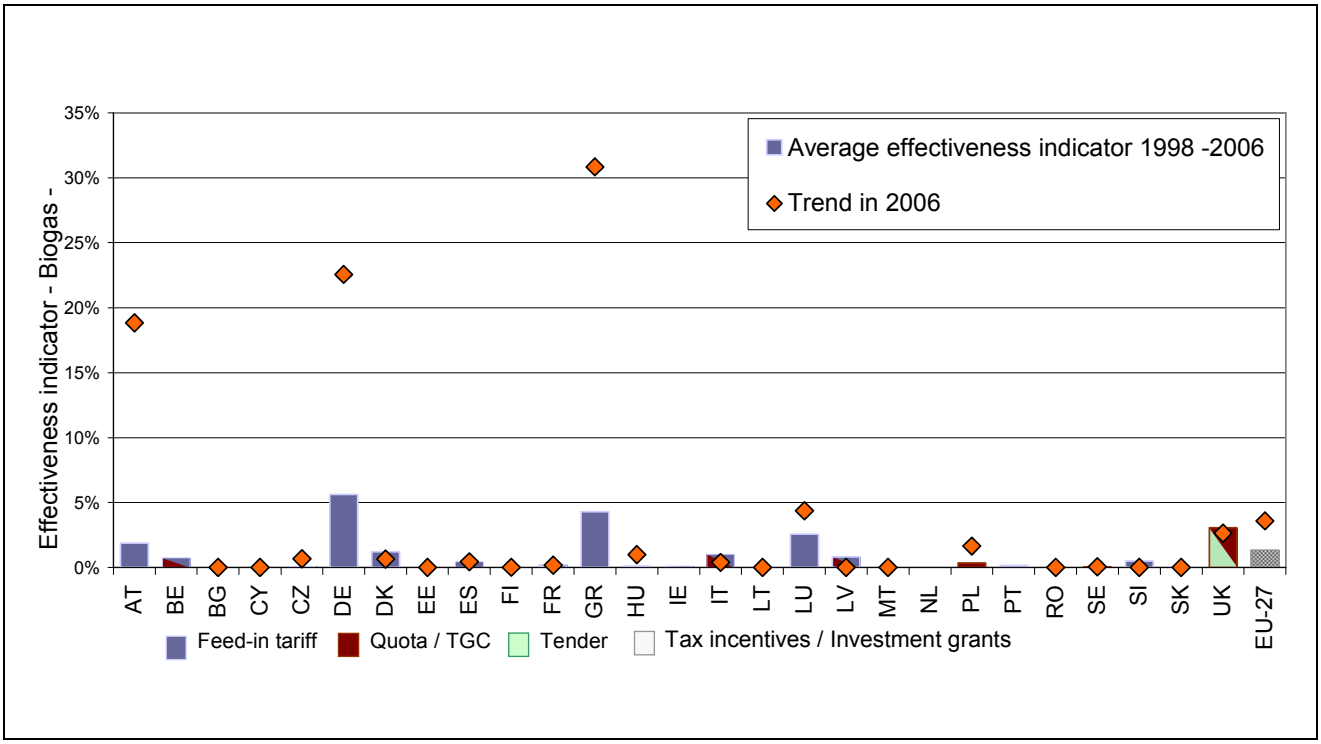


Source: OPTRES, 2007

The effectiveness of policies promoting biogas electricity across the EU27 continues to be very low. The highest growth in biogas electricity over the period can be seen in Germany, which applies feed-in tariffs, and in the UK, which applies a quota obligation with tradable green certificates. For the year 2006, the highest growths have been in Greece, followed by Germany and Austria.

The Finnish tax rebates and the Swedish tax rebates, which were replaced with quota system in 2003, have been unable to trigger investments in biogas plants. Similarly, the Irish tendering system, which was replaced with feed-in tariffs in 2006, did not consider biogas as an option for increasing the generation of electricity from renewable energy sources. The tendering system in the UK, in operation until 2002, showed high effectiveness on the expansion of landfill gas.

Figure 4: Effectiveness indicator for biogas electricity in the period 1998 – 2006, including trend for 2006.



Source: OPTRES, 2007

Biomass forestry

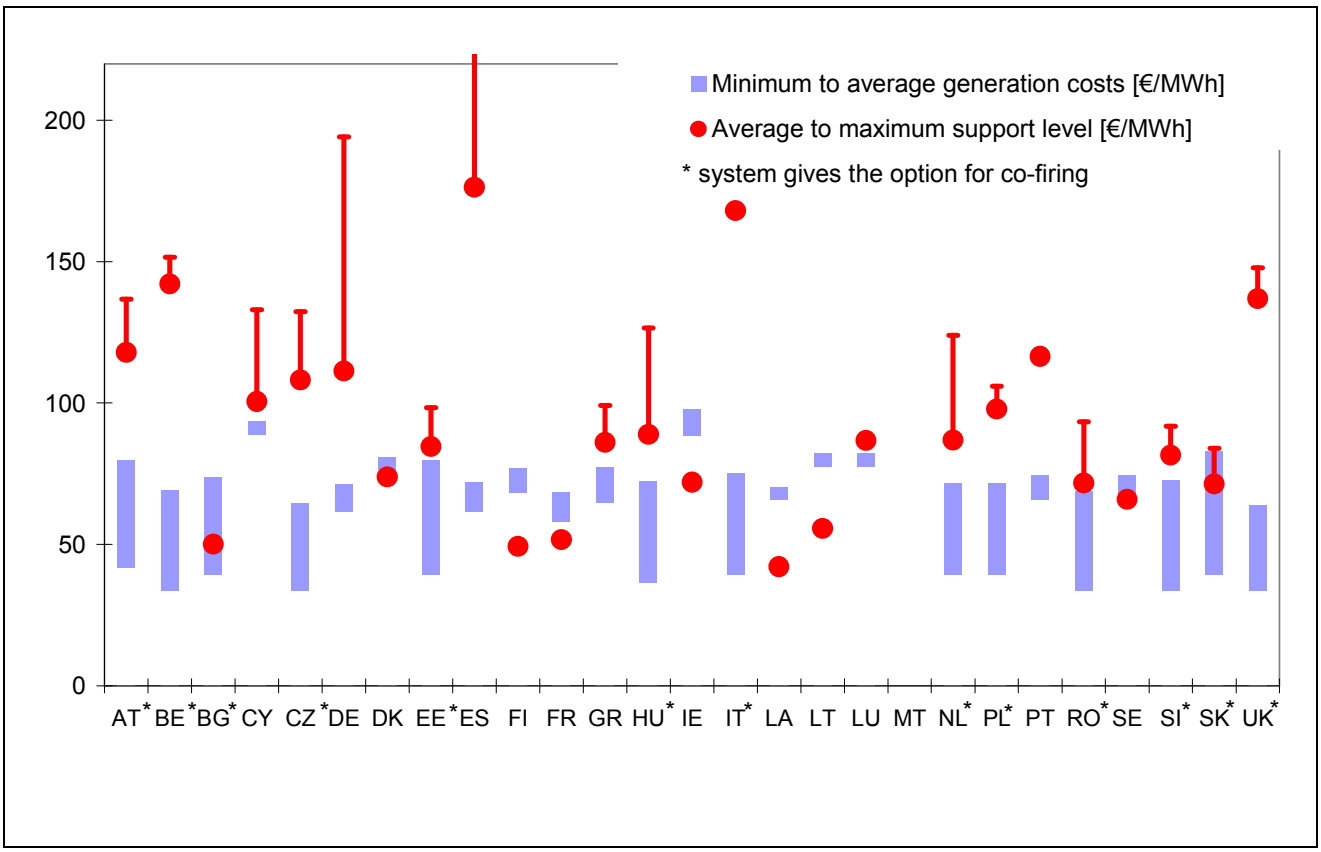
The indicators for solid biomass are presented in figures 5 and 6.

As for the biogas electricity sector, there are large differences in the generation costs for solid biomass. The difference in the generation costs across the Member States is partly due to plant size as well as to the application of cost-efficient co-firing. However, in contrast to the biogas electricity sector, the level of support for electricity from biomass forestry is considered sufficient in more than two thirds of the Member States.

There is no clear picture here as to whether feed-in tariffs regimes are more or less cost-efficient than quota obligations with tradable green certificates. Several Member States, such as Greece, Luxembourg, Estonia, and Sweden provide a level of support which is quite close to the range of generation costs, thereby offering a moderate profit for the most cost-efficient plants. Similar to the case of biogas electricity, feed-in tariffs in Austria and Germany appear high due to the support of

more expensive small- and medium-scale installations. However, also countries with quota obligations have expensive regimes. In some countries, such as Bulgaria and Slovak Republic, the level of support for electricity from solid biomass appears too low for electricity production in new plants, but sufficient in countries also promoting the co-firing of biomass.

Figure 5: Price ranges (average to maximum support) for direct support of biomass forestry in EU27 (average tariffs are indicative) compared to long-term marginal generation costs (minimum to average costs). Support schemes are normalised to 15 years.



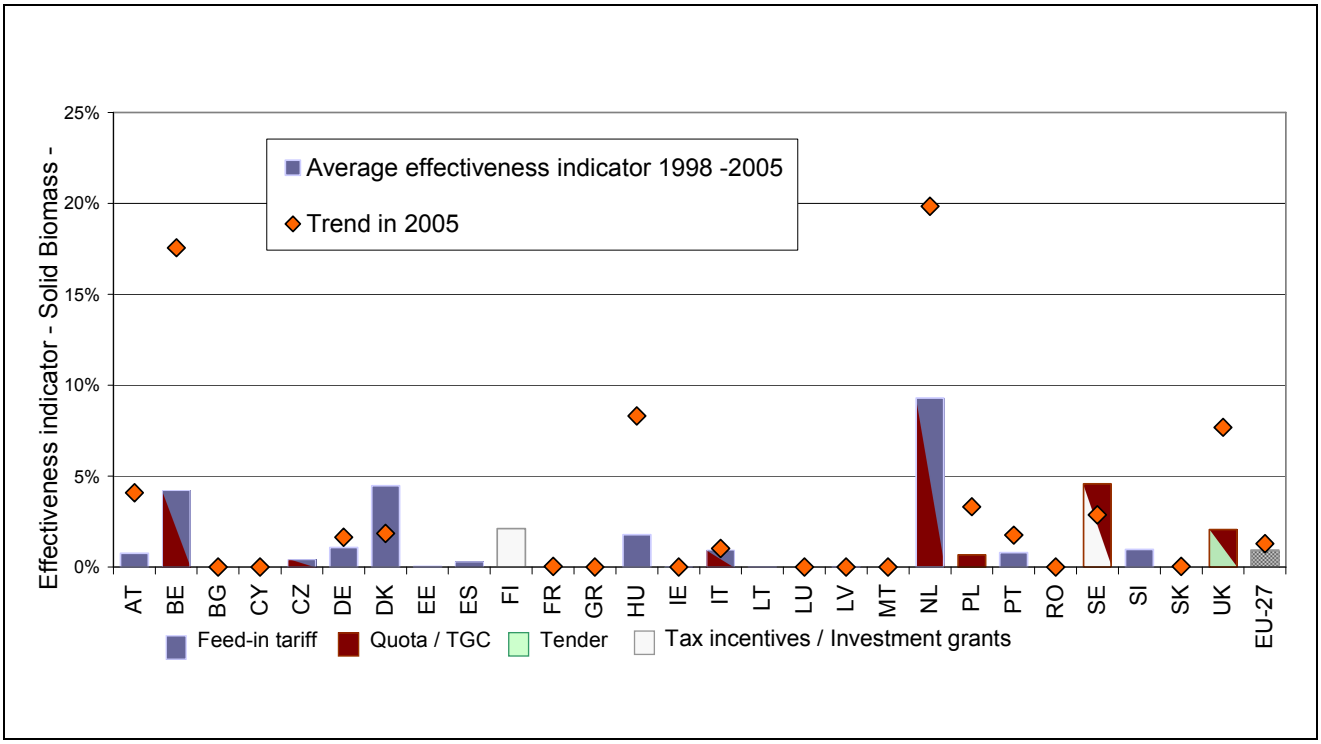
Source: OPTRES, 2007

Since biomass represents the cheapest sources for renewable electricity in several countries, it is not surprising that it attracts the largest share of investments in renewable electricity in countries with support schemes that are non technology specific, such as tax incentives and quota obligations with tradable green certificates. The tax measures in Finland, the Netherlands and Sweden (before 2002) and the present the Belgian and Swedish quota obligations have resulted in a concentration on current least cost technology. It should however also be mentioned that long standing traditions in the biomass sector and the importance of the forestry industry in countries like Finland and Sweden have played an important role in the development of solid biomass electricity.

Biomass electricity is considered cost-efficient in countries with reasonable quantities of exploitable wood waste. However, infrastructure constraints rather than economics is considered to be an important barrier to the development of this sector in many cases.

Despite the potential for solid biomass electricity in new Member States, there has been little development in this sector over the period. An exception to this is Hungary, which has seen significant development mainly based on co-firing.

Figure 6: Effectiveness indicator for electricity from solid biomass in the period 1998 – 2005, including trend for 2006.



Source: OPTRES, 2007

Small hydro[20]

The indicators for small hydro are presented in figures 7 and 8.

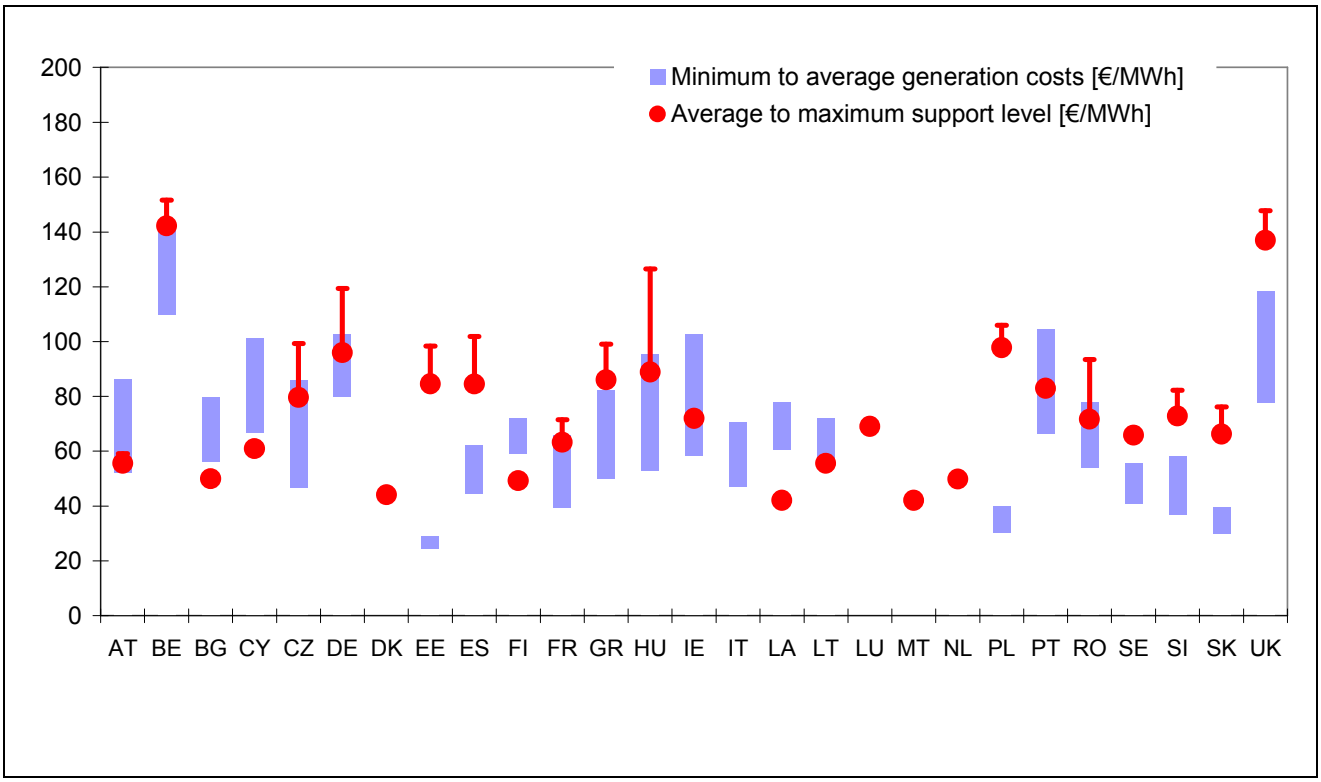
There continues to be a wide variety in the generation costs and support level related to small hydro power. No generation costs are specified in 4 Member States as they are not considered to have any worthy potential or show generation costs, which are so much dependent on the costs of some few individual projects, that it should be misleading to present generic ranges. Of the remaining Member States, around one third are considered to have support levels that are too low to trigger investments, whereas the other two thirds have support levels that match the average generation costs or higher. The two schemes with the highest support in relation to generation costs are Italy and Poland, which have tradable green certificate schemes.

The Czech Republic, France, Greece and Germany seem to have support levels that are well adjusted to the generation costs. The two Member States with highest effectiveness are Germany and Greece, both with feed-in tariff systems. Germany has had a considerable additional deployment in 2005.

Although it is a costly scheme, Poland has the highest effectiveness of all the new Member States.

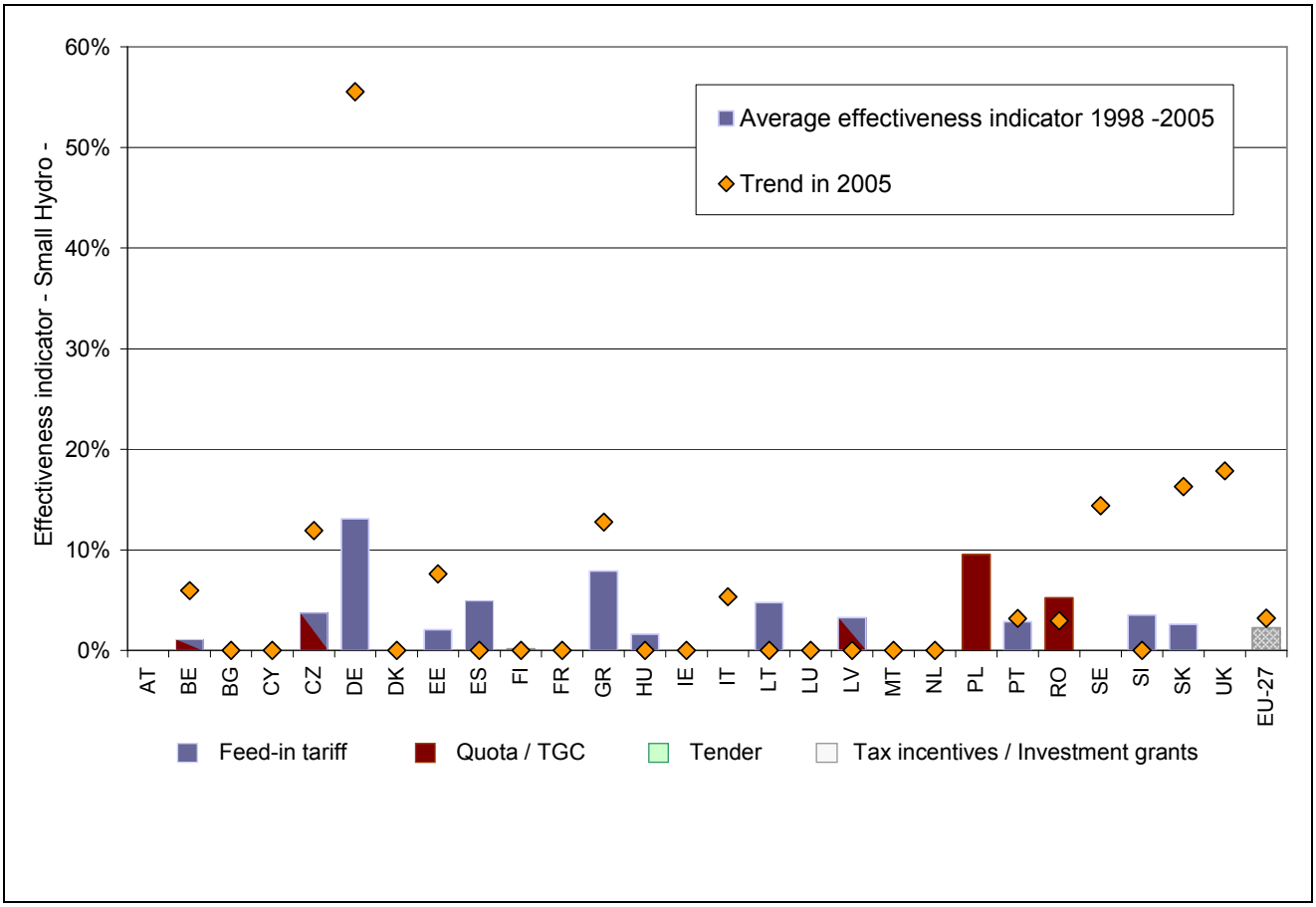
Figure 7: Price ranges (average to maximum support) for direct support of small hydro in EU27 (average tariffs are indicative) compared to long-term marginal generation costs (minimum to average costs). Support schemes are normalised to 15 years.

[20] The definition of a small scale hydro power plant is not uniform in all EU countries. Typically, plants with a capacity of up to 10 MW are considered being small scale and receive support. However, in Spain, for example, hydro power plants up to 50 MW are supported with feed-in tariffs.



Source: OPTRES, 2007

Figure 8: Effectiveness indicator for <u>small hydro</u> in the period 1998 – 2005, including trend for 2005.



Source: OPTRES, 2007

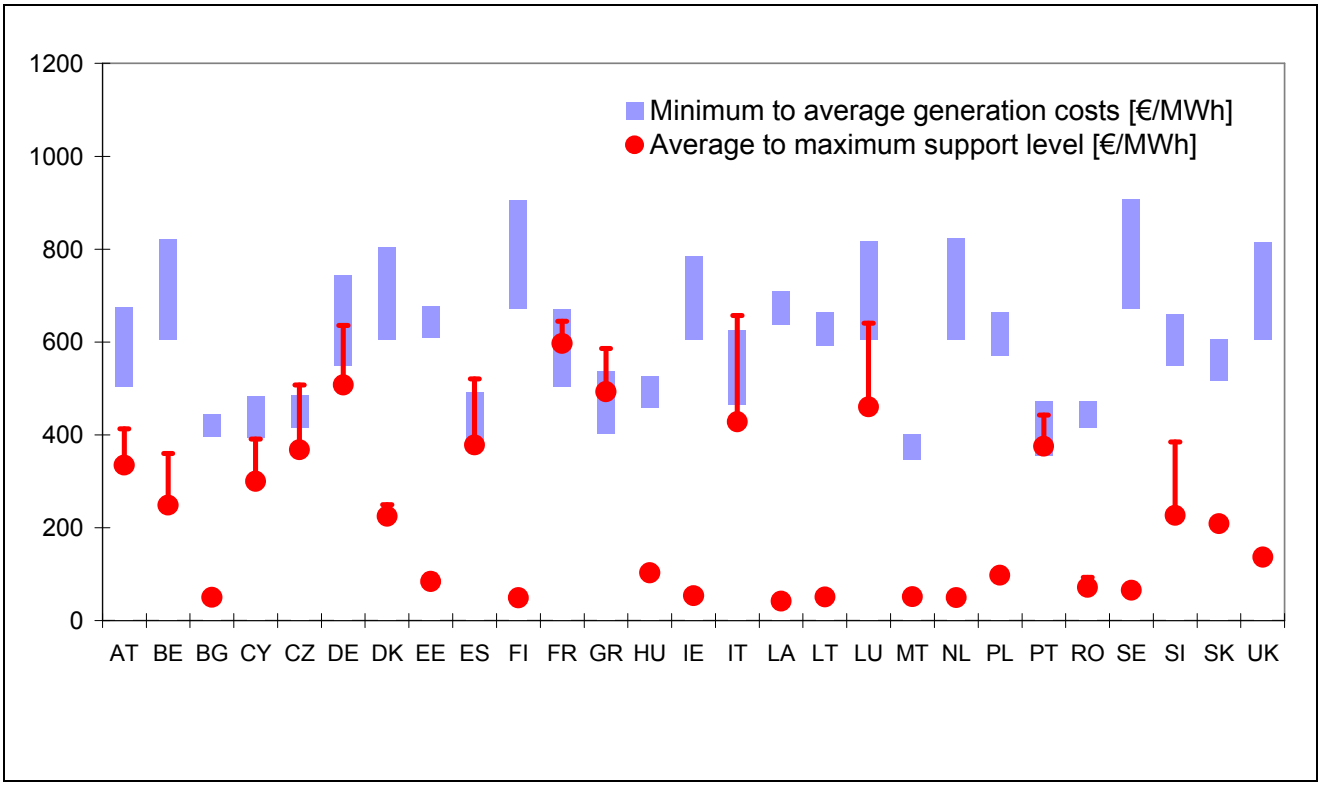
Photovoltaic

The indicators for photovoltaic electricity are presented in figures 9 and 10.

Even though the generation costs have sunk by 10-20% across the EU in the last couple of years, the figure strikingly shows that support given to the development of PV is too low in most Member States. The countries with average support levels closest to the minimum generation costs are the Czech Republic, France, Greece, Italy, Portugal and Spain, which all have feed-in tariffs or premiums. As expected, quota obligations and tax measures give little incentives for investments in PV technology since these support schemes generally promote only the cheapest available technologies.

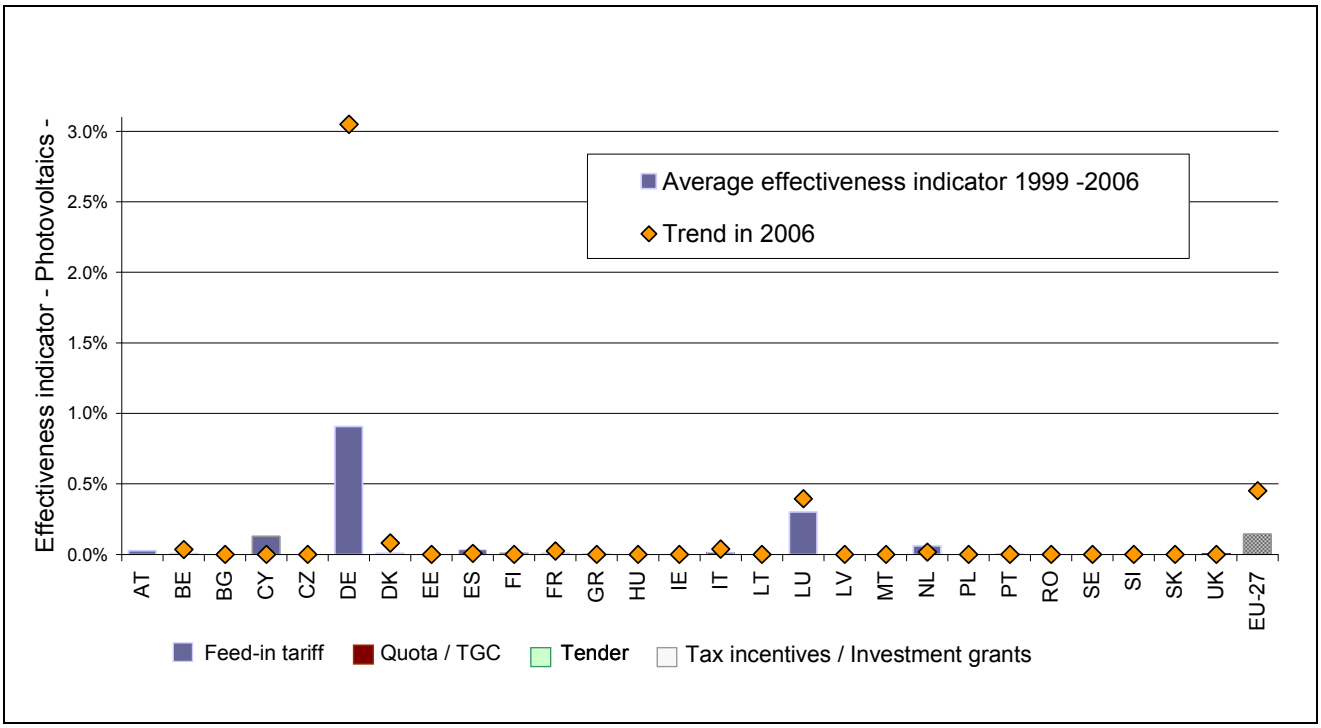
Although Germany, Italy, Portugal and Spain have had relatively good and stable support schemes, only Germany can boast of having had any significant increase in the electricity generated from photovoltaic technology. This is also due to the fact that the other countries introduced such tariffs for PV only more recently.

Figure 9: Price ranges (average to maximum support) for direct support of solar PV in EU27 (average tariffs are indicative) compared to long-term marginal generation costs (minimum to average costs). Support schemes are normalised to 15 years.



Source: OPTRES, 2007

Figure 10: Effectiveness indicator for PV electricity in the period 1998 – 2006, including trend for 2006[21]



Source: OPTRES, 2007

Methodology from an investor's perspective

In addition to the efficiency and effectiveness indicators, a third indicator, which looks at the comparison of profits from an investor perspective and the effectiveness indicator, is presented. This comparison gives an indication as to whether the success of a specific policy is primarily based on the high financial incentives, or whether other aspects have a crucial impact on market diffusion in the considered countries.

The effectiveness of a Member State's policy is defined as the ratio of the change in electricity generation potential during a given period of time to the additional realisable mid-term potential by 2020 for a specific technology. The exact definition is given in Annex 3.

One possible approach for calculating actual support over the entire lifetime from an investor's perspective is to determine **the average expected profit or annuity of the renewable investment**. The annuity calculates the specific discounted average return on every produced kWh by taking into account income and expenditure throughout the entire lifetime of a technology. The formula reads as follows:

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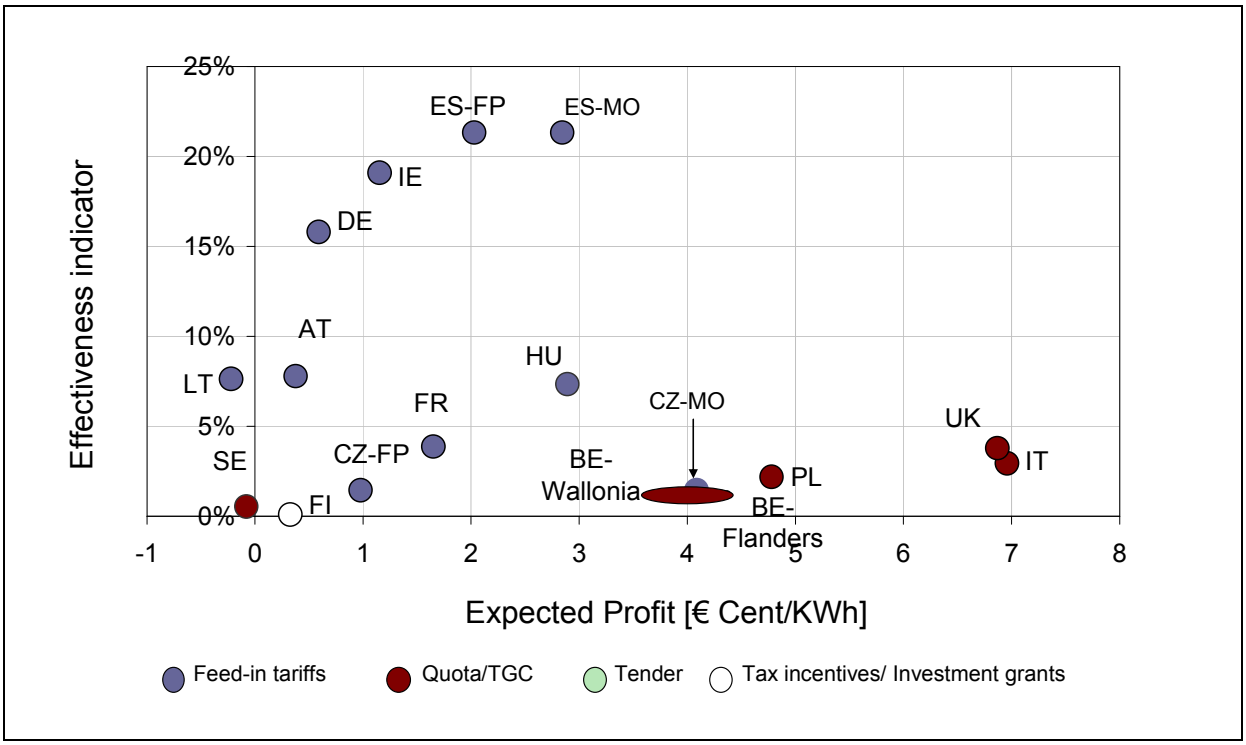
21 The Commission staff working document – Accompanying document to the Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of Regions – A European Strategic Energy Technology Plan (SET-Plan) – Capacities Map - COM(2007) 723, SEC(2007) 1509, SEC(2007) 1510 - mention minimum generation costs of 200€/MWh for Mediterranean regions. This differs from the costs presented in this document. The differences may result from differences in interest rates and depreciation times used to calculate the cost, and to differences between costs and prices of modules.

$$P = \frac{i}{(1-(1+i)^{-n})} * \sum_{t=1}^{n} \frac{\mathrm{Re}\,venue_t - Expenses_t}{(1+i)^t}$$

The average expected profit of wind energy investment in the countries included (Austria, Belgium, Czech Republic, Finland, France, Germany, Hungary, Ireland, Italy, Lithuania, Poland, Spain, Sweden, UK)[22] is calculated based on the expected support level during the period of promotion. The level of support in the German system is annually adjusted according to the regression implemented in the German EEG. For the four countries using quota obligation systems, the certificate prices of the most recent trading year 2007 are extrapolated for the entire active period of support. Furthermore, an interest rate of 6.5% is assumed (4.8% was used for Germany due to soft loans) and country-specific prices of wind technology are used. Therefore, the expected annuity considers country-specific wind resources, the duration the support is given as well as additional promotion instruments, such as soft loans and investment incentives. An important limitation of this approach is that an estimate of the future evolution of certificate prices in quota systems is needed. Such an estimate typically does not exist. We therefore assume that TGC prices will remain constant at 2007 levels (see above).

Figure 11: Historically observed efficiency of support for <u>onshore wind:</u> Effectiveness indicator compared to the expected profit for the year 2006



Source: OPTRES, 2007

General remarks from the analysis for onshore wind are as follows:

[22] This analysis has been carried out for a selection of countries to show the principle differences between the different policy schemes.

- Generally the expected profit and the effectiveness show a broad spectrum in quantitative terms for the countries included in this analysis. It should be pointed out that the different country-specific instruments have different levels of maturity and that in some countries – in particular quota obligation systems – are relatively new and are still in a transitional phase.

- There seems to be a trend that countries with quota obligation schemes with tradable green certificates as the main support scheme for promoting onshore wind seem to have a combination of high profits and low growth rates. The exception is Sweden with low profit and low growth rate. The high profit results in particular from the volatile certificate prices, which increase the risk of investment. For the four countries using quota obligation systems, the certificate price of 2007 was extrapolated for the entire period of the support. This assumption is questionable as certificate prices may fall as certificate markets in those countries mature. However, until now empirical evidence from these markets does not suggest a decrease of certificate prices.

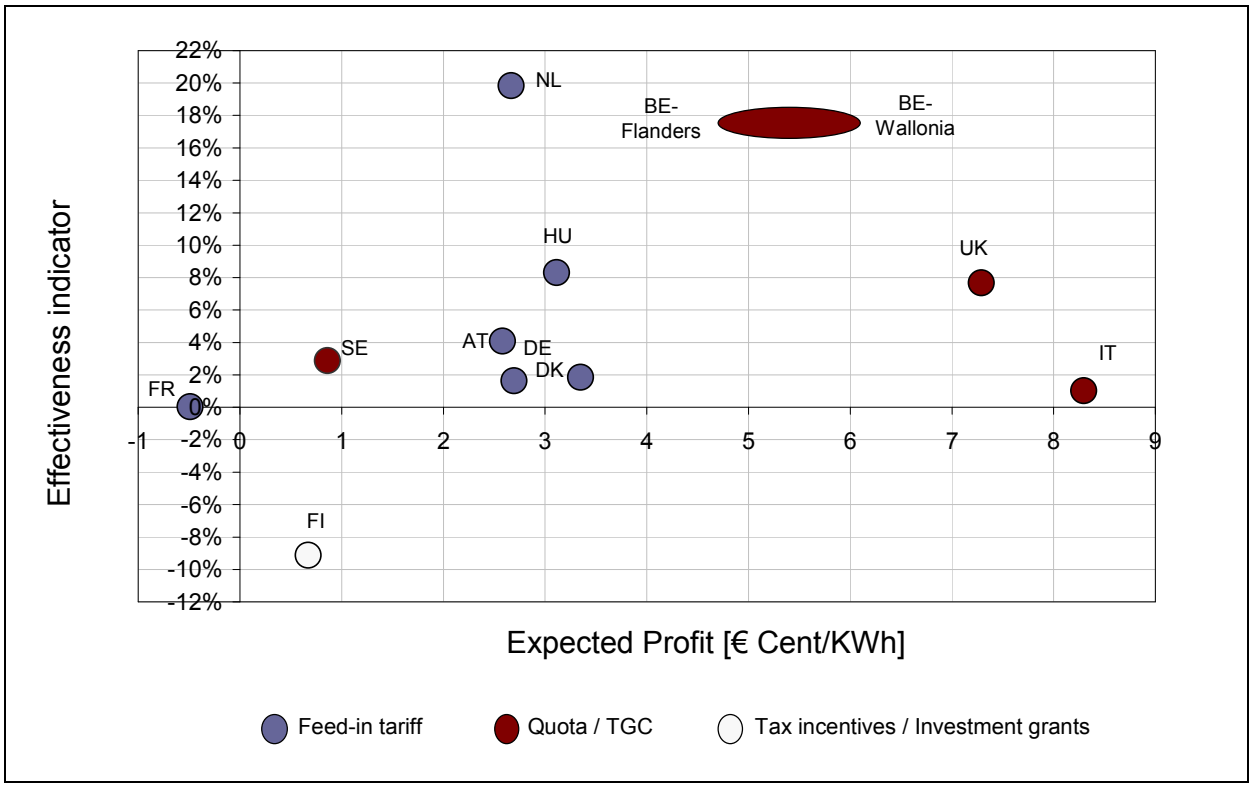
- On the other hand countries with feed-in tariffs seem to be typically more effective at generally moderate support levels. An exception from this rule is France, where strong administrative barriers continue to prevent a rapid development of onshore wind energy.

- Spain continues to achieve the highest growth rates in terms of the effectiveness indicator and at the same time offers an adequate profit. The expected profit here is higher than in most of the other feed-in countries in the analysis. This is not because of a high support level but rather because of the relatively low electricity generation costs due to good resource conditions on the hand and relatively low investment costs on the other.

- In Sweden, the small growth in wind power is the result of a very low expected profit. It is also a result of the fact that the quota system favours the renewable technologies with least costs, which at present is not onshore wind.

As a general conclusion, the investigated feed-in systems appear to be effective at a relatively low producer profit. In contrast, it can be observed that the present quota systems only achieve rather low effectiveness at comparably high profit margins. However, it should be taken into consideration that the quota systems are less mature than some feed-in systems.

Figure 12: Historically observed efficiency of support for biomass forestry: Effectiveness indicator compared to the expected profit for the year 2005



Source: OPTRES, 2007

General remarks from the analysis for biomass forestry are as follows:

- As for onshore wind, there is a broad variety of the effectiveness and efficiency of support policies for electricity from biomass forestry in quantitative terms for the countries included in this analysis. However, as was also the case for onshore wind, it should be pointed out that the different country-specific instruments have different levels of maturity and that in some countries – in particular quota obligation systems – are relatively new and are still in a transitional phase.

- At a first glance it would seem difficult to draw any conclusion for the quota system countries – Belgium, Italy, Sweden and the UK – as the picture seems quite dispersed. However, the high growth rate in 2005 for Belgium was exceptional and for 2006 the growth rate has fallen dramatically. This leaves the majority of quota countries with a low to moderate expansion albeit at a rather high expected profit, presumably due to the risks involved with the certificate markets. An exception to this is Sweden, which shows for the year 2005 a combination of low growth rate and low cost[23].

- Most countries with feed-in regimes also have a low growth rate, with the exception of Hungary and the Netherlands, however at lower expected profits compared to the quota regimes. The Netherlands had in 2005 the best performance from an efficiency-effectiveness perspective.

- Finland, due to its long tradition of using biomass forestry for energy purposes, has traditionally had a combination of high effectiveness and low cost. However, the situation changed in 2005.

[23] This growth rate is based purely on Eurostat data. National data gives a higher growth rate for 2005.

The low effectiveness is presumably due to an increase in biomass prices for forestry products relative to the price of alternative fuels for co-firing.

Annex 4: important state aid decisions concerning national support for electricity from res and chp

Country	State aid Case
Feed-in tariffs	
Austria	Compatible State aid, see decisions of 4.7.2006 in cases N 317a/2006 and N 317b/2006, OJ 2006 C 221.
Germany	No State aid, see decisions of 22.5.2002 in cases NN 27/2000 and NN 68/2000, OJ 2002 C 164.
Luxembourg	Formal investigation procedure pending, see decision of 5.6.2002 in case C 43/2002, OJ 2002 C 255.
Premium payments	
Ireland	Compatible State aid, see decision in case N 571/2006 of 30/10/2007, OJ 2008 C 311. (Previous support schemes were approved on 15.1.2002 in cases N 826/01, OJ 2002 C 59, and N 553/01, OJ 2002 C 45.)
Denmark	Potential State aid is compatible, see decision of 9.11.2005 in case N 602/2004, OJ 2006 C 21. (Previous support schemes were approved on 16.3.2004 in case N 342/2003, on 18.2.2004 in case N 448/2003, and on 19.5.2004 in case N 618/2003.)
Netherlands	Compatible State aid, see decision of 21.12.2007 in case N 478/2007. (Previous support schemes were approved on 15.6.2006 in case N 543/2005, OJ 2006 C 221, and on 19.3.2003 in cases N 707/2002 and 708/2002, OJ 2003 C 148.)
Choice between feed-in tariff and premium	
Slovenia	Compatible State aid, see decision of 24.04.2007 in case C 7/2005, OJ 2007 L 219.
Quota obligation systems	
Belgium	In principle no State aid, potential State aid is compatible, see decisions of 3.5.2005 in case N 608/2004, OJ 2005 C 240; of 25.7.2001 in case N 550/2000, OJ 2002 C 330; of 28.11.2001 in case N 415a/2001, OJ 2002 C 30. No State aid, see decisions of 24.10.2006 in case N254/2006, OJ 2004 C 314; of 2.8.2002 in case N 14/2002, OJ 2002 C 309.
UK	Compatible State aid, see decision of 28.11.2001 in case N 504/2000 of, OJ 2002 C 30. (Subsequently amended and approved in State aid cases N 209/2002, N 600/2003, N 362/2004 and N 474/2005.)
Investment aid	
Netherlands	Compatible State aid, see decision of 17.01.2006 in case N 265/2005, OJ C/141/2006.

The decisions referred to above will be available on the Internet site http://ec.europa.eu/comm/competition/state_aid/register/ii/