



Recent experiences with feed-in tariff systems in the EU – A research paper for the International Feed-In Cooperation

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1. Introduction

According to the Directive 2001/77/EC, the European Union has the objective to increase the share of electricity generated from renewable energy sources (RES-E) to 21% of the total electricity consumption in the EU-27 by 2010. Stimulated by the directive, all Member States implemented support schemes for the promotion of RES-E in the last years, increasing the RES-E share in the EU-27 to approx. 18% in 2009¹. The Directive 2009/28/EC sets a new European target of 20% RES in gross final consumption of energy for 2020, broken down into binding national targets for all EU-27 Member States. In their National Renewable Energy Action Plans (NREAPs), Member States need to include indicative trajectories regarding the share of RES in their electricity, heat and transport energy consumption. Each Member State also has to indicate appropriate instruments in order to achieve these national targets.

With regard to RES-E, the most frequently implemented support instruments are feed-in systems.² Here, two options are available: the feed-in tariff, which guarantees a fixed price per kWh electricity, or the feed-in premium, which is paid on top of the market price for electricity. When this payment is guaranteed to the electricity producers for 15-20 years, they face high investment security.

Among others, Spain and Germany have been applying feed-in tariff systems (FIS) during the last years very successfully, which led to a large increase of RES-E deployment in both countries. In the year 2004 the governments of Spain and Germany initiated the International Feed-In Cooperation in order to promote the exchange of experience and to improve the feed-in system design in the EU and other countries. Slovenia, which has shown particular growth of biomass technologies to nearly 300 GWh until 2008, joined the International Feed-In Cooperation in early 2007.

This report intends to give an overview of recent developments of feed-in systems in the European Union. More background information regarding the characteristics and design options of the instrument can be found in the report "Evaluation of different feed-in tariff design options – Best practice paper for the International Feed-In Cooperation" (Klein et al. 2010), available online at the Feed-In Cooperation's website www.feed-in-cooperation.org.

¹ own calculation based on Eurostat

² While this paper focuses on the EU, feed-in systems are used as support instrument for renewable energies across the world; for a global overview of renewable energy policies, see for example www.ren21.net

2. Feed-in schemes are the most common support scheme in Europe

Currently, Member States apply different support schemes for RES-E, including feed-in tariffs, feed-in premiums, quota obligations with tradable green certificates, investment grants and tax incentives. Differences in support schemes and support scheme design can be explained by different national priorities and framework conditions. Furthermore, national electricity markets still have very different characteristics and remain nationally segmented, despite the market opening foreseen by Directive 2003/54/EC.

Even though significant differences in support scheme design exist, feed-in systems are the most common RES-E support scheme across Europe. 20 of the 27 EU Member States have implemented feed-in schemes as main support instrument; three more Member States as supporting instrument for certain RES-E technologies. The number of countries using feed-in systems has increased steadily: In 2005, 18 Member States were using feed-in systems, in the year 2000 only 9 Member States.

Recently, also Member States with quota systems have introduced feed-in tariffs in combination with their quotas. Italy and the United Kingdom, for example, introduced a feed-in tariff for small scale installations and Belgium one for PV. Furthermore Finland recently decided to move from its investment grant support to a feed-in premium, which will be implemented in 2011. Figure 1 gives an overview of the main support schemes in the EU-27.

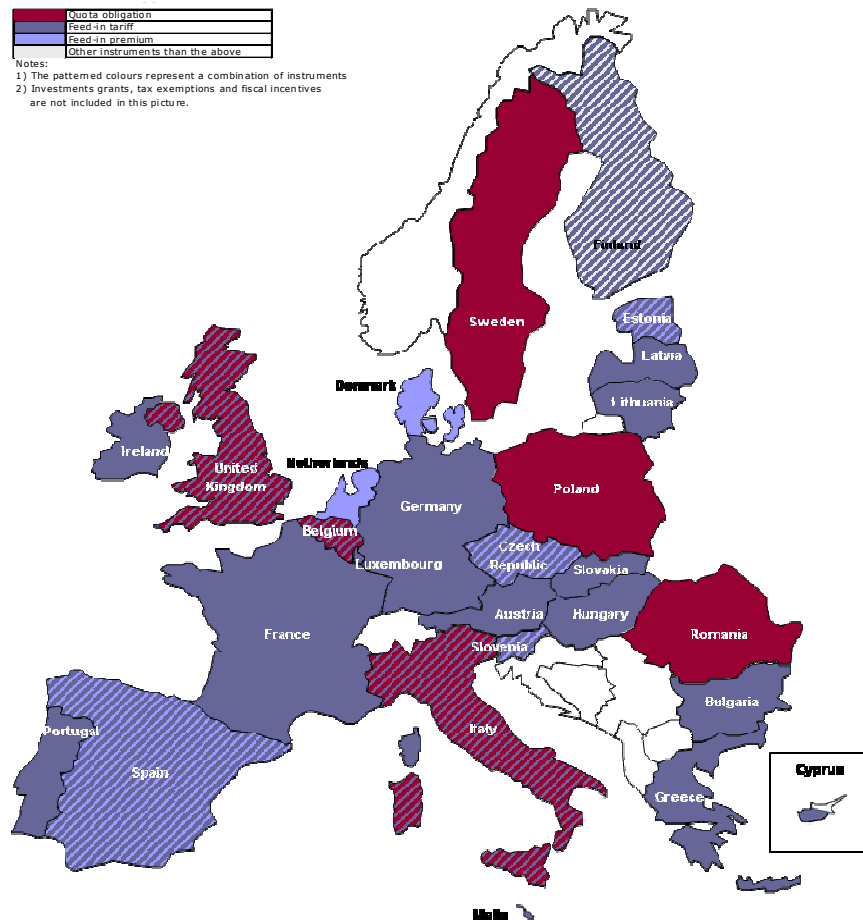


Figure 1 Map of EU countries according to their support mechanisms for RES-E³

The successful role of feed-in schemes for RES-E promotion in Europe is illustrated by Figure 2 and Figure 3, which give an overview of the installed capacities and electricity generation of wind energy, biomass electricity and photovoltaic (PV) in the EU-27 and in EU countries using feed-in system. It can be seen that the vast majority of installed capacity and electricity generation is located in those countries that apply feed-in schemes. However, the effectiveness of feed-in systems varies greatly across Member States and depends on the proper design of the instrument. Best practice design elements are discussed below and – in more detail - in the “Best practice paper for the International Feed-In Cooperation” (Klein et al. 2010).

³ Introduction of Feed-in Premium in Finland planned for 2011.

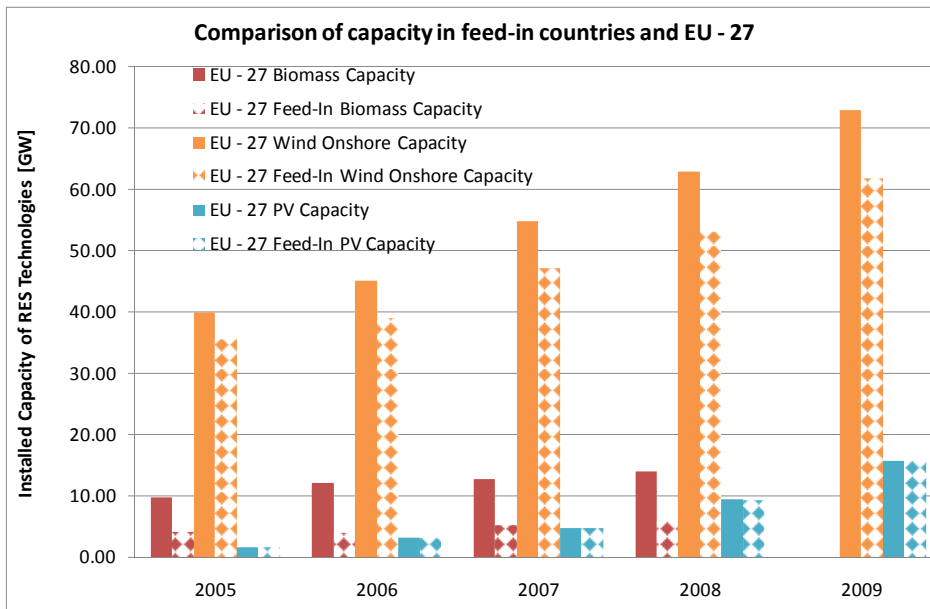


Figure 2 Comparison of the installed capacities (in GW) of biomass electricity, wind on-shore and photovoltaics (PV) in the EU-27 and in countries using feed-in tariffs

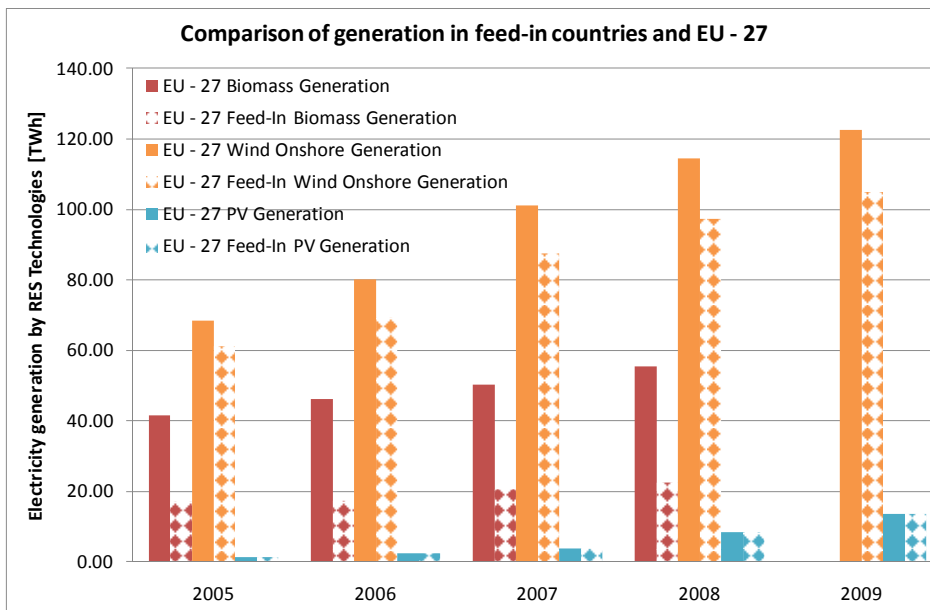


Figure 3 Comparison of the electricity generation (in TWh) of biomass electricity, wind on-shore and PV in the EU-27 and in countries using feed-in tariffs

3. Success stories of feed-in countries

As shown in the previous section countries using feed-in tariffs have been responsible for the majority of newly installed wind onshore and photovoltaics capacity in Europe, 86% of all wind onshore capacity and nearly 100% of all photovoltaics capacity installed by the end of 2009 in Europe was initiated by feed-in tariff systems. Also in overall terms countries using feed-in tariffs have had a leading role in developing renewables in Europe: 77% percent of the new renewable electricity generation in Europe installed between 1997 and 2008 was contributed by these countries. On the other hand feed-in tariff countries are responsible for only 61% of the European electricity demand in 2008.

The positive impact of a feed-in tariff on wind energy deployment is demonstrated by best-practice countries, particularly Spain, Germany, Denmark and Portugal. Germany has seen a strong increase in installed wind energy over the last ten years: the installed capacity increased from 4442 MW in 1999 to 18415 W in 2005 to 25777 MW in 2009. By the end of 2009, wind energy accounted for 6.7% of German electricity production; in Spain, 12.7% of the electricity supply was provided by wind, in Denmark even 19.5%.⁴ The feed-in tariff also had a strong impact on the wind energy market in Portugal. By the end of 2009, wind energy capacity increased to 3535 MW. Also Greece has seen a strong increase, but starting from a lower installed capacity. In 1999, 112 MW wind capacity were installed in Greece, rising to 1087 MW in 2009. Bulgaria, which introduced a feed-in system for wind installations in 2007, increased its wind power capacity to 180 MW in 2009.

In total, the installed wind power capacity in Europe⁵ has increased by a factor of almost 8 from 1999 to 2009 and risen from 9678 MW to 74767 MW. From 2008 to 2009, the growth in wind energy capacity was 16%.

In most of the countries with significant PV deployment, the vast majority of installations have occurred following the introduction of a feed-in scheme. The strong growth in Germany and formerly Spain are the clearest indicators, but also recent tariff introductions in Italy, France, Portugal, Czech Republic and Slovenia have led to stimulation of previously insignificant markets for PV.

⁴ Eurostat 2010: Data in Focus 14/2010 – Energy statistics provisional data for 2009)

⁵ EWEA 2010: Cumulative installed capacity per EU Member State 1998 – 2009 http://www.ewea.org/fileadmin/ewea_documents/documents/statistics/cumulative_wind_per_ms_1998_2009_ws.xls

European PV installations reached 15861 MW_p in 2009, which was an increase of almost 53% compared to 2008.⁶ In Germany, the installed PV capacity increased from 1910 MW in 2005 to 6019 MW in 2008 and 9830 MW in 2009. Italy increased its PV capacity from 458 MW in 2008 to 1032 in 2009. In the Czech Republic, the capacity increased from 55 MW in 2008 to 466 MW in 2009, in France from 104 to 289 MW, in Portugal from 68 to 102 MW and in Greece from 19 MW to 55 MW in 2009. One of the countries with the strongest relative growth was Slovenia: 0.2 MW installed PV capacity in 2005 increased to 2 MW in 2008 and 8 MW in 2009. Also Bulgaria has seen a strong relative increase: from no PV capacity in 2005 to 1 MW in 2008 and 6 MW in 2009.

In contrast to PV and wind, biomass shows slightly higher installations in countries using quota systems and tax measures. Due to the high share of fuel costs in total generation costs the long term investment security given by feed-in systems is less relevant in the case of biomass technologies.

4. Feed-in schemes can help to decrease RES-E generation costs

One goal of energy policy should be to provide incentives for technology improvements and more efficient solutions in order to reduce the electricity generation costs of RES-E technologies. Especially for technologies that do not require any expenses for fuel, such as wind power, PV, geothermal energy or hydro power, the largest share of costs are the capital costs of the power plant and the installation costs.

One best practice element of feed-in systems is the regular degression of tariffs: The tariff / premium level depends on the year in which the RES-E plant starts to operate. Each year the level for new plants is reduced by a certain percentage. Therefore the later a plant is installed, the lower the reimbursement received. The tariff degression can be used to provide incentives for technology improvements and cost reductions. Ideally the rate of degression is based on the empirically derived progress ratios for the different technologies.

Germany: According to the German Renewable Energy Act, the tariffs for electricity from RES are reduced annually. Depending on the type of technology, the FITs for new installations decrease by 1% for wind power plants and, once in July 2010 up to 13% and in October 2010 another 3% for PV according to the revised renewable energy act. This way cost reductions due to the learning curve effect are included in the policy and

⁶ EurObserv'ER 2010: Photovoltaic Barometer. <http://www.eurobserv-er.org/pdf/baro196.pdf>

a continuous incentive for efficiency improvements and cost reductions for new plants is offered⁷.

In **Greece**, for small photovoltaic systems (<10 kWp) a tariff degression is applied. A regression of 5% is foreseen for new entrants between 2012 and 2019⁸.

In **France** a tariff degression of 2% annually is applied for electricity from new wind turbines from the year 2008 on⁹.

Italy applies a similar legislation for PV. From 2007 on the level of FITs for electricity from new PV plants is reduced by 2% annually¹⁰. Plants commissioned in 2010 will receive a premium being cut by another 2%.

In the **Czech Republic** feed-in tariffs for new and existing RES-E generation are adjusted annually according to the inflation by at least 2% but no more than 4%, with exception of biomass and biogas plants. The feed-in tariffs for the following year shall not be reduced by more than 5% compared to the tariff in force at the time of the calculation of the new tariff.

Slovenia has recently adjusted its support scheme: RES-E generation plants with a capacity up to 5MW are supported through a feed-in tariff. Larger plants get support from a feed-in premium on top of the market price. For the feed-in tariff, currently no regular degression is foreseen apart for PV. Here, the annual degression is 7%. The feed-in premium, however, is regularly adjusted on the basis of reference energy market prices.

In **Latvia** has only recently introduced a new tariff structure for the RES-E generation, which is nevertheless currently being reviewed as the feed-in tariffs (which vary from the source of RE and capacity of installation) are the highest among Europe. It is therefore expected that the tariff level for wind power and other RES will be decreased.

5. Design elements to manage support expenditures

Besides the annual tariff degression implemented in many feed-in tariff systems further measures are used to limit the support expenditures of feed-in systems.

⁷ Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit

⁸ Art. 3 Par. 3 FEK 1079/2009

⁹ Ministère de l'Économie, des Finances et de l'Industrie 2006

¹⁰ Ministero delle attività produttive 2005, Art. 5

Many Member States apply a **stepped tariff design**, where the level of the tariff depends on the specific resource condition of the individual plant. Especially the costs of electricity from wind energy vary significantly depending on the wind yield, which is taken into account by such a tariff design. In the **Netherlands, Portugal, Denmark, France** and **Germany** concepts are applied where the FIT level depends on the local conditions at the plant site. In the first four countries in this list the guaranteed payment of a higher tariff level is limited to a maximum energy output of a plant. A lower level of the tariff applies, when this amount of power output is reached. In **Germany** the support system for wind energy is a little different. Operators of onshore wind turbines receive a fixed FIT during the first five years after the plant has started operating. The German Renewable Energy Act ("Erneuerbare-Energien-Gesetz", EEG) defines a *reference wind turbine*, which is located at a site with a wind speed of 5.5 m/s in an altitude of 30 meters. This reference turbine would generate a so-called *reference yield* in a five-year-period. If a wind turbine produces at least 150% of this reference yield within the first five years of operation, the tariff level will be reduced for the remaining 15 years of support. However, for each 0.75% the generated electricity stays below the reference yield, the higher starting tariff will be paid for two further months. This means that the use of wind energy to generate electricity is not restricted to locations with very good wind conditions but that sites with less favourable conditions can also be exploited.

Many EU Member States want to support (especially high price) technologies but are afraid that support costs may increase uncontrollably. Some countries set caps, limiting the amount of annual installations to a certain capacity or financial amount. The downside of caps is the reduced investment stability for market parties and a frequent stop-and-go in the market. Therefore other countries set growth corridors with continuous automatic adjustments of tariffs. The latter option preserves investment stability to a higher degree but may be less effective in limiting the increase of support expenditures.

A growth corridor or growth path is the amount of renewable capacity a country would like to see installed in a given year (e.g. 800-1.200 MW, or 1.000 MW) or part of a year (e.g. 200-300 MW per three month). In case growth is in line with that growth corridor the normal tariff depression would apply (e.g. minus 10% per year). In case growth is stronger than envisaged, the tariff depression is increased (e.g. minus 1% per 10% overshoot). In case of less growth than envisaged, tariff depression is decreased. The higher the frequency of adjustments (e.g. once in three month instead of once a year) and the higher the increase of tariff depression in case of overshoot, the higher the control on support cost but the lower the investment stability. Germany currently uses

this system in the case of photovoltaics, whereas Spain applies a fixed cap for the annual installed capacity.

Support for autoproducers through net metering was introduced in a number of countries with the aim to decrease the grid load and also to limit the support expenditures. The most prominent example for this policy is Italy, which revised its former Net Metering policy in 2009 and introduced a law which allows RES-E plants with a nominal power of up to 20 kW, plants with a capacity up to 200 kW that started production after 31.12.2007 and high-efficiency CHP plants up to 200 kW to apply Net Metering. Under this scheme, the producer is able to compensate the value of electricity consumed with the value of the electricity produced in different periods, thus reducing the producer's electricity bill. Therefore, there is no direct remuneration for (excess) electricity fed into the grid but an exchange of the value of electricity consumed and produced.

In **Germany**, in July 2010 an amendment of the existing Act concerning net metering for PV was adopted. Since then, small-scale producers with PV installations up to 500 kW have the option of a "split tariff". Electricity fed into the grid is supported with the usual feed-in tariff. Autoconsumed electricity from PV also receives a payment depending on the size of the application and share that is consumed by the producer. Up to a share of 30% electricity that is consumed directly, for each of these kWh 16.38 €ct are deducted from the corresponding regular feed-in tariff; above 30% autoconsumption, the deduction amounts to 12€ct.¹¹.

6. Design elements to improve system and market integration

Alternatively to the common implementation of feed-in systems as a fixed tariff a number of EU Member States have implemented a premium feed in tariff, that is paid on top of the electricity market price (the *premium tariff*). In the latter case the development of the electricity price has an influence on the remuneration level under the premium option.

The premium option shows a higher compatibility with the liberalised electricity markets than fixed feed-in tariffs. It allows a higher demand orientation of renewable electricity generation and therefore shows better properties, when integrating large RES shares into an electricity system. Depending on the detailed design of the premium option the risk for the RES-E producers may be larger. This is the case for a fixed premium,

¹¹ BMU 2010

where the premium does not depend on the average electricity price at the power market. In case of the sliding premium (as implemented in the Netherlands), where the premium is a function of the average electricity price, the investment risk does not necessarily increase. As said above the most promising option to avoid extra costs for electricity consumers could be a premium varying with the electricity market price, as applied in the Netherlands or a top limit for the overall remuneration paid in the case of the premium option. A bottom limit could be introduced as well, in order to compensate falling electricity prices. Such a cap and floor system has been introduced in **Spain**. Generally it has to be said that premium feed-in design options are a very innovative instrument to combine all major advantages of feed-in systems with a higher demand orientation of RES generation and the need for a higher market compatibility of renewable generation. Currently, most of the European countries with feed-in systems opted for the fixed tariff model. Premium tariffs are applied in **Spain**, the **Czech Republic**, **Slovenia**, **Estonia** the **Netherlands**, **Denmark** (for onshore wind energy) and **Italy** (for PV).

Steadily increasing shares of renewable energies in electricity generation lead to the need to take these energy sources into account more and more when managing the grid. For the large share of wind energy, **Germany** has been pioneer in this area.

The revised German Renewable Energy Sources Act therefore makes it mandatory for newly (after 2008) built turbines to actively contribute to grid stability and thus integrate this energy source better. Onshore wind turbines built between 01.01.2009 and 01.01.2014 have to fulfil certain technical standards in the field of reactive and real power in order to be connected to the grid and receive the feed-in tariff. Their feed-in tariff increases by 0.5 €/kWh, this extra bonus is called "Systemdienstleistungs-Bonus". In addition, the revised act also introduces an incentive for older turbines to be retrofitted on a voluntary basis. If turbines built between 2002 and 2008 are upgraded to fulfil the technical standards for new turbines until the end of 2010, they receive an extra bonus on top of their feed-in tariff of 0.7 €/kWh for five years.

7. A smart combination for large projects: tender and feed-in premium

In 2008, the **Danish** Renewable Energy Act has been enacted, but support has been similar to the now valid system also before that. Now, wind energy is supported in two ways:

Onshore wind turbines connected to the grid after February 20 2008 receive a feed-in premium of 25 øre/kWh (ca. 33.6€/MWh) for 22,000 full load hours. In addition, 2.3 øre/kWh are paid to compensate for balancing costs.

Offshore wind parks are subject to a tendering procedure. The Danish Energy Agency will announce a tender for a specific size in a specific area, therefore applicants can submit a quotation for the price at which they would be willing to produce electricity. After the wind park is connected to the grid, a premium will be paid on top of the market price so that the sum will be at the level of the bidding. The premium will be paid for 10 TWh, but no longer than 20 years. Currently, two offshore wind parks are supported under this scheme: for Horns Rev II, the market price plus premium together amount to 51.8 øre/kWh (69.9 €/MWh). For Rødsand II, the sum amounts to 62.9 øre/kWh.

In the **Netherlands** this year (2010) for the first time a tender for offshore wind energy (capacity of 700 MW) was announced and made eligible for the feed-in tariff (Subsidies Duurzame Energie (SDE)). The award of the contract was dependant on the premium which had to be paid to the bidder. Currently it is being discussed if the premium should be paid through an allocation mechanism in the future instead out of the annually state budget in order to create more planning reliability for the producers.

8. Feed-in systems as a supplement to other support schemes: the case of UK and Italy

As stated above, the **UK** has only recently, on 1 April 2010, introduced a feed-in tariff for projects with a maximum size of 5MW. Other plants are continuingly supported through the Renewables Obligation (RO). Projects smaller than 50kW always receive support under the FIT; projects between 50kW and 5MW can choose between support under the RO or the FIT. There is no proposed cap on the annually available budget or volume of new installations in the FIT scheme. The tariff is expected to deliver a return on investment of 5-8% for well-sited installations. It consists of three elements:

- Generation tariff: a fixed payment from the electricity supplier for every kWh generated.
- Export tariff: a guaranteed price for any surplus electricity that is not used on site but exported to the grid, also paid by the electricity supplier. It has been set at 3p per kWh.
- In addition, with power generated on site, sites will need less from the national grid, so power bills will be lower.

The tariff levels and support period for the supported technologies are listed in Table 1. The tariffs will be reviewed in 2013.

Table 1 Feed-in tariff levels introduced in the UK in 2010

Energy Source	Scale	Generation Tariff (p/kWh) ^[A]	Duration (years)
Anaerobic digestion	≤500kW	11.5	20
Anaerobic digestion	>500kW	9.0	20
Hydro	≤15 kW	19.9	20
Hydro	>15 - 100kW	17.8	20
Hydro	>100kW - 2MW	11.0	20
Hydro	>2kW - 5MW	4.5	20
Micro-CHP ^[B]	<2 kW	10.0	10
Solar PV	≤4 kW new ^[C]	36.1	25
Solar PV	≤4 kW retrofit ^[C]	41.3	25
Solar PV	>4-10kW	36.1	25
Solar PV	>10 - 100kW	31.4	25
Solar PV	>100kW - 5MW	29.3	25
Solar PV	Standalone ^[C]	29.3	25
Wind	≤1.5kW	34.5	20
Wind	>1.5 - 15kW	26.7	20
Wind	>15 - 100kW	24.1	20
Wind	>100 - 500kW	18.8	20
Wind	>500kW - 1.5MW	9.4	20
Wind	>1.5MW - 5MW	4.5	20
Existing generators transferred from RO		9.0	to 202

In **Italy** the 2008 Budget Law (244/2007), updated by law 99/2009, also introduced a 15 years feed-in tariff for RES-E plants with capacities below 1 MW as alternative to Tradable Green Certificates (TGCs) and a coefficient for banding TGC according to technologies, which is expected to produce a significant effect on the market. The current tariffs are shown in Table 2.

Table 2 Technology-specific feed-in tariffs for small plants in Italy

	Plant capacity < 1MWe
	Optional Feed-in tariff (€/MWh)
Wind on-shore	220
Wind off-shore	--
Geothermal	200
Wave & tide	340
Hydro	220
Biodegradable waste, biomass different from that defined below	220
Biomass and agricultural/forestry biogas	280
Biomass and biogas used in high yield CHP reusing the heat power produced in agricultural sector	--
Other Biogas (including landfill and sewage gas)	180

PV is not included in the feed-in tariff, as it is supported with a *Premium* (Conto Energia), initially introduced in 2005 and modified again in 2007.¹² The electricity produced remains on the availability of the investor and can be auto consumed, sold or exchanged with the network (net metering up to 200 kW installed capacity). The initial premiums of 2007 have been reduced by 2% per year, and will be reduced by a further 2% for plants beginning production in 2010. In the beginning of 2010 a new decree was drafted which states that for large solar plants of over 1MW, the proposed tariff as of January 1, 2011, is to be €0.313/kWh, compared with €0.298 /kWh in the previous version. The €0.313/kWh tariff is expected to decline to €0.2642/kWh at the end of 2011. The tariffs would then decrease by 6 percent a year in 2012 and 2013.

Table 3 PV premiums in Italy

	Capacity	Premium (€/kWh) 2009	Duration (years)
Plant not integrated	1 kW < P <3 kW	0.392	20
	3 kW < P 20 kW	0.372	
	P > 20 kW	0.353	
Plant partially integrated	1 kW < P <3 kW	0.431	
	3 kW < P 20 kW	0.412	
	P > 20 kW	0.392	
Plant fully integrated	1 kW < P <3 kW	0.480	
	3 kW < P 20 kW	0.451	
	P > 20 kW	0.431	

9. Summary & Outlook

The use of feed-in tariffs is increasing in the EU as the only or as a combined policy instrument to support renewable energies as sources for electricity production. After only nine EU Member States having started with a feed-in system in 2000, today 20 countries are applying feed-in schemes as main RES supporting instrument and three more countries as a supplementary instrument for selected technologies and plant sizes. Finland, as 24th country, has announced to introduce a feed-in tariff in 2011. The importance of feed-in systems for RES-E promotion in Europe is also reflected by the fact that in 2008 77% of the renewable electricity produced in the EU are generated from plants supported through a feed-in system.

Feed-in systems have been proven to be flexible on the adjustment to market developments. It is therefore important that they are designed smartly to support renewables in a cost efficient way. Among others, this can be achieved by implementing stepped tariff design, a regular degeneration of tariffs, the combination with

¹² D.M. 28/07/2005, 06/02/2006, 19/02/2007, AEEG deliberation 188/05 and its updates

tendering approaches for large plants or the introduction of growth corridors for more expensive technologies.

However, such support systems alone cannot guarantee a strong and successful development of renewable electricity production. Challenges still lie in the alleviation of administrative barriers and the electricity grid expansion to integrate an increasing share of renewable electricity.

Another important effect of supporting renewables is the impact on employment and economic growth. According to the Employ-RES study¹³ conducted on behalf of the European Commission the renewable energy sector is a very important sector in terms of employment and value added already today. New industries with strong lead market potential have been created, which contribute about 0.6% to total GDP and employment in Europe. Only in Germany 340.000 jobs have been created in the renewable energy sector by the year 2009.¹⁴ This development is likely to accelerate if current policies are improved in order to reach the agreed target of 20% renewable energies in Europe by 2020. The study finds that currently the strong investment impulses - based on installations in Europe and exports to the rest of the world - dominate the economic impact of renewable energy policies and therefore lead to positive overall effects. In order to maintain this positive balance - between economic stimulus and increased costs of electricity due to RES support - it will be necessary in the future to uphold and improve the competitive position of European manufacturers of RES technology and to reduce the costs of renewable energies by exploiting their full learning potentials. Therefore policies, which promote technological innovation in RES technologies and lead to a continuous and sufficiently fast reduction of the costs, will be of major importance. These elements will also represent key requirements for the further development of feed-in systems in the European electricity sector. Besides the implementation of strong policies in the EU, it will be of key relevance to improve the international framework conditions for renewable energies to create large markets, exploit economies of scale and accelerate research and development.

¹³ Ragwitz M, W. Schade, B. Breitschopf, R. Walz, N. Helfrich, M. Rathmann, G. Resch, C. Panzer, T. Faber, R. Haas, C. Nathani, M. Holzhey, I. Konstantinaviciute, P. Zagamé, A. Fougeyrollas, B. Le Hir, 2009: Employ-RES - The impact of renewable energy policy on economic growth and employment in the European Union, Final report of a study led by Fraunhofer ISI done on behalf of the European Commission (Contract no.: TREN/D1/474/2006).

¹⁴ Ulrike Lehr, Christian Lutz, Oleksii Khoroshun, Dietmar Edler, Marlene O'Sullivan, Joachim Nitsch, Kristina Nienhaus Barbara Breitschopf, Peter Bickel, Marion Ottmüller: Kurz- und langfristige Arbeitsplatzwirkungen des Ausbaus der erneuerbaren Energien in Deutschland, study on behalf of BMU.