Support Schemes for Renewable Energy

A Comparative Analysis of Payment Mechanisms in the EU

OVERVIEW

Supported by the European Commission

Contents

For an electronic version of this Overview, the full Report and the Internet based background documents, please visit http://www.ewea.org/06projects_events/projects.htm

Abstract

The RE-Xpansion project has analysed some of the principal institutional mechanisms used to support electricity generation from renewable energy around the EU. The study has entailed detailed investigation of the different types of mechanism and their effects on renewable electricity generation. Classification of the mechanisms was carried out, and models developed whereby their relative efficacy can be gauged. The analysis involved surveys of a broad section of the renewable energy sector. Recommendations are made for the future of EU policy regarding payment mechanisms in the context of eventual harmonisation of support mechanisms.

1. Introduction: The Renewables Directive

Under the terms of the Kyoto protocol, for the period 2008 to 2012 the European Union (EU) should reduce greenhouse gas (GHG) emissions to 8% less than in 1990. Renewable energy sources (RES) are expected to play an important role in the implementation of these GHG reductions.

In its White Paper on a strategy for the development of renewable energy, the European Commission set the goal of supplying 12% of EU energy consumption from RES by 2010 (double the 6% in 1997), mainly from biomass, hydropower, wind power, and solar energy. Biomass and wind power are expected to be the principal additional sources.

Within these energy targets, electricity generation is a key factor. This study considers only electricity generation and supply from renewables, abbreviated as 'RES-E'.

In 2001, after more than four years of negotiation, the EU Directive 2001/77/EC (the Renewables Directive) on the promotion of electricity from renewable energy sources was adopted. According to this Directive, each Member State should generate a specified proportion of its electricity from RES in 2010. These specifications are presently indicative; however the Commission may set mandatory targets if the present targets seem unlikely to be met.

The directive also recognises other benefits of RES: *"The potential for the exploitation of renewable energy sources is underused in the Community at present (...) environmental protection and sustainable development (...) create local employment (…) a positive impact on social cohesion (…) contribute to security of supply.*

The promotion of electricity produced from renewable energy sources is a high Community priority (…) for reasons of security and diversification of energy supply, of environmental protection and economic cohesion."

Commission Evaluation by End 2005

By October 2005, according to the directive, the European Commission should have evaluated the support mechanisms used to promote renewable technologies in different Member States. These include (a) 'fixed price systems', such as investments subsidies, fixed feed-in tariffs, fixed premium systems, and tax credits; and (b) 'fixed quantity systems' such as obligated tendering and tradable green certificates (TGCs).

By the end of 2005, the Commission is also expected to present a summary report on the implementation of the Renewables Directive. During the many years of negotiations that led to its final adoption, the issues of harmonisation and choice of support mechanism were keenly debated. That debate is expected to reawaken in the second half of 2005, with the publication of the Commission reports.

The full report of the RE-Xpansion project, available through the European Wind Energy Association website[1], highlights the characteristics, benefits and disadvantages of the various support mechanisms for RES-E. As such, the Report should provide important input to the forthcoming debate. This Executive Summary focuses on the recommendations resulting from the analysis of the main Report.

1 www.ewea.org

2. RE-Xpansion Project Objectives

The main objective of the RE-Xpansion project has been to analyse the various support schemes for RES electricity, including their impact on the development of renewable technologies. The project provides background information and an economic analysis to assist the European Commission in the evaluation process.

The expansion of renewable energy in Europe depends on national and EU factors. Unless stable conditions exist within a country for RES investment, it will be impossible to meet EU goals. If the EU moves towards the creation of an Internal Market for RES electricity, the need for harmonisation, and removal of barriers to trade becomes increasingly evident.

RE-Xpansion attempts to bridge the gaps between theoretical economic analysis of possible Europe-wide support mechanisms, the regulatory framework, and renewable energy industry stakeholders.

Increasing the amount of RES electricity in the EU is a great challenge, given the need for compatibility with the emerging Internal Electricity Market, itself characterised by market failures, vested interests and trade barriers. The main objectives of the project have been to:

- Analyse present and potential regulatory environments, and identify trade barriers.
- Simulate the effects on RES-E development of a Europe-wide framework, based on various existing support mechanisms; examples are investment subsidies, fixed feed-in tariffs, fixed premiums, taxes, tendering for obligated supply and Tradable Green Certificates (TGCs).
- Analyse the investment behaviour of stakeholders, such as developers, financiers and manufacturers, and then derive requirements for stable market conditions.
- Assess development pathways for a single European framework for the promotion of RES-E, taking into account the EU intention to internalise the external costs of electricity generation (see below), and to meet its targets.
- Identify pitfalls and barriers, and then recommend best practice guidelines for the development of a European framework.

3. Present Status of Renewable Energy

Figure 1 illustrates the proportions of total EU-25 electricity production by generation type. Electricity from renewable energy sources (RES-E), including large hydropower, accounts for at least 13.8%.

Figure 1: EU-25 electricity production by generation type in 2003

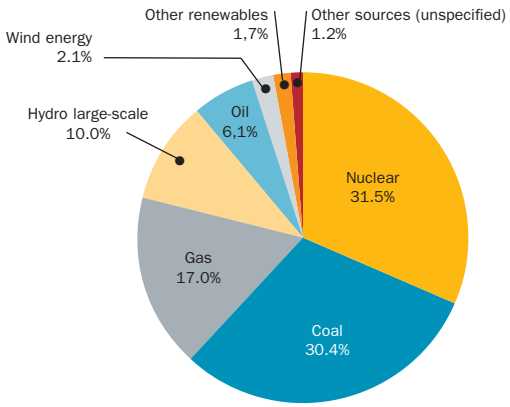
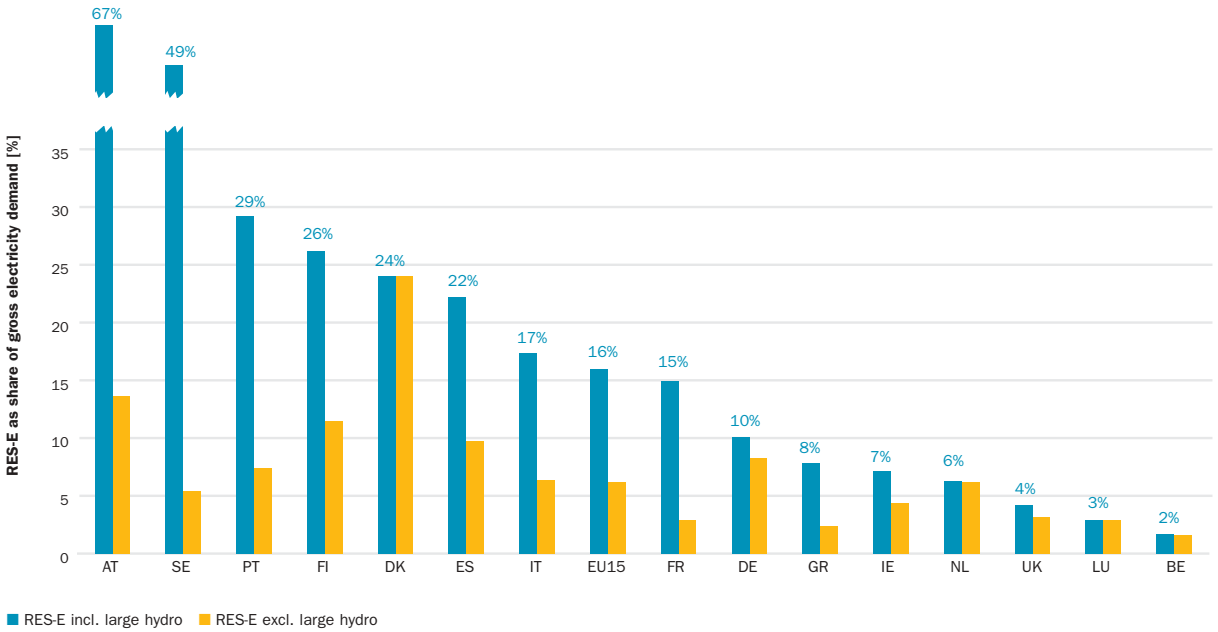


Figure 2 shows EU-15 countries ranked by proportion of RES-E in the national electricity mix, in 2004. Two countries, Austria and Sweden, generate more than a third of total electricity from renewables, but in other Member States RES-E represents a much smaller proportion.

Figure 2: EU-15 countries ranked in terms of RES-E production as a proportion of total electricity (with and without large hydro) in 2004



4. External Costs

No electricity generation technology completely avoids pollution or negative environmental impact of some kind; even renewable energy impacts the environment to a small degree, albeit dramatically less than conventional technologies. Should such impacts entail a financial burden on citizens, it would seem reasonable that electricity generators (and hence their customers) should cover the cost, in line with the Polluter Pays Principle.

Such impacts may be difficult to quantify and even more difficult to allocate to particular individuals. For example, how to assess the cost of lost coastal amenities due to sea-level rise from climate change, health effects of air pollution, or reduction in property values near power plant?

A number of policy instruments exist to internalise such external effects and so encourage electricity producers to reduce their emissions to an agreed 'optimal' social welfare level. When this level is achieved, the market will allocate energy supply technologies according to their social costs: the price for the electricity will reflect its "true cost".

4.1 The ExternE Project

The European Community and the United States Department of Energy launched the ExternE Project in 1991 to assess the external cost of fuel cycles. Its principal objectives included:

- The development of a unified methodology for quantifying the environmental impacts and social costs associated with production and consumption of energy; and
- The use of this methodology to evaluate the external cost of incremental use of different fuel cycles in different locations in the European Union.

The ExternE project estimated that the cost of producing electricity from coal or oil in the EU would double, and the cost of electricity production from gas would increase by 30%, if external costs, in the form of damage to the environment and health, were taken into account.

This study assumed average electricity production costs in the EU were Euro 0.04 per kWh. The study further estimated that the external costs amounted to 1-2 % of EU GDP, or between €85 billion and €170 billion, not including the cost of human induced climate change and not considering long-term costs of nuclear waste. The effects of pollution on human health make up for the second largest portion of external costs (after climate change).

The fossil fuel cycles have significantly larger specific external costs (i.e. per kilowatt hour) than other generation. Table 1 shows this for coal & lignite, peat, oil, orimulsion and gas, of which gas has the least external cost. Electricity generated from renewable energy was calculated to have specific external costs of *one to two orders of magnitude* less than from fossil fuel generation.

Table 1: Specific external cost of energy

Damage in eurocents/kWh of electricity supplied[a]

Country	Coal & Lignite	Peat	Oil & Orimul.	Gas	Nuclear	Biomass	Hydro	PV	Wind	Waste
AT				1.1-2.6		2.4 -2.5	0.004			
BE	3.7-15			1.1-2.2	0.4-0.47					
DE	3.0-5.5		5.1-7.8	1.2-2.3	0.44-0.7	2.8-2.9		0.14-0.33	0.05-0.06	
DK	3.5-6.5			1.5-3.0		1.2-1.4			0.09-0.16	
ES	4.8-7.7			1.1-2.2		2.9-5.2[b]			0.18-0.19	1.5-2.4
FI	2.0-4.4	2.3-5.1				0.8-1.1				
FR	6.9-9.9		8.4-10.9	2.4-3.5	0.25	0.6-0.7	0.6			6.7-9.2
GR	4.6-8.4		2.6-4.8	0.7-1.3		0.1-0.8	0.51		0.24-0.26	
IE	5.9-8.4	3.3-3.8								
IT			3.4-5.6	1.5-2.7			0.34			4.6-7.7
NL	2.8-4.2			0.5-1.9	0.74	0.4-0.5				
NO				0.8-1.9		0.24	0.23		0.05-0.25	
PT	4.2-6.7			0.8-2.1		1.4-1.8	0.03			
SE	1.8-4.2					0.27-0.3	0.004-0.7			
UK	4.2-6.7		2.9-4.7[c]	1.1-2.2	0.24-0.27	0.53-0.57			0.13-0.15	

a. Subtotal of quantifiable externalities (public health, occupational health, material damage, global warming)
b. Biomass co-fired with lignite
c. Orimulsion: 3.1-5.2

Table 1 shows the main results of the ExternE study: the external costs of various energy sources expressed in Eurocents/kWh. Concerning the nuclear cycle, the ExternE study has assumed, contentiously, that radioactive waste management and other potentially hazardous impacts are well managed for all time, so having small external cost now. The methodology behind the figures for nuclear power has not been made available for analysis; so whether or not such issues have been addressed as accident probability or waste storage, remains unclear.

No assessment of external costs was made regarding the military, terrorist and security aspects of the nuclear fuel cycle, and neither were delayed costs on future populations included. The figures lack therefore the credibility of the other estimates, and are contradicted by other studies.

If externalities were incorporated in current market prices, the perceived cost of renewable energy would be practically unchanged, whereas the perceived low cost of conventional technologies would increase dramatically with the incorporation of their external costs. However, even without the internalisation of external costs, some forms of renewable energy are approaching cost competitiveness with conventional technologies, such as onshore wind energy at sites with strong wind. With the internalisation of external costs, conventional fuels would cease to be competitive.

5. The Promotion of Renewable Energy

The RE-Xpansion Report discusses support mechanisms, such as investment subsidies, fixed feed-in tariffs, fixed premium systems, and tax credits; and fixed quantity systems such as tendering systems and tradable green certificates (TGCs). However, these instruments are not the only methods of supporting renewable energy production.

Harmonised Energy Taxes

Harmonised energy taxes, reflecting the actual environmental impact of each electricity production technology, is an effective way of internalising external costs. They could make the full production costs of electricity generation transparent, level the playing field in a future Internal Electricity Market and introduce fair competition between renewables and conventional power technologies.

After 6 years of negotiations, a landmark EU directive[2] setting minimum tax rates for energy products came into force on 1 January 2004. However, as a result of numerous compromises among Member States, the level of the minimum energy tax rate is close to being the lowest common denominator for the Community and is considerably lower than originally proposed by the Commission (in 1997) and the Parliament (in 1999). Consequently, the effect of the directive on renewables development will be insignificant in the short term.

Several EU countries have introduced tax incentives for renewable energy. These are summarised in Table 2.

Table 2: Specific national tax incentives for renewable energy

Country	Investment-based tax incentives.
Austria	Private investors get tax credits for investments in using renewable energies (personal income tax). Note, the amount is generally limited to about 3,000 € per year.
Belgium	13.5 – 14% of RES-investments deductible from company profits, regressive depreciation of investments. Reduced VAT on building refurbishing if energy efficiency is included (6% instead 21%).
Denmark	The first 3,000 DKK of income from wind energy are tax free.
France	Deduction of 15% investment costs with a maximum of 3,000 € per person. Reduced VAT (5.5%) on renewable equipment (not applicable to installation costs).
Germany	Losses of investments can be deducted from the taxable income. This fact increases return on investments into wind projects.
Greece	Up to 75% of RES-investments can be deducted.
Ireland	Corporate Tax Incentive: Tax relief capped at 50% of all capital expenditure for certain RES-investments.
Portugal	Up to 30% of any type of investments on RES can be deducted with a maximum of 700 € per year. Reduced VAT (12%) on renewable equipment.
Spain	Corporation Tax: 10% (up to 20% in some autonomous regions) tax liability instead of 35% for investments in environment friendly fixed assets.
The Netherlands	EIA scheme: RES-investors (most renewable energy systems) are eligible to reduce their taxable profit with 55% of the invested sum. Lower interest rates from Green Funds: RES-investors (most renewable energy systems) can obtain lower interest rates (up to 1.5%) for their investments. Moreover dividends gained are free of income tax for private investors.

2 Directive 2003/96/EC of 27 October 2003

5.1 Payment Mechanisms

It is very uncommon now for external costs to be internalised. The general situation is that environmentally harmful practices are accepted, and indeed often subsidised, and there are few environmental taxes or other charges that internalise the external costs of electricity production. The market does not respond to external costs in general, since predominantly they are not charged at source.

- A Second Best Solution

Without mechanisms to fully internalise externalities, a second best solution for a level playing field in the electricity markets is for Member States (and potentially the EU) to establish adequate *incentives* to increase the proportion of RES electricity. Incentive mechanisms should be viewed as compensation for the lack of internalisation of external costs in power production. This is also the overall rationale given in the Community guidelines on State aid for environmental protection (2201/c 37/03).

Several types of incentive have been used to promote the increased deployment of wind power. These can be grouped into three main categories:

- Voluntary Systems, where the market determines the price and the quantity of renewable energy (*green marketing*).
- Systems where the government dictates the electricity prices paid to the producer for RES-E and lets the market determine the quantity (*fixed prices*).
- Systems where the government dictates the quantity of renewable electricity and leaves it to the market to determine the price, perhaps within certain limits (*obligated quotas*).

Willingness to Pay?

In theory, voluntary demand could provide a market for wind power and other renewable energy technologies independently of government policy. However, experience with voluntary systems or "Green Marketing Programmes" to date clearly suggests that voluntary green-power schemes, purely based on customers' willingness to pay extra for green electricity i.e. without additional measures, has had only small and insignificant impact on RES deployment.

Voluntary strategies are mainly based on the willingness of consumers to pay premium rates for renewable energy. There are two main categories: investment focused, including shareholder programs, donation projects and ethical thrusts; and generation based, including green electricity tariffs, with and without labelling. Such systems are discussed in more detail in the Main Report and in the background documents available at www.ewea.org.

RES-E can also be promoted by means of *indirect strategies*, for example CO_2 (Climate Change) taxes, GHG emission trading or removal of subsidies previously given to fossil and or nuclear generation.

5.2 Mechanisms in Use Today

Fixed price systems and obligatory quotas for renewable electricity are ways of creating a protected market for RES-E within an open electricity market. This is needed if new RES electricity has difficulty in competing with previously subsidised or depreciated nuclear and fossil-fuel power plants. Protected markets for RES-E are also ways of offsetting (fully or partly) the competitive disadvantage arising from the market's neglect of the external environmental costs and benefits of energy production, as mentioned above.

Quota Based and Price Based Systems

It is often argued that systems where the government fixes the quantity of renewable electricity demand (e.g. renewables quotas with green certificate trading) is more "market oriented" than systems where governments fix the price. This is not necessarily the case. The economics of the two methods vary and, in practice, the amount of renewables capacity installed under the contrasting mechanisms may be significantly different.

The main difference between quota based and price based mechanisms is that the former introduces competition between the electricity producers (e.g. wind turbine operators) as the quota target is approached, whereas all producers are equal in priced-based systems. Competition between manufacturers of plant (e.g. wind turbines), which is crucial in order to bring down capital costs, occurs so long as a market is created, whether the government dictates price or quantity.

The oil cartel OPEC operates its mechanism by controlling wholesale prices through set quantities reaching the market, rather than directly through set prices. The reason is that oil quantities are easier to administer than prices. In the World Trade Organisation (WTO), quantitative restrictions are

generally banned, although tariffs are accepted; this is because the WTO regards quotas as more market distorting than tariffs.

The main objectives of economic mechanisms that support RES technologies are to provide incentives for reduction in harmful emissions, for technological development, for increased renewable installed capacity and thereby reduced costs through competition, and for cheap and clean technologies to be available as competitive alternatives to conventional power sources. Whatever the market mechanism, be it control through prices or through quantities, the most important point is that the objectives are achieved in a rational and effective manner.

Five Main Mechanisms

There are currently five main mechanisms to support electricity from renewable energy sources in the Member States: investment subsidies, fixed price mechanisms, fixed premium mechanisms, obligated quota systems based on auctions and tradable green certificates.

The aim of all these mechanisms is to offset some of the competitive disadvantage for renewables as a consequence of electricity markets neglecting the external costs of electricity production. Cheap electricity prices are of little benefit if they lead to expensive social costs from harmful impacts.

Table 3 provides a classification of existing promotion strategies for RES-E support mechanisms.

Regulatory, Price Driven Mechanisms

Generators of electricity from RES receive financial support in terms of a subsidy per kW capacity installed or a payment per kWh produced and sold.

- Investment focused: Investment Subsidies and Tax Credits (€ per unit of generating capacity).
- Generation based: Fixed Feed-in Tariffs (FITs) and Fixed Premium Systems (€ per unit of generated energy) – with flat rates or a stepped design.

Regulatory, Quantity Driven Mechanisms

The desired level of generation or market penetration of electricity from RES is set by a government decision, commonly called *Quota Obligation or Renewable Portfolio Standard*. The price is set through competition between generators. The most important mechanisms incorporate:

- Tendering / bidding,
- Tradable Green Certificate (TGC)

Table 4 provides an overview of current promotion schemes for RES-E in EU-15 countries (as at the end of 2004), detailing the strategies and the technologies addressed, by country.

Table 3: Fundamental types of promotional strategies

		Direct		Indirect
		Price-driven	Quantity-driven (quotas)	
Regulatory (obligated)	**Investment focussed**	• Investment subsidies • Tax credits	• Tendering system	• Environmental taxes
	Generation based	• (Fixed) Feed-in tariffs • Fixed Premium system	• Tendering system • Tradable Green Certificate system	
Voluntary	**Investment focussed**	• Shareholder Programs • Contribution Programs		• Voluntary agreements
	Generation based	• Green tariffs		

Table 4: Current (end 2004) promotion strategies for RES-E in EU-15 countries

	Major Strategy	RES-E TECHNOLOGIES CONSIDERED			
		Large Hydro	Small Hydro	'New' RES (Wind On- & Offshore, PV, Solar Thermal Electricity, Biomass, Biogas, Landfill Gas, Sewage Gas, Geothermal)	Municipal Solid Waste
Austria	FITs	No		Renewable Energy Act 2003. (Ökostromgesetz). Technology-specific FITs guaranteed for 13 years for plants which get all permissions between 1 January 2003 and 31 December 2004 and, hence, start operation by the end of 2006. Investment subsidies mainly on regional level. No decision yet on follow-up support after 2004.	FITs for waste with a high biodegradable fraction
Belgium	Quota/TGC + Guaranteed Electricity Purchase	No		Federal: The Royal Decree of 10th July 2002 (operational from 1st of July 2003) sets minimum prices (i.e. FITs) for RES-E.[3] On regional level promotion activities include: Wallonia: Quota obligation (TGC-system) on electricity suppliers – increasing from 3% in 2003 up to 12% in 2010. Flanders: Quota obligation (TGC-system) on electricity suppliers – increasing from 3% (no MSW) in 2004 up to 6% in 2010. Brussels region: No support scheme yet implemented.	
Denmark	Fixed Premiums	No		Act on Payment for Green Electricity (Act 478): Fixed premium prices instead of former high FITs. Guaranteed for 3 (biogas) to 20 (wind) years. Tendering plans for offshore wind.	No
Finland	Tax Exemption	No	Tax refund: 4.2 €/MWh (plant <1MW)	Mix of tax refund and investment subsidies: tax refund of 6.9 €/MWh for wind and of 4.2 €/MWh for other RES-E. Investment subsidies up to 40% for wind and up to 30% for other RES-E	Tax refund (2.5 €/MWh)
France	FITs	No		FITs for RES-E plant < 12 MW guaranteed for 15 years (20 years PV and hydro). Tenders for plant >12 MW. FITs in more detail:biomass: 49-70 €/MWh, biogas: 46-58 €/MWh, geothermal: 76-79 €/MWh, PV: 152.5-305 €/MWh; landfill gas: 45-57.2 €/MWh; wind[4]: 30.5-83.8 €/MWh; hydro[5]: 54.9-61 €/MWh. Investment subsidies for PV, biomass and biogas (biomass and biogas PBEDL 2000-2006).	FIT: 25.8-47.2 €/MWh
Germany	FITs	Only refurbishment		Renewal of German Renewable Energy Act in 2004: FITs guaranteed for 20 years[6]. In more detail, FITs for new installations (2004) are: hydro: 37-76.7 €/MWh; wind[7]: 55-91 €/MWh; biomass & biogas: 84-195 €/MWh; landfill-, sewage- & mine gas: 66.5-96.7 €/MWh; PV & solar thermal electricity: 457-574 €/MWh; geothermal: 71.6-150 €/MWh.	No
Greece	FITs + Investment Subsidies	No		FITs guaranteed for 10 years (at a level of 70-90% of the consumer electricity price)[8] and a mix of other instruments: a) Law 2601/98: Up to 40% investment subsidies combined with tax measures; b) CSF III: Up to 50% investment subsidies depending on RES type.	No
Ireland	Tendering System	No		Tendering scheme - to be replaced by FITs in 2005. The last tendering competition, AER VI, took place in 2003: It included technology bands and price caps for small wind(<3 MW), large wind (>3 MW), small hydro (<5 MWp), biomass, biomass CHP and biogas.	No
Italy	Quota/TGC			Quota obligation (TGC-system) on electricity suppliers: 2.35% target (2004), increasing yearly up to 2008; TGC issued for all (new) RES-E (incl. large hydro and MSW) – with rolling redemption[9]; penalty in size of 84.2 €/MWh (2004) but market distortions appear[10]. Investment subsidies for PV (Italian Roof Top program).	
Luxembourg	Fixed Premiums	No	No	FITs[11] guaranteed for 10 years (PV: 20 years) and investment subsidies for wind, PV, biomass and small hydro. FITs for wind, biomass and small hydro: 25 €/MWh, for PV: 450 €/MWh.	No
The Netherlands	FITs + Tax Exemption			Mixed strategy: Green pricing, tax exemptions and FITs. The tax exemption for green electricity amounts 30 €/MWh and FITs guaranteed for 10 years range from 29 €/MWh (for mixed biomass and waste streams) to 68 €/MWh for other RES-E (e.g. wind offshore, PV, small hydro).	No
Portugal	FITs + Investment Subsidies	No		FITs (Decree law 339-C/2001 and Decree law 168/99) and investment subsidies of roughly 40% (Measure 2.5 (MAPE) within program for Economic Activities (POE)) for wind, PV, biomass, small hydro and wave. FITs in 2003: wind[12]: 43-83 €/MWh; wave: 225 €/MWh; PV[13]: 224-410 €/MWh, small hydro: 72 €/MWh.	No
Spain	FITs or Fixed Premiums	Depending on the plant size[14]		FITs (Royal Decree 436/2004): RES-E producer have the right to opt for a fixed FIT or for a premium tariff[15]. Both are adjusted by the government according to the variation in the average electricity sale price. In more detail (only premium as valid in 2004 for plant < 50 MW): wind, small hydro, geothermal, tide & wave: 42 €/MWh; solar thermal & PV[16]: 194 €/MWh, biomass: 35-42 €/MWh. Moreover, soft loans and tax incentives (according to "Plan de Fomento de las Energías Renovables") and investment subsidies on regional level.	Premium FIT: 17 €/MWh
Sweden	Quota/TGC	No		Quota obligation (TGC-system) on consumers: increasing from 7.4% in 2003 up to 16.9% in 2010. For wind investment subsidies of 15% and additional small premium FITs ("Environmental Bonus"[17]) are available.	No
United Kingdom	Quota/TGC	No		Quota obligation (TGC-system) for all RES-E: increasing from 3% in 2003 up to 10.4% by 2010 – penalty set at 30.5 £/MWh. In addition to the TGC system, eligible RES-E are exempt from the Climate Change Levy certified by Levy Exemption Certificates (LEC's), which cannot be separately traded from physical electricity. The current levy rate is 4.3 £/MWh. Investment grants in the frame of different programmes (e.g. Clear Skies Scheme, DTI's Offshore Wind Capital Grant Scheme, the Energy Crops Scheme, Major PV Demonstration Program and the Scottish Community Renewable Initiative).	No

Table 4 shows the broad set of promotional instruments and mechanisms now existing in the EU. However, most attention has been concentrated on five of these, namely (i) investment subsidies, (ii) feed-in tariff schemes, (iii) fixed premium schemes, (iv) obligated quotas, (v) tendering. Tradable green certificates may be used as mechanisms to facilitate any of these mechanisms. No single instrument has been applied broadly across the EU. The instruments are discussed in detail in the main report, and in the internet-based background documents available at www.ewea.org.

Notes from Table 4

3 FITs are guaranteed on national level for the first 10 years of operation, e.g. in case of offshore wind in size of 90 €/MWh. Note, they can only be claimed exclusively – in other words, they cannot be claimed if support is given by the regional TGC-systems.
4 Stepped FIT: 83.8 €/MWh for the first 5 years of operation and then between 30.5 and 83.8 €/MWh depending on the quality of site.
5 Producers can choose between four different schemes. The figure shows the flat rate option. Within other schemes tariffs vary over time (peak/base etc.).
6 The law includes a dynamic reduction of the FITs (for some RES-E options): For biomass 1% per year, for PV 5% per year, for wind 2% per year.
7 Stepped FIT: In case of onshore wind 87 €/MWh for the first 5 years of operation and then between 55 and 87 €/MWh depending on the quality of site.
8 Depending on location (islands or mainland) and type of producer (independent power producers or utilities).
9 In general only plant put in operation after 1st of April 1999 are allowed to receive TGCs for their produced green electricity. Moreover, this allowance is limited to the first 8 years of operation (rolling redemption).
10 GRTN (Italian Transmission System Operator) influences strongly the certificates market selling its own certificates at a regulated price – namely at a price set by law as the average of the extra prices paid to acquire electricity from RES-E plant under the former FIT-programme (CIP6).
11 Only valid for plants up to 3 MW (except PV: limited to 50 kW).
12 Stepped FIT depending on the quality of the site.
13 Depending on the size: <5kW: 420 €/MWh or >5kW: 224 €/MWh.
14 Hydropower plants with a size between 10 to 25 MW receive a premium of 42 €/MWh, larger plants (25 to 50 MW) can opt for a premium of 35 €/MWh.
15 In case of a premium tariff, RES-E generators earn in addition to the (compared to fixed rate lower) premium tariff the revenues from the selling of their electricity on the power market.
16 In case of PV the expressed premium tariff refers to plant > 100 KW. For small-scale plant (<100 kW) a fixed FIT in size of 414.4 €/MWh is applied.
17 Decreasing gradually down to zero in 2007

6. Evaluation of Support Schemes

An ideal payment mechanism for development of renewable energy technologies is not by itself sufficient for the extensive deployment of renewable sources. Several other issues have also to be in place. If this is not so, even the seemingly best designed payment mechanism has little chance of success.

There are then four main ingredients in a potentially effective overall promotional strategy for renewables:

1. Well designed payment mechanisms
2. Grid access and strategic development of grids
3. Appropriate administrative procedures and streamlined application processes
4. Public acceptance

Any framework for the development of renewable energy sources has to include the above four components. If even one is missing, deployment of renewables will be severely restricted.

The RE-Xpansion Report focuses primarily on the first component – the support scheme. In the Annex 1 of the Report, the issue of grid integration is also addressed.

So called "generic" and "advanced" versions of the five principal payment mechanisms in use were evaluated against ten criteria through a survey of industry experts. The relative importance (weighting) of the criteria themselves was also derived through a survey of industry experts. For the full methodology of the evaluation process, please consult the main report and the internet-based background documents at www.ewea.org. The criteria were as follows:

1. Simple and transparent in design and implementation, implying low administration costs
2. High diversity in the technologies supported
3. High investor confidence
4. Encouraging lower manufacturing costs
5. Capable of reducing the price for power consumers
6. High effectiveness in deployment
7. High conformity with the power market and with other policy instruments
8. Facilitating a smooth transition process
9. Encouraging local and regional benefits
10. Increasing public acceptance of renewable technologies

The boxes below show the definitions of the Generic and Advanced Versions of the Payment Mechanisms.

Investment subsidies	
Generic	**Advanced**
The current level of support is known up front. Support is defined as a % of the approved investment costs	Level and duration of support for new installations for the coming five years is announced
Future price of electricity unknown (spot price known)	Power purchase agreements (PPAs) of maximum three years are available[18]
The level of support is the same for each technology and reflects the cost of the cheapest technology	Support level varies between technologies, reflecting differences in cost structures
The investment subsidies are paid by the electricity consumer as a levy within power bills.	

Fixed Feed-in Tariffs	
Generic	**Advanced**
Only current tariff known, i.e. future changes in level unknown	Tariffs guaranteed for existing capacity for period sufficient to recover investment (10-20 years depending on technology and the level of the tariff)
Duration unknown	Tariffs can be changed, reflecting changes in cost structures, but new tariffs only apply to new investments
The tariff is the same for each technology and reflects the cost of the cheapest technology	Support level varies between technologies, reflecting differences in cost structures
The tariff is paid by the electricity consumers	Tariffs vary according to resource availability on sites (stepped feed-in tariff). The tariff is structured so that it is still more profitable to put turbines in the most resource rich areas

18 (Ideally the PPAs should be at least ten years, but this is considered unrealistic to achieve in the short to medium term in all European power markets).
19 As above

Fixed Premium Systems	
Generic	**Advanced**
Only current premium known, i.e. future changes in level unknown	Premium guaranteed for existing capacity for period sufficient to recover investment (10-20 years depending on technology and the level of the premium)
Duration unknown	Premium can be changed, reflecting changes in cost structures, but new premiums only apply to new investments
Future prices of electricity unknown (spot price known)	Premium level varies between technologies, reflecting differences in cost structures
The premium is the same for each technology and reflects the cost of the cheapest technology	Premium level does not vary according to resource availability
The premium is paid by the electricity consumers	Power purchase agreements (PPAs) of up to three years available[19]

Tendering Systems	
Generic	**Advanced**
The level of support is known up front by the winner of the tender	The tender is based on an auction over the lowest 15-year Power Purchase Agreement (PPA)
Future prices of electricity unknown	Deadlines and meaningful penalties for exceeding deadlines
No technology banding, i.e. the renewable energy technology is not specified in the tender	Technology banding introduced, i.e. different tenders are announced for each renewable technology
No penalties / performance bonds	
No deadlines for construction	
Based on an auction over lowest premium / kWh for 15 years above an unknown future market price for electricity	
The premium is paid by the electricity consumers as a levy within power bills	

Tradable Green Certificate Systems	
Generic	**Advanced**
Future electricity prices unknown (spot price known)	Power purchase agreements (PPAs) of up to three years available[20]
Future certificate prices unknown (spot price known)	Contracts on certificates of up to three years available. (Ideally the certificate contracts for at least ten years should be available, but this is considered even more unrealistic to achieve than for PPAs in the short to medium term in all European power markets)
Duration of scheme unknown	Long-term (at least 20 years) mandatory targets known
Mandatory targets setting a gradually increasing quota	Duration of scheme known
Penalties for non-compliance	Gradually increasing quota
No price cap or floor on certificates	Technology differentiation
No technology differentiation	
The certificate is paid by the electricity consumers	

The relative weights assigned to the ten evaluation criteria listed above are shown in Table 5. As can be seen from the table, stakeholders see Investor Confidence as the most important issue, while the lowest weight is accorded to the Smooth Transition Criterion.

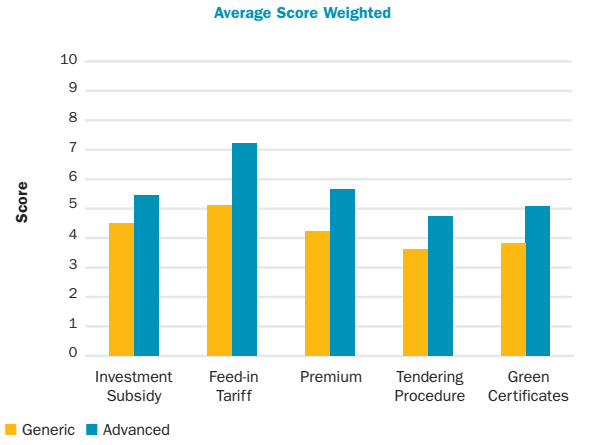
20 As above

Table 5: Criteria Weighting Results

	Average weight	Standard Deviation (%)
Simplicity	9.9	58.3
Diversity of technologies	8.4	77.6
Investor confidence	20.6	52.7
Lower manufacturing costs	6.7	82.6
Lower consumer price	7.6	93.9
Effectiveness	17.0	56.0
Policy conformity	8.2	62.9
Smooth transition	4.3	72.3
Local benefits	7.8	63.9
Public acceptance	9.7	93.1
Total	100	-

These weights were used to calculate the weighted average scores for each of the five generic and advanced mechanisms. A summary of the results is shown in Figure 3, and gives an indication of the overall performance of the mechanisms as perceived by the respondents.

Figure 3: Average weighted scores for each of the five support schemes



The Feed-in Tariff has the highest score, both for the generic version and for the advanced one. The Investment Subsidy ranks second in the generic version, followed by the Premium Scheme, however these two change place in the advanced version. However, only marginal differences are found between the scores of the Investment Subsidy and the Premium scheme. Green Certificates rank fourth and the Tendering Procedure has the lowest score of all.

Although no single mechanism was favoured by a clear majority of participants, the trend of the responses has been included as supportive evidence for the conclusions and recommendations outlined in section 7 below[21].

6.1 Computer Simulation of "Advanced" Mechanism Effects

Computer simulations of the effects of the advanced models of the support schemes on renewable electricity production were run using the Green-X Model, developed by EEG[22]. The model provides the following outputs on a yearly base up to 2020 for each Member State, for the European Union as a whole, and for each technology:

- General results, including:
  - Installed RES-E capacity
  - Total fuel input electricity generation
  - Total electricity generation
  - National electricity consumption
  - Import / export electricity balance (% of generation)
  - Total CO_2 emissions from electricity generation compared to baseline (BAU, Kyoto-target, etc.)
  - Market price of electricity (yearly average price)
  - Market price of Tradable Green Certificates
- Producer expenditure, including:
  - Total electricity generation costs
  - Total producer surplus for electricity generation
  - Marginal generation costs per technology for electricity generation
- Impact on consumer, including:
  - Additional costs due to promotion of RES-E
  - Additional costs due to Demand Side Management (DSM) strategy
  - Additional costs due to CO_2 strategy
  - Total (transfer) costs due to the selected support schemes and policy options

For further information on the methodology and results in the Green-X simulation runs, and for details of the findings of the simulations on which the below conclusions and recommendations are based, see the main report and the internet-based background documents, available at www.ewea.org.

21 For more detail, visit http://www.ewea.org/06projects_events/projects.htm
22 http://www.green-x.at/

7. Conclusions and Recommendations

It constitutes a market failure that electricity retail prices do not include the full cost to society of electricity production. If environmental costs were levied on electricity generation according to their impact, many renewable technologies would no longer require support. Having harmonised energy taxes, reflecting the actual environmental impacts of each technology, would be an effective and fair way of internalising environmental costs.

If, at the same time, direct and indirect subsidies to electricity generation from fossil and nuclear fuels were removed, the need to support renewable electricity generation would diminish still further.

However, it does not seem politically feasible in the short to medium term to agree on measures to fully internalise external costs in electricity production, or to remove unproductive subsidies to conventional energy sources. Therefore, second-best mechanisms are needed to support RES-E.

Support Frameworks as Compensation for Market Failure

Support frameworks for renewable energy sources should be viewed as compensation mechanisms for correcting the market failures. Such support frameworks provide the necessary, yet temporary, support to enable renewable energy technologies to achieve mainstream status, and eventually full competition with conventional electricity production technologies.

While the financial framework, i.e. the payment mechanism for renewables, is vital for increasing the renewable share of the power mix, it is important to recognise that attention must be given simultaneously to the development of appropriate measures in each of four vital areas:

- Well designed payment mechanisms
- Grid access and strategic development of the grids
- Appropriate administrative procedures
- Public acceptance and support

RE-Xpansion has focused on the analysis of payment mechanisms. However, if one of the other three elements is missing from an overall framework, little progress will occur. It is therefore vital that analysis of support mechanisms in the Member States, such as the Commission's evaluations of progress towards meeting the targets, identifies successes and failures; "cause–effect" analysis is essential. Otherwise the assessment of support mechanisms may lead to the wrong conclusions.

7.1 Little Evidence of Effectiveness beyond Feed-In Tariffs and Premiums

Based on past experience, it appears that policies based on fixed tariffs and premiums can be designed to work effectively. However, introducing them is not a guarantee of success. Most countries with mechanisms to support renewables have, at some point, used feed-in tariffs. However, not all feed-in mechanisms have contributed to an increase in renewable electricity production. It is the design of a mechanism, in combination with other measures that determines its success.

It is too early to draw final conclusions on the potential impacts of the full range of policy options available, since more complex systems, such as those based on tradable green certificates, are at an early stage of implementation and still in an experimental phase. These must be given time to prove their effectiveness. More time and experience are needed to make credible conclusions on their potential ability to attract investments and deliver real growth in renewables capacity.

There is not enough evidence yet that mechanisms other than fixed tariffs and premiums can be effectively applied at Community or national level at this time without dramatically affecting the European market for renewables. Mechanisms, especially complex ones, take time to prove their ability to attract investment, and so increase RES market share.

7.2 Voluntary Best Practice Design Guidelines

There are five main payment mechanisms in use in Member States today. These are:

- Investment subsidies (capital grants)
- Fixed feed-in tariffs
- Fixed premiums (environmental bonus systems)
- Auction models / tenders
- Renewables quota obligations (possibly combined with tradable green certificates (TGCs))

However, different variations of these five main systems have evolved in the Member States - systems that are not immediately compatible, which is to say that 25 different variants of the five mechanisms exist in the EU today. Their redesign, in order to facilitate fair trade, would cause widespread investor uncertainty in all markets, if undertaken too quickly.

In order to minimise these disruptive effects and to prepare for a potential Community-wide mechanism, a set of voluntary Best Practice Design Guidelines should be developed in consultation with stakeholders. Such an approach has also been adopted for gas infrastructure and cross-border gas in the context of the European Gas Regulatory Forum (Madrid Forum).

Development of "Market Clusters"

Best Practice Design Guidelines would indicate to Member States the choices for a future mechanism, and create the opportunity for more coherence among both existing and potential mechanisms.

Rather than introducing dramatic changes in all 25 independent markets, this would lead to gradual alignment of the support mechanisms of Member States that have chosen a similar version of one of the five mechanisms (e.g. tradable green certificates in Sweden, Wallonia, Flanders, Italy and the UK; fixed feed-in tariffs in Germany, France and Portugal; fixed premiums in Spain and Denmark, etc.). Such "market clusters" would increase the ease with which the country of origin of a unit of renewable electricity could be recognised (avoiding 'double counting'), and provide valuable insight and experience on which to base a Community decision later on.

The Voluntary Best Practice Design Guidelines should be based on a set of design requirements for support mechanisms. The RE-Xpansion survey analysis was based on ten such design requirements (see section 6, above). The survey results clearly show that the specific design of payment mechanisms has a significant impact on how the performance of a mechanism is perceived, i.e. the "advanced" mechanisms score significantly higher than the "generic" mechanisms.

7.3 Real Competition in Power Markets

The "advanced mechanisms" defined in section 6 assume that certain elements of electricity markets are available, e.g. long-term power purchase agreements, and the existence of long-term contracts for certificates. Another underlying assumption is that real competition exists in the European power markets today. However, some of the elements assumed in the analysis are not present in today's power markets.

The European Commission's four benchmarking reports on the implementation of the EU electricity and gas directives conclude that real competition in the electricity market is still far off. Creating a market for renewables that is compatible with a well functioning internal market should be a goal of the Community.

However, it seems premature to force renewable electricity into an Internal Market framework at a time when competition in the conventional power market is far from being effective and will only exist in theory for many years to come. Due to its interaction with the power market, fair trade in renewable electricity will be impossible to achieve unless distortions in the internal electricity market are overcome e.g. increased concentration, ineffective ownership unbundling, massive subsidies paid to conventional electricity sources and market dominance, and failure to internalise externalities. New renewables (excluding large hydro) account for approximately 5% of EU electricity consumption. Competition in renewables should be preceded by fair and real competition in the remaining 95% of the power market.

7.4 Payment Mechanisms and Externalities

Article 174 of the Treaty establishing the European Community states that the Community bases its environmental policy on the principles ensuring that preventive action should be taken, that environmental damage should be rectified at source and that the polluter should pay.

If external costs, in the form of damage to the environment and health, were taken into account, the EC-funded ExternE study estimated that the cost of producing electricity from coal or oil would double and the cost of electricity production from gas would increase by 30 %.

The study further estimated that these costs amount to 1-2 % of EU GDP, or between €85 billion and €170 billion, not including the cost of global warming and climate change. The RE-Xpansion analysis shows that wind power alone is expected to avoid external costs of €25 billion/year by 2020[23].

23 See main report and Internet-based background reports for details at www.ewea.org.

The evaluation and design of payment mechanisms for renewables must also consider mechanisms to internalise external costs for all forms of generation. Only then will an optimal allocation of society's resources be achieved. Therefore, internalising external costs should be an additional design parameter in developing the Voluntary Best Practice Guidelines proposed in section 7.2.

In general, it is preferable to internalise a known external cost directly, e.g. via a tax or levy, instead of indirectly, e.g. through a renewable energy support mechanism. This is because such taxes and levies may establish social costs within the retail prices of both conventional and renewable electricity production. In contrast, the subsidisation of renewable energy sources (through a fixed premium, for example) only corrects the price difference between the polluting conventional energy technology and the promoted renewable energy technology; it does not clarify the true cost of the non-renewable supply.

7.5 A Harmonised System for Promoting Renewables?

The adoption of the Renewables Directive in 2001 has initiated a positive Europe-wide political process to develop adequate frameworks for renewables. However, in many Member States, these frameworks are still not yet operational, being still in the preparatory phase, but should nonetheless be effective soon. The Commission should encourage these Member States to speed up the process of implementation of national renewables frameworks, specifically in relation to the best design of payment mechanism, and to overcoming administrative and grid barriers.

Any change towards an EU-wide system at present would stall the development of renewable policies in many Member States by at least another 2-3 years - at a critical time for the technologies. The present efforts of Member State would be wasted and such a move could have devastating effects on national markets where signs of activity are at last beginning to show.

Introducing a Common System Now would be Premature

A premature move towards a common approach could stop, or seriously delay, development even before it starts; Member States would fail to meet their national targets and European global leadership in renewable energy technologies would be put at serious risk.

There is much evidence that changes to frameworks - even the discussion of potential change - creates uncertainty for renewables, and introduce an initial adverse impact on renewables markets. The initiation now of a community-wide mechanism would undermine several years of Member State efforts to develop effective mechanisms.

Finally, it is still too early to draw a final conclusion on the relative effectiveness of the various policy options for support mechanisms. While mechanisms based on feed-in tariffs (e.g. the German mechanism) and premiums (e.g. the Spanish mechanism) have proved effective in attracting investments, more complex systems, such as those based on tradable green certificates, are still at an experimental and early stage of implementation.

These more recent mechanisms must be given time to prove their effectiveness before a decision on a common harmonised mechanism is decided. More time and experience are therefore needed to make credible conclusions on the impacts of the full range of options.

A shift to a Community-wide support mechanism for the promotion of renewable energy sources must be well prepared. Preparations could include the development of a set of Voluntary Best Practice Design Guidelines for support mechanisms. These should be based on a set of design requirements, for which the RE-Xpansion project has suggested an approach.

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EWEA
THE EUROPEAN WIND ENERGY ASSOCIATION

T: +32 2 546 1940 · F: +32 2 546 1944
ewea@ewea.org · www.ewea.org

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