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Energy Strategies in EU Countries
Wolfgang Mostert, May 2007

Interaction between EU & global policies and national energy policy

Energy policies of EU countries are increasingly defined and shaped in an interplay between national-internal policy discussions and EU-level policy discussions. Until the late 1990s, the latter used to play a rather sub-ordinate role. As unlike agriculture, energy does not have a separate chapter in the EU-treaties; EU energy policy initiatives, are created ad-hoc and with reference to other policies such as the “internal market” and “industrial competitiveness”. The important EU reforms in the 1990s for the liberalization of the national electricity and natural gas markets were not the result of energy policy discussions; they were driven by *the EU’s “internal market policy”* to expand cross-border trade and competition and cross-border mergers and acquisitions in the EU.

The EU’s influence on member states energy policies got an upward push by the negotiations leading to the *Kyoto protocol and the follow-up discussions* on post 2012 global strategies to combat climate change. Since energy conversion and consumption accounts for 80 percent of the EU’s CO₂-emissions, policies to *reduce energy consumption* through increased energy efficiency (EE) and to *increase the share of renewables* (RE) in the production of power, heat and cooling and of fuels for the transport sector came to the forefront of EU policy attention.

A further EU-profile raising factor is political concern about the *rising energy import dependency* of EU countries, which is forecast to increase from the present 50% to 80% within the next two decades. This provides a case for coordinated action in energy infrastructure investments. Security of supply concerns make it easier also for national governments to set up ambitious goals for climate change policies as mitigation measures reduce energy consumption and thus, fuel imports.

The policy-induced shift in energy consumption and supply from fuel-based to know-how based energy supply and consumption creates new energy services and technologies and leads to a gradual phasing out of existing ones. The achieved expansion in the market for *national industries and services* - the increase in *employment, national productivity and industrial competitiveness* – is one of the benchmarks for measuring the impact effectiveness of RE&EE support instruments.

The situation has led the EU – and its individual member states – to adopt *three objectives* for energy policy:

1. environmental protection,
2. security of energy supply,
3. industrial competitiveness.

The first and second objectives will – when it comes to specific policy actions – always go hand in hand, the first and the third can imply trade-offs. The EU and member states’ *strategy* to achieve the energy objectives is (i) to *curb the growth in demand* through changes in energy taxation, promotion of energy management and the dissemination of new technologies; (ii) to *change the structure of internal supply* by developing less polluting energy sources and promoting use of

national renewable energy sources (keeping the nuclear power option open) and (iii) to *safeguard external supplies* through a diversification of the supply base and negotiated agreements with key suppliers.

Despite the growing role of the EU, member states' energy policies differ substantially from one-another; in their stated policy objectives and use of specific policy instruments. Partly this is due to history: the EU expanded its influence on national energy policy only recently. Partly member state policies differ due to national energy resource endowments. Partly this is due to different market philosophies of the member governments: French energy policy argues for continued involvement of state and municipally owned companies in energy supply, British policy consistently seeks to limit the state and municipal role to the creation of effective frameworks for private initiatives and private public partnerships. The differences in *energy supply policies* are large, policies and instruments differ less with regard to *energy management*.

EU policy and strategy is enshrined in a series of new EU directives. Because of the national differences, EU directives give general principles and guidelines only, details are decided by member states. Since EU policy is limited to "common denominators", the more advanced policies and penetration targets are set by national governments, EU directives serve mainly to pull up the policies of "footdragging nations". The most relevant directives are listed below in the chapters on renewable energy and on energy savings.

The feature of common objectives and flexible means turns the EU into a laboratory of experiments with alternative policy instruments. There is diversity with regard to penetration targets for specific RE-technologies (RETs), type of energy saving (RUE) investments and of deployment instruments. Instruments can be compared with regard to impacts, distributional efficiency and cost efficiency.

We shall see below first at the differences in member state policy objectives and draw some very general lessons about RE-policies. Since the topic matter is promotion of rational use of energy – including RE-technologies – issues such as power sector reform, policies for the downstream petroleum sector, etc. are not addressed. Policies for grid connected RE-systems are treated under one heading and policies to promote energy savings and micro-generation using RET under another.

General trends in and lessons from energy policy in EU countries

Although the overall trend is towards a consolidation and sophistication of policy instruments, purely conceived or designed policies continue to be implemented. Recent examples are the EU's CO₂ Directive setting up the European Trading System (ETS) for European Allowance Units (EAU) and the EU and national policies to promote biofuels.

- The EU-ETS has two build-in flaws. One is that the quota allocations for a regional system are done by national agencies; not by an EU agency: this is a guarantee for over-allocation of quotas and low EAU-prices. The other is that allocations to power generators are not done by auction, but are "grandfathered" at least 70% of their quota needs free of charge. As following the logic of the liberalized power markets generators "always" include the full market value of used quotas into their bid prices for the power pools, the EU-ETS provides over-profits for generators by transferring revenue from tax payers (forgone state income from sales of quotas) to the owners of power generators.
- The promotion of biofuels is done with reference to CO₂ abatement; secondary objectives are security of supply and generation of rural employment and income. Yet, it is well-

known that the CO₂ reduction from the present “first generation of biofuel technologies” is close to zero, and that it has negative social consequences through increased international food prices and negative environmental impacts from forest and land clearing in Malaysia, Brazil and other countries.

Policy errors can be caused by political wishes for taking advantage of a momentum – leaving details to be corrected during implementation – by the work of pressure groups and lobbyists from stakeholders that gain from the change in policies and by slogan-based misunderstandings about how the market works.

Therefore, despite use of expensive consultant studies and lengthy policy discussions, one can be certain in all countries to find examples of expensive energy policies with little impact.

EU member countries differ with regard to the *formalization of energy policy*.

- France codifies its national energy policy in an Energy Law: “LOI n° 2005-781 du 14 juillet 2005 de programme fixant les orientations de la politique énergétique ». This law inter alia underlines the position of the energy sector as a cross-cutting sector by dictating the elaboration of four joint ministerial plans. (i) between the minister responsible for energy and the minister for housing (“plan Face-Sud” promoting RETs in buildings by installing 200,000 solar water heaters and 50,000 solar roofs by 2010), (ii) with the minister for agriculture (plan “Terre-énergie” for a national biomass energy plan replacing the consumption of 10 million tons of oil by 2010), (iii) with the minister of research (national energy research strategy) and (iv) with the minister responsible for development (plan for French assistance to energy for development). In addition, a “Climate Plan” is to be prepared every two years.
- Germany has no such law, just specific sub-sector laws.
- Denmark is in between as the Government with irregular intervals publishes an official national energy policy document, which is approved by Parliament.

All countries publish *national carbon policy plans*.

The *stated national energy objectives* are rather similar. Differences concern emphasis.

- France’s Energy Law of 2005 mentions energy security of supply; competitive energy prices; environment protection and social cohesion as objectives – in that order without however, assigning specific priorities. Other countries start with the environmental objectives after which they underline the objective of cost-effective energy policies, national competitiveness, and employment creation as further objectives.
- France’s Energy Law specifically mentions the need to maintain nuclear power as a key technology in France and fixes the construction of a next generation reactor by 2014 (the last reactor build in EU countries was French and came into operation in 1999). Finland has a nuclear reactor under construction, the Baltic countries and Bulgaria consider investing in a new nuclear reactor. Denmark in its January 2007 policy paper declares total rejection of fossil fuel use a long term policy objective and its replacement by renewable energy; Sweden and Germany have decided to move out of nuclear energy; Denmark not to use it.
- UK and France include specific references to social protection as energy policy concerns, other countries do not mention social considerations, leaving these to social policy; although the latter countries in their implementation of concrete policy measures address social concerns too.

The individual country strategies and policies differ because different situations provide for differences in cost-effectiveness of individual policies. Because of its dominant use of CO₂ neutral nuclear power generation, France puts little emphasis on the promotion of renewable energy for power generation or for saving electricity. The year 2010 targets for promoting wind energy and solar water heaters cannot impress a Tunisian; Moroccan or Egyptian minister of energy. Germany, on the other hand, despite having a modest wind regime – the average capacity factor of wind farms in Germany is 13%, versus over 20% in Denmark and 30% in Ireland - is the world champion in terms of installed wind power capacity; and despite modest solar energy resources – solar irradiation is around 1100 kWh/m² – also with regard to installed PV-capacity.

All countries fix *quantitative targets* for the penetration of RE in 2010/12 and for 2020, targets for expected improvements in EE are given as well. In the setting of long-term targets, countries compete to outdo each other: UK and France both want to reduce their CO₂ emissions by 80% by 2050; Denmark in its January 2007 policy paper declares total elimination of fossil fuel use a long term policy objective (for 2025, a more modest goal of 15% reduction is fixed).

Because ambitious CO₂ reduction targets can be achieved only by *implementing individual “big bang” activities yielding large savings and a myriad of “small individual impact” activities*, energy programs at EU level and at individual country level try systematically to identify and to implement “all” potentially justifiable policies.

Different attitudes towards public ownership of energy assets and towards the virtues of competitive market solutions are reflected in the *choice of institutional options*. The French Energy Law confirms the role of publicly owned energy companies. Danish and British reviews and consultations about the ideal solution for transmission grids to/from offshore windfarms led predictably in the UK to the choice of the competing transmission company option (inheritance since the Thatcher government) and in Denmark to the choice of the state owned national transmission company (tradition since the 1979 oil crisis of planned solutions for energy infrastructure).

One general lesson that EU countries have accepted is the *need for comprehensiveness in energy policy*. The design and implementation of successful deployment programmes demands activities and public funding for promoting energy R&D, actions to reduce market barriers for new technologies and specific institutional initiatives for promoting market transformation by aligning the activities of public and private stakeholders. The complexity of energy policy is reflected in the recourse to the publication of so-called *road maps* for new policy initiatives by EU member states and the EU Commission. Five years ago that word was unknown to energy economists, they knew *action plans* only.

Another general lesson is the need for *long-term stability in policy* – stop-and-go policies are costly and inefficient. That has been the case always; but particularly in the present situation where governments plan the huge transformation of their energy use towards low-carbon economies.

Strategies for promoting large scale RE-systems for grid connection

The *EU Renewable Energy White Paper* states that indigenous renewable sources of energy will have to play an important role in improving security of energy supply. It sets an indicative target of

12% for the share of renewables in the EU's primary energy portfolio in year 2010, more than double the share in 1995. The investment in RET over the period 1997-2010, required to reach the objective is put at € 165 billion. Some 58% (€ 95 billion) of this would be 'incremental', i.e. accounted for by the higher investment cost of renewables.

The EU directives for renewable energy policy are few. The *Directive on the promotion of electricity from renewable energy sources* in the internal electricity market intends to increase the share of renewable energy of the supply of electricity from about 14% in 1997 to 21% by 2010.¹ The *Directive on Combined Heat and Power (CHP)* targets to double the share of CHP from 9% in 1994 to 18% in 2010 and has special provisions for renewable energy in CHP. The *Directive on Liquid Biofuels* fixes a target of 5.75% by 2010 and mandates a minimum use of biofuels and their detaxation. The *CO₂-certificates Directive* for the European Trading System (ETS) defines the procedures for the allocation and registration of emission reduction units (ERUs) by member states. Since the national allocation plans need approval by the EU Commission, it can indirectly influence member states' energy policy. *Directive 2003/54/EC concerning common rules for the internal market in electricity* has some articles of relevance for renewable energy policy; it requires member states to introduce systems for monitoring origin of source of electricity ("green or not green").

The 100,000 Roofs Solar Power Programme, part of the new energy programme, commenced on 1 January 1999. It was not expected that the Feed-in Tariff Law from 1991 would so soon be replaced by a new regulation. The Law for the Priority of Renewable Energy (REL) came into force on 1 April 2000, providing a buy-back rate of €0.51 (US 45¢) per kWh generated by photovoltaic power plants. Although this buy-back rate is set to decrease by 5% every year from 2002, the 100,000 Roofs Solar Power Programme provides low interest loans (1.91% in 2001) for a total installed power of 300 MWp (10 MWp in 1999, 50 MWp in 2000, 65 MWp in 2001, 80 MWp in 2002 and 95 MWp in 2003). With 8.91 MWp power installed in 3529 PV plants in 1999, about 40.63 MWp (an additional 8107 PV plants) were installed and approved by the responsible governmental authority, the Kreditanstalt für Wiederaufbau (KfW) by the end of 2000

German feed-in-law ("Stromeinspeisegesetz") determining the feed-in tariffs from 1991 to 1999 and the year 2000 Renewable Energy Law ("Gesetz für Vorrang Erneuerbarer Energien"; modified in 2004) determining the tariffs from 2000 to 2010 led to a decline in the tariff for new wind farms from 18.4 eurocents in 1991 to 8.3 eurocents in 2003 and to 6.3 eurocents in 2010 (all expressed in year 2003 prices).

In the EU, electricity consumption is growing at 2% per year.

Over the last three decades, worldwide, 92% of all R&D funding (€227 billion) has been spent on non-renewables – largely fossil fuels and nuclear technologies – compared to €19 billion for all renewable energy technologies. (Source: EWEA: "Large scale Integration of Wind"; 2006)

Spain has put in place 11 MW of large solar thermal power in 2006 and there are 65 MW under construction.

Wind is poorly supported in nine of the twenty-five Member States. Where the total support received by producers is lower than generation costs, no take-off of renewable energies can be

¹ The Directive covers 4 main areas: setting of national indicative targets for the consumption of electricity from renewable energy sources; streamlining administrative procedures for new RES producers; ensuring fair treatment for RES producers seeking connection to the national electricity grid; and establishing mutually recognised guarantees of origin for electricity from renewable energy sources.

expected. For biomass forestry, half of the Member States do not give enough support to cover generation costs. In the case of biogas, in nearly three quarters of the Member States, support is not sufficient for deployment. (Source: EU Commission: "Progress Report Renewable Electricity"; 2006) Since 2000, wind power capacity has increased by more than 150% in the EU. The amount expected in the White Paper on renewable energies¹⁷ of 40,000 MW was reached five years ahead of schedule. Total wind installed capacity of 40,455 MW produced 82 TWh in 2005. The excellent performance of the wind sector has enabled the industry to upgrade its target to 75,000 MW in 2010.

New wind power represents 33% of the new electricity generating capacity in the EU. The remaining 67% is mainly conventional thermal power stations.

The main cause of this slow development is not deliberate policy but delays in authorisations, unfair grid conditions and slow reinforcement and extension of the electric power grid.

Under the Directive, Member States have set up individual RES-E (electricity from renewable energy source) targets. They are free to choose their preferred support mechanism in order to achieve the targets and/or are allowed to continue to do so for a transitional period of at least seven years after a new EU-wide regulatory framework would be adopted. Article 4 of the Directive states that, *not later than 27 October 2005, the Commission shall present a well documented report on experience gained with the application and coexistence of the different mechanisms used in Member States. The report shall assess the success, including cost effectiveness, of the support systems* promoting the consumption of electricity from renewable energy sources in conformity with the national indicative targets.

There are currently in the EU a range of different support systems operational that can be broadly classified into four groups: feed-in tariffs, green certificates, tendering systems and tax incentives.

- **Feed-in tariffs** exist in most of the Member States. These systems are characterised by a specific price, normally set for a period of around several years, that must be paid by electricity companies, usually distributors, to domestic producers of green electricity. The additional costs of these schemes are paid by suppliers in proportion to their sales volume and are passed through to the power consumers by way of a premium on the kWh end-user price. These schemes have the advantages of investment security, the possibility of fine tuning and the promotion of mid- and long-term technologies. On the other hand, they are difficult to harmonise at EU level, may be challenged under internal market principles and involve a risk of overfunding, if the learning-curve for each RES-E technology is not built in as a form of degression over time. A variant of the feed-in tariff scheme is the fixed-premium mechanism currently implemented in Denmark and partially in Spain. Under this system, the government sets a fixed premium or an environmental bonus, paid above the normal or spot electricity price to RES-E generators.

- Under the **green certificate** system, currently existing in SE, UK, IT, BE and PL, RES-E is sold at conventional power-market prices. In order to finance the additional cost of producing green electricity, and to ensure that the desired green electricity is generated, all consumers (or in some countries producers) are obliged to purchase a certain number of green certificates from RES-E producers according to a fixed percentage, or quota, of their total electricity consumption/production. Penalty payments for non-compliance are transferred either to a renewables research, development and demonstration (RD&D) fund or to the general government budget.

Since producers/consumers wish to buy these certificates as cheaply as possible, a secondary market of certificates develops where RES-E producers compete with one another to sell green certificates. Therefore, green certificates are market-based instruments, which have the theoretical potential, if

functioning well, of ensuring best value for investment. These systems could work well in a single European market and have in theory a lower risk of over-funding. However, green certificates may pose a higher risk for investors and long-term, currently high cost technologies are not easily developed under such schemes. These systems present higher administrative costs.

- Pure **tendering** procedures existed in two Member States (IE and FR). However, France has recently changed its system to a feed-in tariff combined with tendering system in some cases and Ireland has just announced a similar move. Under a tendering procedure, the state places a series of tenders for the supply of RES-E, which is then supplied on a contract basis at the price resulting from the tender. The additional costs generated by the purchase of RES-E are passed on to the endconsumer of electricity through a specific levy. While tendering systems theoretically make optimum use of market forces, they have a stop-and-go nature not conducive to stable conditions. This type of scheme also involves the risk that low bids may result in projects not being implemented.

- Systems based only on **tax incentives** are applied in Malta and Finland. In most cases (e.g. Cyprus, UK and the Czech Republic), however, this instrument is used as an additional policy tool.

The **current level of support** for RES-E differs significantly among the EU Member States. Annex 3 gives a detailed assessment of the differences between the total money received for renewable energy produced and the generation cost², therefore pointing at the cost-efficiency of the different schemes. When delivering, the wider the gap between “generation costs” and “support” the less the cost-efficient the system is. Due to the complexity of the different renewable energies and the differences in national situation, an analysis per sector has been chosen. A parallel lecture of the graphs in Annex 3 can give how cost-effective and efficient such a system is.

In the case of wind power, the green certificate systems show a big gap between generation and support. The reasons for the higher cost may be found in the higher investment risk, with such schemes and probably in the still immature market for green certificates.

Alongside the cost, the **effectiveness** of the different support systems is also an essential parameter in the assessment. Effectiveness refers to the ability of a support scheme to deliver green electricity. In assessing effectiveness, the effects of more recent systems are difficult to judge. In particular, the experience with green certificates is more limited than with feed in tariffs. Moreover, the amount of green electricity delivered needs to be assessed against the realistic potential³ of the country. For wind energy, Annex 3 shows that all countries with an effectiveness higher than the EU average use feed-in tariffs. This type of system currently has the best performance for wind energy.

for biogas, both feed-in and green certificates produce good results (four countries with feed-in and two countries with green certificates show a higher effectiveness than the European average). In the biomass forestry sector, it cannot be concluded that one system is better than another. The complexity of the sector and the regional variations mean that other factors play a strong roles. In general, incentives to forest harvesting should help mobilise more unused forest biomass for all users.

Barriers that project developers and investors encounter when installing new capacities can be of administrative, grid, social and financial nature. Recently, the Commission launched a public consultation process on how barriers were perceived¹⁸. The identified administrative barriers can be classified into the following categories: *1. Large number of authorities involved and lack of coordination between them* *2. Long lead times needed to obtain necessary permits* For onshore wind projects authorisation procedures may take two to seven years¹⁹, which has in some cases it has led to insinuations of totally ‘freezing’ the development of the market. The track record of

authorisation procedures for offshore wind projects is even more inefficient, as until recently no clear procedures were established for the division of responsibilities among the different government authorities concerned. 3. *RES insufficiently taken into account in spatial planning* In many countries and regions, the future development of RES projects is not taken into account in drawing up spatial plans. This means that new spatial plans have to be adopted in order to allow for the implementation of an RES-E project in a specific area. This process can take a very long time. Often obtaining the permits related to spatial planning accounts for the largest part of the overall period needed for the development of a project. This is especially the case for projects in the field of wind and biomass. Authorities should be encouraged to **anticipate the development of future RES projects (pre-planning)** in their region by allocating suitable areas.

Where different levels of authorities are involved, a possible solution could be the **preplanning** carried out in Denmark and Germany where municipalities are required to assign locations that are available to project developers for a targeted level of renewable electricity generating capacity. The Commission recommends the following actions: - **One-stop authorisation agencies** should be established to take charge of processing authorisation applications and providing assistance to applicants. - **Clear guidelines** for authorization procedures should be established by Member States with a clear attribution of responsibilities. As the case law of the Court of Justice states, authorization procedures must be based on objective, nondiscriminatory 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 arbitrarily²¹.

- Member States should establish **pre-planning mechanisms** in which regions and municipalities are required to assign locations for the different renewable energies. - **Lighter procedures** should be created for small projects. - Guidance on the relationship with European environmental legislation.

Good practice can be found in a number of countries, such as Denmark, Finland, Germany and the Netherlands. In these countries transparent rules for bearing and sharing the costs of various grid investments have been put in place. These countries have chosen a “shallow” cost approach, under which that grid connection costs are borne by project developers requesting connection or shared with grid operators, while costs related to the necessary grid extensions and reinforcements at distribution or transmission level are covered by the grid operators, and passed on through the grid tariff structure. To ensure that RES-E can represent a considerable share of the electricity mix, better planning and overall management of the networks is needed.

Member States have to implement a system guaranteeing the origin of electricity produced from renewable energy sources in order to facilitate trade and consumer transparency²². Directive 2003/54/EC concerning common rules for the internal market in electricity
In accordance with Article 3(6) of Directive 2003/54/EC, Member States are required to implement a scheme for the disclosure of the fuel mix.

France Pluriannual Programming of Investments (PPI): for each class of technologies, targets to be met by 2010, including 21% target for renewables; Tariffs: guaranteed tariffs for electricity from renewables, for capacities up to 12 MW; Calls for tenders, if necessary to meet PPI's objectives;

^zPrice is guaranteed for the economic life-time of the installation (15 years for windmills);

^zLevel is fixed according to technologies needs and PPI's targets For wind energy: 15 years contract, 8,38€/kWh for 5 years, then 3,05 to 8,38 €/kWh for 10 years, according to site quality.

z“Over-costs” will be reimbursed to utilities and shared by all electricity consumers; zEstimation is yfrom 0,35 c? / kWh to 0,50 c? / kWh in 2010, yfrom 1,5 G? to 2 G? each year, yfrom 4% to 6% for a residential consumer bill.

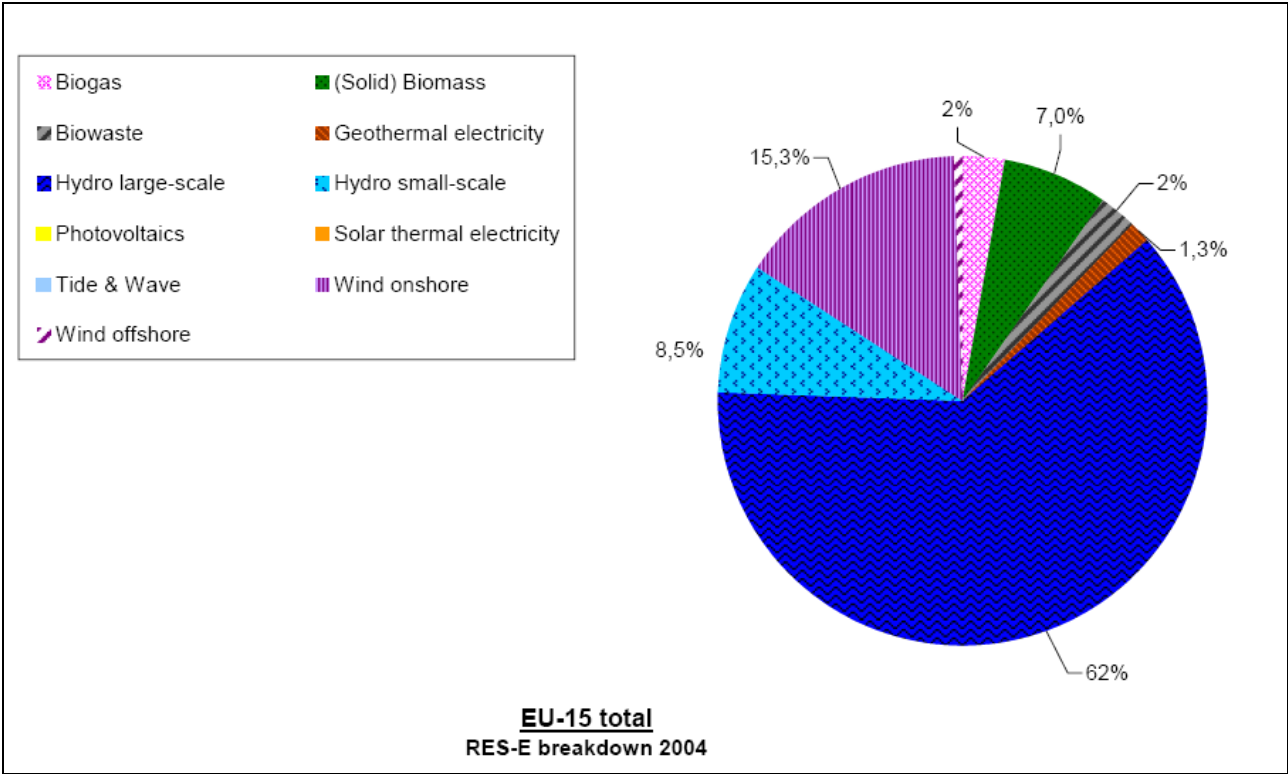
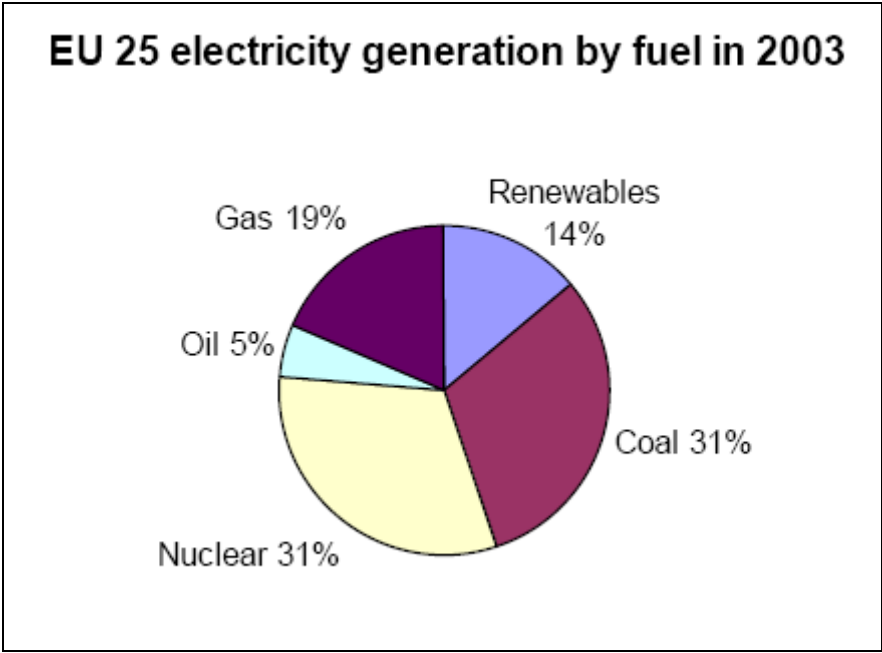
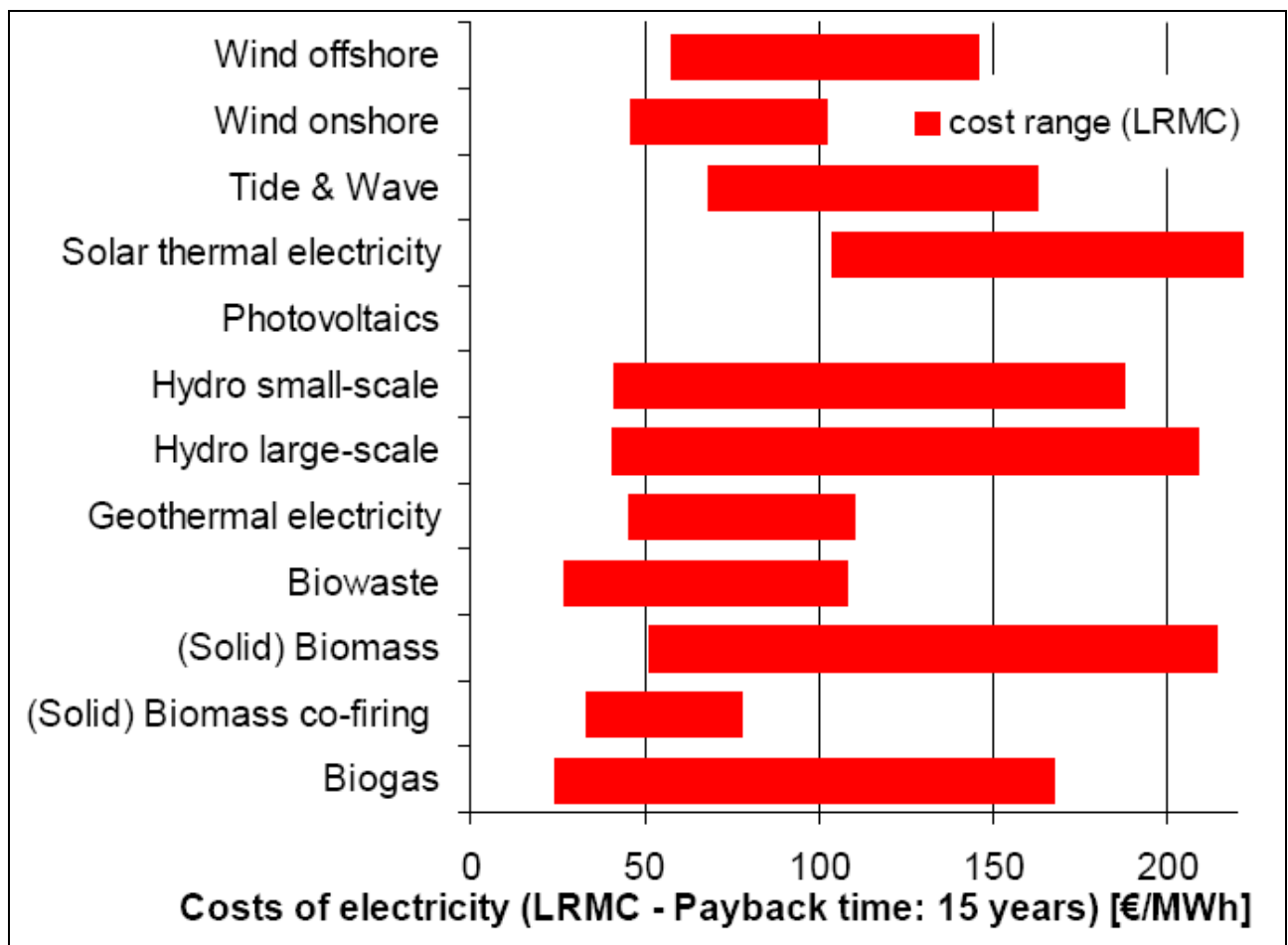
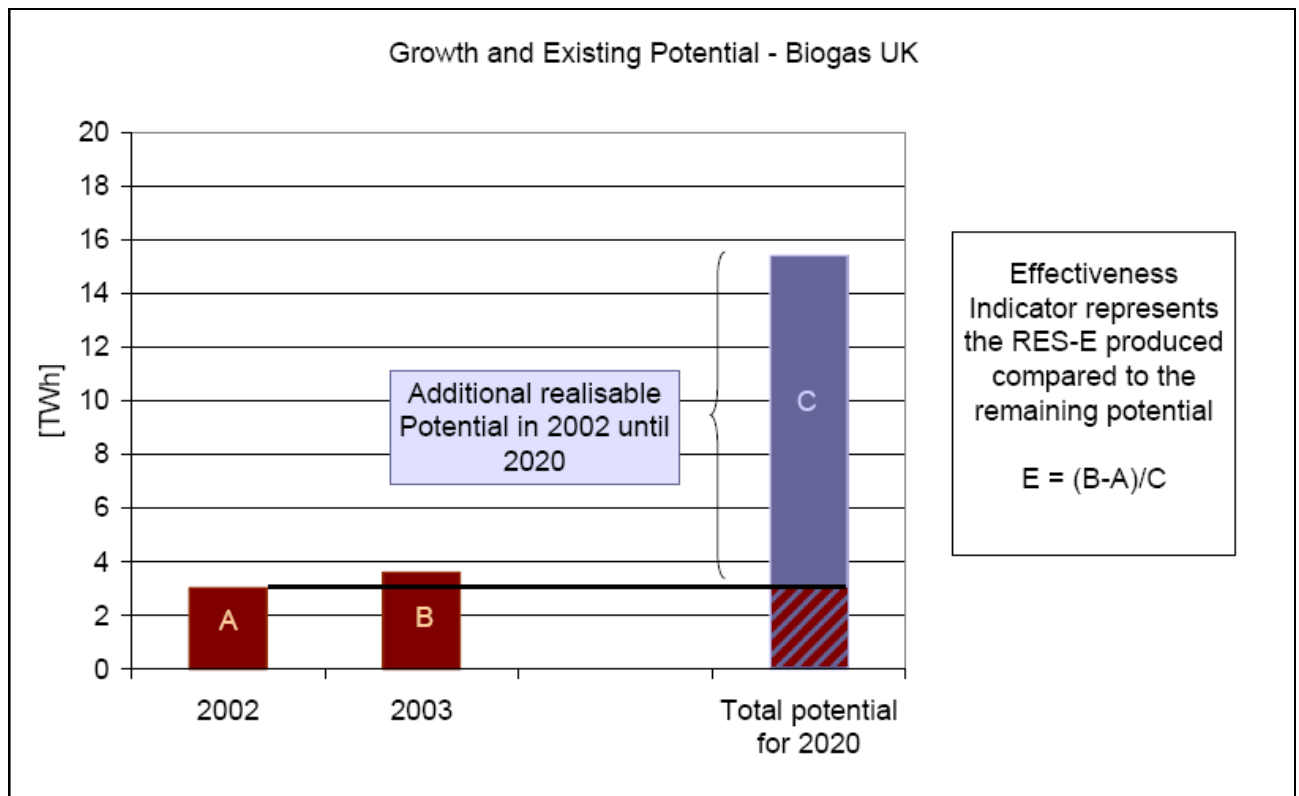


Table 1: Overview of the main policies for renewable electricity in EU-15		
Country	Main electricity support schemes	Comments
Austria	Feed-in tariffs (now terminated) combined with regional investment incentives.	Feed-in tariffs have been guaranteed for 13 years. The instrument was only effective for new installations with permission until December 2004. The active period of the system has not been extended nor has the instrument been replaced by an alternative one.
Belgium	Quota obligation system / TGC ²⁷ 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.
Denmark	Premium feed-in tariffs (environmental adder) and tender schemes for wind offshore.	Settlement prices are valid for 10 years. The tariff level is generally rather low compared to the previously high feed-in tariffs.
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.	For power plants < 12 MW feed-in tariffs are guaranteed for 15 years or 20 years (hydro and PV). For power plants > 12 MW a tendering scheme is in place.
Germany	Feed-in tariffs.	Feed-in tariffs are guaranteed for 20 years (Renewable Energy Act). Furthermore soft loans and tax incentives are available.
Greece	Feed-in tariffs combined with investment incentives.	Feed-in tariffs are guaranteed for 10 years. Investment incentives up to 40%.
Ireland	Tendering scheme. It has been announced that the tendering scheme will be replaced by a feed-in tariff scheme.	Tendering schemes with technology bands and price caps. Also tax incentives for investment in electricity from RES.
Italy	Quota obligation system / TGC. A new feed-in tariff system for photovoltaic valid since 5 th August 2005.	Obligation (based on TGCs) on electricity suppliers. Certificates are only issued for new RES-E capacity during the first eight years of operation.
Luxembourg	Feed-in tariffs.	Feed-in tariffs guaranteed for 10 years (for PV for 20 years). Investment incentives also available.
Netherlands	Feed-in tariffs.	Feed-in tariffs guaranteed for 10 years. Fiscal incentives for investment in RES are available. The energy tax exemption on electricity from RES ended on 1 January 2005.
Portugal	Feed-in tariffs combined with investment incentives.	Investment incentives up to 40%.
Spain	Feed-in tariffs.	Electricity producers can choose between a fixed feed-in tariff or a premium on top of the conventional electricity price, both are available over the entire lifetime of a RES power plant. Soft loans, tax incentives and regional investment incentives are available.
Sweden	Quota obligation system / TGC.	Obligation (based on TGCs) on electricity consumers. For wind energy, investment incentives and a small environmental bonus are available.
UK	Quota obligation system / TGC.	Obligation (based on TGCs) on electricity suppliers. Electricity companies which do not comply with the obligation have to pay a buy-out penalty. A tax exemption for electricity generated from RES is available (Levy Exemption Certificates which give exemption from the Climate Change Levy).

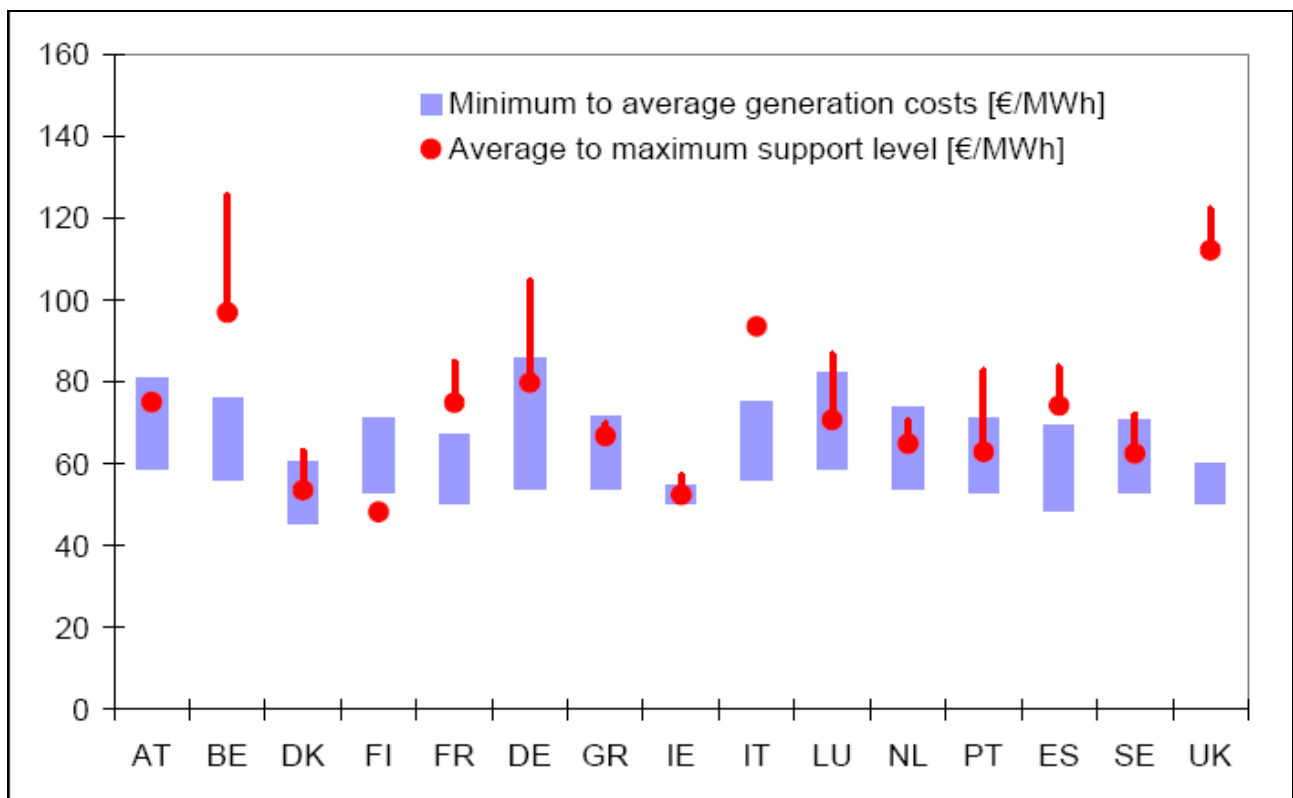
Source: Communication from the Commission: The support of electricity from renewable energy sources {SEC(2005) 1571};



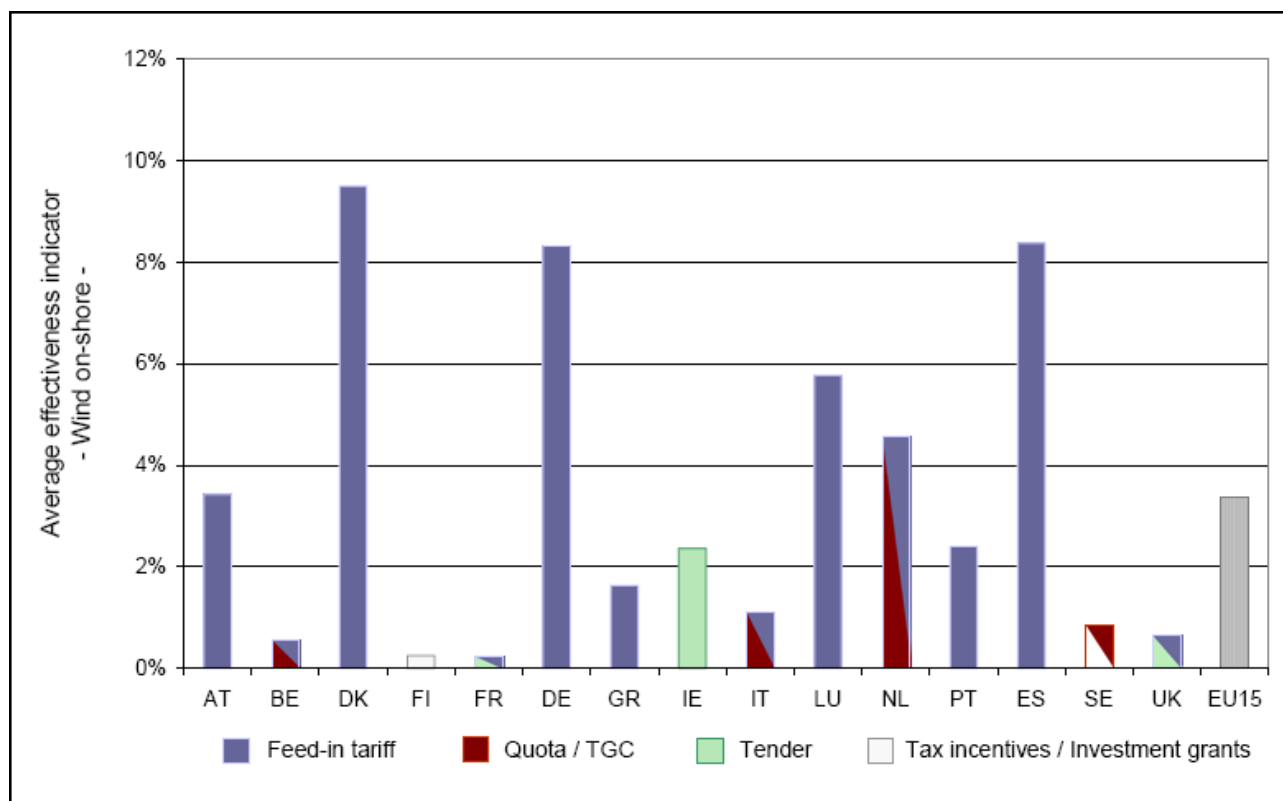


Effectiveness Indicator

Support schemes for wind vary considerably throughout Europe with values ranging from €30/MWh in Slovakia to €110 per MWh in the UK.



Cost of Windfarm Generation and Cost of Support to Windfarms



Effectiveness Indicator for Onshore Windfarms 1998-2004

Germany applies a stepped tariff with different values depending on wind resources. France uses the same system. This stepped support scheme – although controversial as it does not use only the best potentials – is justified at national level in order to extend potential resources in the country and avoid concentration in one region and hence NIMBY effect. The values used in Figure 4 consider the maximum tariff for Germany³¹.

It is commonly stated that the high level of feed-in tariffs is the main driver for investment in wind energy especially in Spain and Germany. As can be seen, the level of support is rather well adjusted to generation cost. A long-term stable policy environment seems to be the key to success in developing RES markets, especially in the first stage.

The three quota systems in Belgium, Italy and the UK, currently have a higher support level than the feed-in tariff systems. The reason for this higher support level, as reflected in currently observed green certificate prices, can be found in the higher risk premium requested by investors, the administrative costs and the still immature green certificate market. The question is how the price level will develop in the medium and long term.

Strategies for promoting energy efficiency and RE for micro-generation

The European Commission issued a Green Paper on energy efficiency in June 2005, identifying possibilities for cost-effective energy savings equivalent to 20% of the European Union's current energy use by 2020. An action plan on how to achieve these savings will be presented shortly and

will identify guidelines for actions that should be taken by the European Union to become an energy-efficient economy.

Le premier axe de la politique énergétique est de maîtriser la demande d'énergie afin de porter le rythme annuel de baisse de l'intensité énergétique finale à 2 % dès 2015 et à 2,5 % d'ici à 2030

Pour les **bâtiments neufs**, l'Etat abaisse régulièrement les seuils minimaux de performance énergétique globale, avec un objectif d'amélioration de 40 % d'ici à 2020. The **development** of markets for cleaner and more efficient energy technologies; En outre, il favorise la construction d'une part significative de logements dans lesquels il est produit plus d'énergie qu'il n'en est consommé.

Compte tenu d'un taux de renouvellement des bâtiments de 1 % par an, la priorité porte sur l'amélioration de l'efficacité énergétique des **bâtiments anciens** afin de diviser par quatre les émissions de dioxyde de carbone avant 2050. réduction des émissions individuelles moyennes de dioxyde de carbone des automobiles neuves à 120 grammes de dioxyde de carbone émis par kilomètre parcouru à l'horizon 2012

Letting all electrical motors be equipped with modern regulation technology

Germany:

Façade: 12 cm insulation (20 cm high)

Blower-door-test of tightness: low pressure inside the house, measures to what extent air flows from the exterior into the interior..

Altbauten: 20-25 litre per m² per year. Renovated low-energy house down to 3 liters

Niedersächsisch Bauunternehmen Viebrock is down to 2 litres per m².

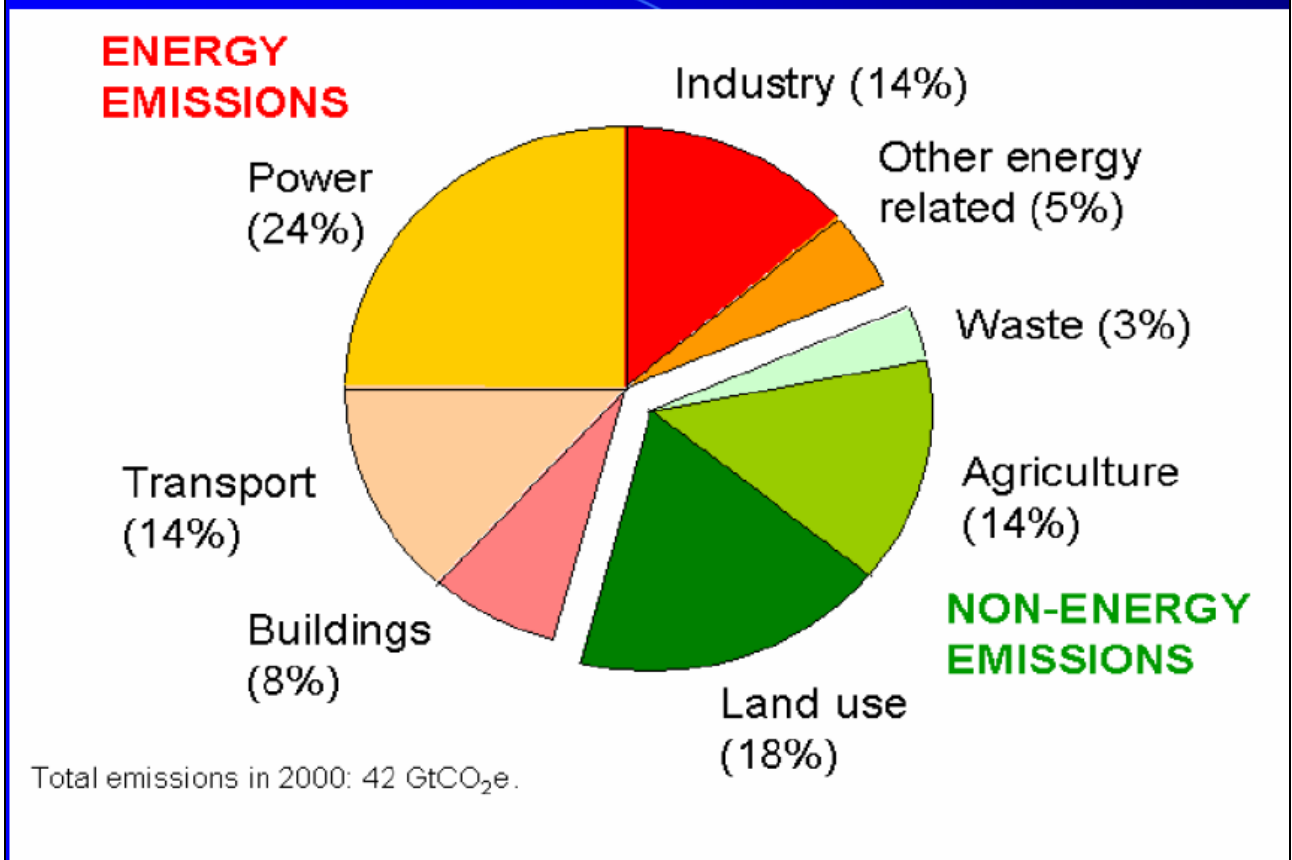
Those who build a house with a yearly energy consumption below 40 kWh/m² can get credits from the KfW.

“Niedrigenergiehaus” since Energieeinsparverordnung from February 2002

“Plusenergiehäuser”: Heizenergiebedarf of 11-14 kWh/m²

Contracting model

Sources of GHG emissions



Source: Stern Report

Energy efficiency in buildings:
another spectacular market failure?

- ☐ Saves money
 - ☐ Improves comfort
 - ☐ Improves security of supply
 - ☐ Creates jobs
 - ☐ Reduces demand for finite resources
 - ☐ Reduces GHG emissions.....
- but it's so painfully slow to implement!

Commission's Action Plan

In brief:

- ☐ 20% (at least) of energy currently wasted due to energy inefficiency (390 Mtoe)
- ☐ Goal: Reduce energy consumption by 20% by 2020 (saving 100 billion € per annum)
- ☐ Double rate of improvement in energy efficiency to 3,3% annually
- ☐ Plan proposes only cost-effective measures

- ☐ Covers first 6 year period

Commission's Action Plan

- ☐ Priority Action 1
- ☐ Appliance + equipment labelling + min. energy performance standards
- ☐ Includes boilers + water heaters
- ☐ Instruments:
- ☐ Labelling + eco-design + energy end-use directives
- ☐ Framework directive 92/75/EC on labelling to be revised + reinforced (target for adoption 2008)

Priority Action 2

- ☐ Making buildings more energy efficient
- ☐ Building performance requirements + very low energy buildings
- ☐ Instruments:
- ☐ Commission to develop strategy for very low energy or passive houses (target 2008)
- ☐ EPBD (2002/91/EC) to be expanded by lowering current threshold of 1000 m² for minimum performance requirements for major renovations

Some ideas

Owners of buildings once certified could be entitled to (carrots):

- ☐ Subsidies/tax abatements/reduced VAT on implementing energy efficiency measures mentioned on the certificate
- ☐ Preferential energy tariffs upto a certain threshold and expensive ones above

But energy utilities would need to be

transformed into energy service providers!

Promote/subsidise increased training (not just inspectors!)

At the macro-level general lessons learned can be summarized as follows:

The first is comprehensiveness of effort if the energy. one wants to achieve EU is proposing sharp curbs on cars' CO₂ emissions by 2012 as a central part of its push to fight global warming. the 120 g/km the EU is targeting by 2012.

Support programs for RE

1. The Vth Framework Programme (ENERGIE),

The main objective is technological development
Budget of 1,042 MEuro (1998 - 2002)

2. The ALTERNER II Programme

Fills the gap between demonstration & commercialization -

Non technological actions and studies aiming at overcoming non technical barriers.

Budget of 74 MEuro (1998- 2002)

3. Regional Policy & Structural Funds

Budget dedicated for deployment of RES in most promising EU Regions

Know-how building instruments. The most striking aspect, as one moves from the larger centralized grid-connected systems to the smaller consumer owned buildings and RE-systems is the huge expansion in the number of involved actors in the supply chain: from policy making & enforcement (public institutions) to R&D, advisory services, manufacturing, financing, energy supply, retailing and installing.

Der neue ganzheitliche Ansatz der Verordnung (insbesondere Gebäudehülle, Heizung und Warmwasserbereitung) ermöglicht individuelle Planungsoptimierung -

Command and control instruments and the two macro-categories of market based instruments; *know-how building instruments* (information, TA, advice, R&D) and *financial instruments* (direct investment grants, soft loans, loan guarantees, tax credits, fuel taxation).

One notices since around 2000 (when the Kyoto CDM-reducing obligations began to “bite” in several countries) and in particular since 2005 (shift in long-term expectations concerning high oil prices) a trend towards greater use of command and control instruments, whilst simultaneously new forms of PPPs (public-private-partnerships) were being tested. It is that

It's easy to see that windows, doors and skylights lose energy. Because of that, most building codes - especially those in colder climates - have set minimum standards for the energy efficiency of these components.

Finland and State of Karelia, North-West Russia (1999-2006)

- The starting point was that Russia had a law in force with an obligation to all major energy consumers (>6.000 toe/a) to carry out energy audits
- No real enforcement since no sanctions in place

with energy audits the known action gaps are between

Knowing ...and... Getting started

Making a few pilot audits ...and... Establishing permanent business

Knowing the measures ...and... Implementing them

Step four (2005) Analysis of the stock of energy audit reports

- Good potentials, short payback times, but not implemented if capital needed
- Step five (2006) Activating implementation (development of local ESCOs)

•

Mobilization of commercial funding for energy efficiency

and renewable energy investments by way of specialized banking instruments

Existing buildings:

- EuroACE: More than 50 %
- Danish studies: 40 – 60 %

New Danish Action Plan state the following potentials in 2015:

- Economic potential for the consumer: 47 %
- Socio-economic potential: 24 %

Barriers: Split incentives:

- New buildings: The focus is on building cost – not on life-cycle cost
- Existing buildings: The owner is not paying the bill!
- Lack of information and knowledge
- Wrong incentives – tariffs etc.
- Difficult to implement
 - People don't trust craftsmen
- Short term decisions
- Low status

Framework for measures

- LESS - Removed the bad
 - Regulation
 - Standards
- MORE - Promote the good
 - Incentives
 - Labelling
 - Information
- NEW – Develop better
 - RD&D
 - Procurement

A cost affective strategy A combination of

- Measures
 - Normative, economic, labelling, consulting, agreements, information, R&D, organisation, etc.
- Actors
 - EU, national governments, regional and local authorities, energy utilities, producers, green organisations, etc.
- Target groups
 - Consumers, producers, installers, developers, etc.

New building codes in DK

- Energy demand reduced with 25-30 % from 2006
 - Use Energy Performance
 - Also requirements for components

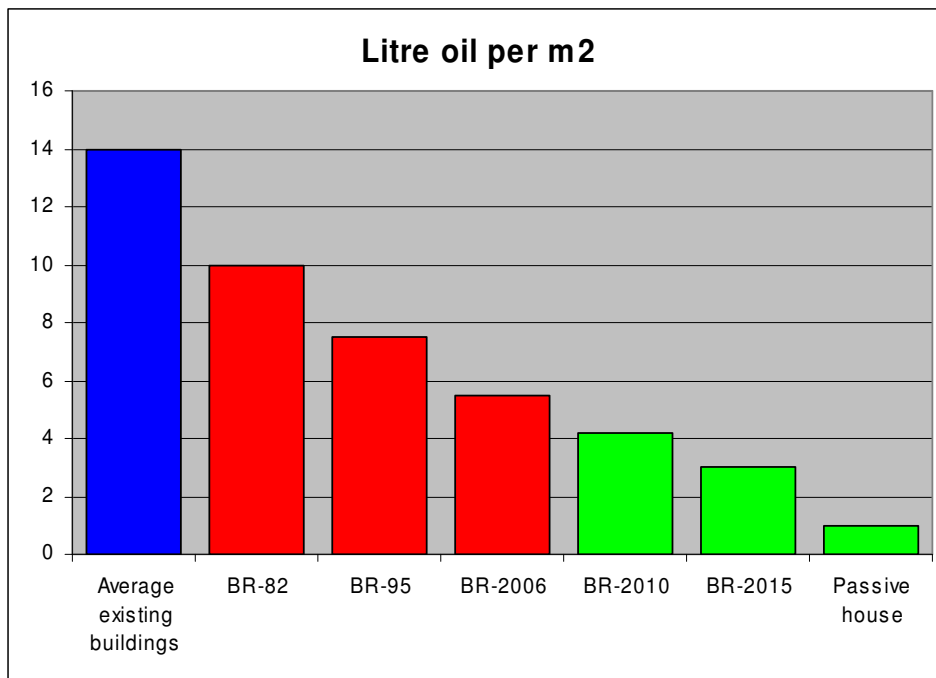
- Will be tighten again with 25 % in 2010 and 2015
- Incentives to build better buildings
 - Low energy classes

1=> 50 % , 2=> 75 %

Energy certification of new buildings

Compliance:

- Energy certification just after construction
- Control based on building codes, pipe insulation etc.
- Part of building authority permission for use
- Control => competition on same conditions



Incentive to build better buildings:

- Focus on low energy houses
- Information for buyer or renter
- Spatial planning - obligations

Existing buildings

- Economic incentives to reduce consumption
 - Taxes,

tariffs, etc

- Information on actual performance and saving possibilities
 - Energy labelling/certification schemes
 - Is a basis for improvement
- Set mandatory requirements in the building in relation to:
 - Major renovations
 - Replacements of components
- Help to implementation
 - Subsidies. loans, tax deduction, etc.
 - White certificates, etc.
 - Make it easy, simple and secure for the consumer
- Existing buildings are included under the building codes
- Requirements are set in relation to:
 - Major renovations – both large and small buildings
 - Replacements of
 - Roofs
 - Windows in a facade
 - Boilers
 - Facade skin

➤ Change in heat supply

New certification schemes from 2006:

- One-Family Houses:
 - At sale and renting
 - Many each year - Keep it simple
 - Valid for 5 years
- Multifamily Houses:
 - At sale and renting of building and flats
 - Whole building incl. typical flats
 - Regular every 5 years > 1000 m²
- Trade & Services and Public
 - Regular every 5 years
 - Trade and service only > 1.000 m²
 - By sale or renting < 1.000 m²

EE measures in DK

- Energy taxes in households and in the public sector
- CO₂ taxes on energy used in all sectors
- Building codes
- Energy labelling of buildings.
- Energy labelling of appliances (EU and GEEA).
- Minimum efficiency standards.
- Agreements about energy efficiency in industries (CO₂ packet)
- The Electricity Saving Trust.
- The energy-saving activities carried out by the grid companies (electricity, natural gas, district heating)
- Energy Saving Act
- There have been different subsidies schemes

Network and distribution companies

- Have been involved in energy savings for some years (DSM)
- Shall deliver a significant part of the increased savings
- A new market based framework:
 - Annual saving obligations – commitments for electricity, natural gas, district heating and oil companies
 - Large degree of freedom to deliver in the cheapest way

Energy savings in buildings A main focus area in the action plan:

- Both new and existing buildings
- Stronger requirements in building codes
- Energy certification (labelling) of buildings
- Help to implementation
 - The energy companies shall give savings in buildings priority

Public sector

- Shall show an exemplary role
- Implement energy efficient procurement
 - Move the whole market as a big buyer

- Obligation to realisation of savings with reasonable payback times (up to 5 years)
 - Energy services companies can play a role
- Make the energy consumption public
 - Electricity consumption at the Internet
- Regulation for all Government institutions are implemented
 - The municipalities are next step

EU EE directives

- Labelling Framework Directive (92/75/EC)
 - 8 Implementation directives
- Energy Star Agreement on office equipment (Regulation (EC) No 2422/2001)
- Eco-Design Directive (2005/32/EC)
- Energy Performance of Buildings Directive (2002/91/EC)
- Energy End-Use Efficiency and Energy Services Directive (2006/32/EC)

New EU Action Plan

- Appliances and products
 - Mandatory minimum efficient standards
 - Ambitions timetable for implementation
 - Dynamic with regular update
 - Update of labelling
 - New framework directive
 - Move of scale for products – only 10-20 % shall be A class
- Buildings
 - Minimum performance requirements
 - For new and renovated buildings
 - Also for components
 - Strategy for very low energy ore passive houses
- Transport – more efficient cars

Durch den Verzicht auf die ständige Bereitschaftsschaltung (Stand-by) von Fernseher, CD-Spieler, Computer oder anderen Elektro(nik)-Geräten kann jeder Bürger viel Energie und Geld sparen. Laut Umweltbundesamt betragen die Leerlaufverluste mindestens 11 % des Stromverbrauchs der Privathaushalte!

Energieeinsparverordnung (EnEV), die mit der Neufassung vom 2.12.2004 nochmals an fortgeschriebene Regeln der Technik angepasst wurde. Die EnEV fasst die bisherigen Anforderungen der Wärmeschutz-Verordnung und der Heizungsanlagen-Verordnung zusammen und setzt neue Standards für die Energieeinsparung bei Neubauten: Der zulässige Energiebedarf der Gebäude wird um rund 30 % gegenüber dem gegenwärtigen Anforderungsniveau gesenkt damit ist künftig der so genannte Niedrigenergiehaus-Standard die Regel.

m Altbaubestand ist der Energieverbrauch noch bei weitem zu hoch, obwohl hier die bisherigen Wärmeschutz- und Heizungsanlagen-Verordnungen den Energiebedarf gegenüber dem Standard vor 1978 inzwischen bereits um über 60 % reduziert haben. sie wird diese Reserven durch weitere Modernisierungsverpflichtungen und Vorgabe erhöhter Standards bei ohnehin anstehenden Modernisierungs- oder Instandsetzungsmaßnahmen verstärkt mobilisieren (so genannte bedingte Anforderungen).

Eigentümer von älteren Häusern und Wohnungen richtet sich das Förderprogramm "Vor-Ort-Beratung" des Bundes: Eigentümer können sich von einem besonders qualifizierten Ingenieur(in) oder Gebäudeenergieberater(in) (HWK) darüber beraten lassen, mit welchen Maßnahmen am Gebäude sich die meiste Energie einsparen lässt . Der Bund gibt einen Zuschuss zu den Beratungskosten. Darüber hinaus unterstützt die Kreditanstalt für Wiederaufbau (KfW) mit zinsgünstigen Darlehen umfassende Energiesparmaßnahmen in Gebäuden
400 Energieberatungsstellen der Verbraucherzentralen bundeswey
die Mitarbeiter des Call-Centers der Deutschen Energie-Agentur (dena)

Special role for municipalities: are closer to consumers, make the changes where markets cannot provide. (i) Best equipped to look long-term for EE, encourage citizens to invest in EE in houses (at national level: tax incentives) (ii) Public transport: opportunity but also challenge, (iii) Educating the citizens (young generation in schools)

Get gvt to make an EE national strategy plan and make sure it is implemented

Prconditions for municipal EEFinancer

1. macro-economic stability
2. demonstration of local bankable municipal EE projects (street lighting 1.5-2 yrs, schools, hospital, DH)
3. demonstration of municipal energy planning is beneficial for local communities

“Steady, long-term policy support is crucial to sustain this growth and attract investment

support of policies that encourage research, development, demonstration and deployment

is to consider the combination of renewable energy and energy efficiency technologies that add value to one another, rather than viewing them as competing for R&D funding

net importing countries should maintain emergency oil stocks and co-ordinate their use during significant disruptions in supply.

Energy security requires preparing our nation for supply emergencies, and assisting low-income Americans who are most vulnerable in times of supply disruption, price spikes, and extreme weather”.

a secure, reliable and affordable supply of energy is ensured.

Most of the policies tend to use conventional instruments well known by governments and widely used in other policy areas (e.g., regulatory instruments, fiscal measures and public information campaigns). However, marketbased instruments contributing to climate change mitigation, such as emissions trading and other Kyoto Protocol mechanisms as well as green certificates, have also played an important role in national strategies over the past year, particularly in European countries.

The vast majority of fiscal measures take the form of either incentives or subsidies. These are usually grants or preferential loans/funds such as the Carbon Trust of the United Kingdom, developed to promote energy efficiency, or the grants made by the Dutch government to promote combined heat and power (CHP) and renewable energy sources in the residential sector. Feed-in tariffs are more complex to set up but have also been developed in 2001 in both Austria and France. The other main type of fiscal measure is taxes – and in 2001, these were initiated in almost all European countries. The majority of tax measures adopted in 2001 were tax credits, reductions or exemptions for low-emission technologies and renewable energy, such as the tax exemption programme to promote the rational use of energy in Belgium.

In addition, a few countries adopted fiscal measures directly aimed at limiting the use of conventional energy sources, i.e., direct taxes. Most commonly, these were rather limited in scope (the heavy vehicle tax in Switzerland). In 2001, the only new tax policy adopted was in the United Kingdom, which introduced a broad tax scheme, the Climate Change Levy.

Regulatory policies represent close to a third of all new measures taken or planned in 2001 by IEA Member countries. Mandates and standards are the most common type of regulatory policies used to promote either energy efficiency or renewable sources of energy.

In energy efficiency, standards were set for electricity consumption (such as those for washing machines and other appliances in the United States, or the planned EUwide efficiency standards in buildings). A requirement for mandatory efficiency labelling was another policy option used by IEA Member countries to stimulate the purchase of energy-efficient goods. Such measures taken in 2001 include fuel consumption labelling of passenger cars in both Australia and the Netherlands, and of refrigerators in Turkey.

2001 also marked the adoption of a number of renewable energy mandates. Mandates and standards in this sector were often used to set a minimum mandatory share of electricity to be produced from renewable sources. In 2001, EU Member

Voluntary agreements are increasingly being introduced as a co-operative and less rigid way of reducing GHG emissions. In 2001, twelve Member countries enacted such voluntary agreements. Using the IEA classification, these can be qualified as “strong” (legally binding) – such as the agreement signed between the German government and energy-intensive industries to develop combined heat and power (CHP) solutions to reduce their energy consumption by 30% – or “weak”, without involving any legally binding commitments. This more common category includes the agreement signed by the Australian Department of Defence to reduce its GHG emissions by 13%, and the agreements signed by three industrial sectors (cement, limestone and non-ferrous) in Wallonia (Belgium) voluntarily to reduce GHG emissions.

United Kingdom has negotiated particular energy efficiency or carbon saving targets agreements with industry-sector associations. Companies which have joined in the negotiated sector agreements

receive an 80% discount from the Climate Change Levy in return for working towards their targets. At the end of 2001, over 40 of these “umbrella agreements” had been signed.

Policy processes represent one-third of all policies and measures taken or planned in IEA Member countries in 2001. This is the most broadly used category of policy instruments and plays an important role in all IEA Member countries’ mitigation strategies. A clear distinction can be made within policy processes between “**planning**” policies (consultation, strategic planning and institutional development) and “**outreach**” policies (information dissemination and advisory efforts). In 2001, policy processes were more or less evenly distributed between the two. Planning policies are the backbone of GHG mitigation programmes. In the past three years, all IEA Member countries have developed national, regional or sectoral climate change strategies. These set out a co-ordinated plan of action for more specific measures to be undertaken.

Consultation processes involving both the public and the private sectors often precede such measures.

Outreach policies aim to inform and advise people or organisations on how to reduce their GHG emissions efficiently. The general aim of these programmes is to increase awareness and influence behaviour regarding GHG abatement. The form of public information dissemination varies considerably. Although visits, seminars and exhibitions are most commonly the focus of the initiatives, more aggressive and modern means have recently been introduced, including television, newspaper and magazine advertising, information dissemination on the Internet and the use of telephone hotlines.

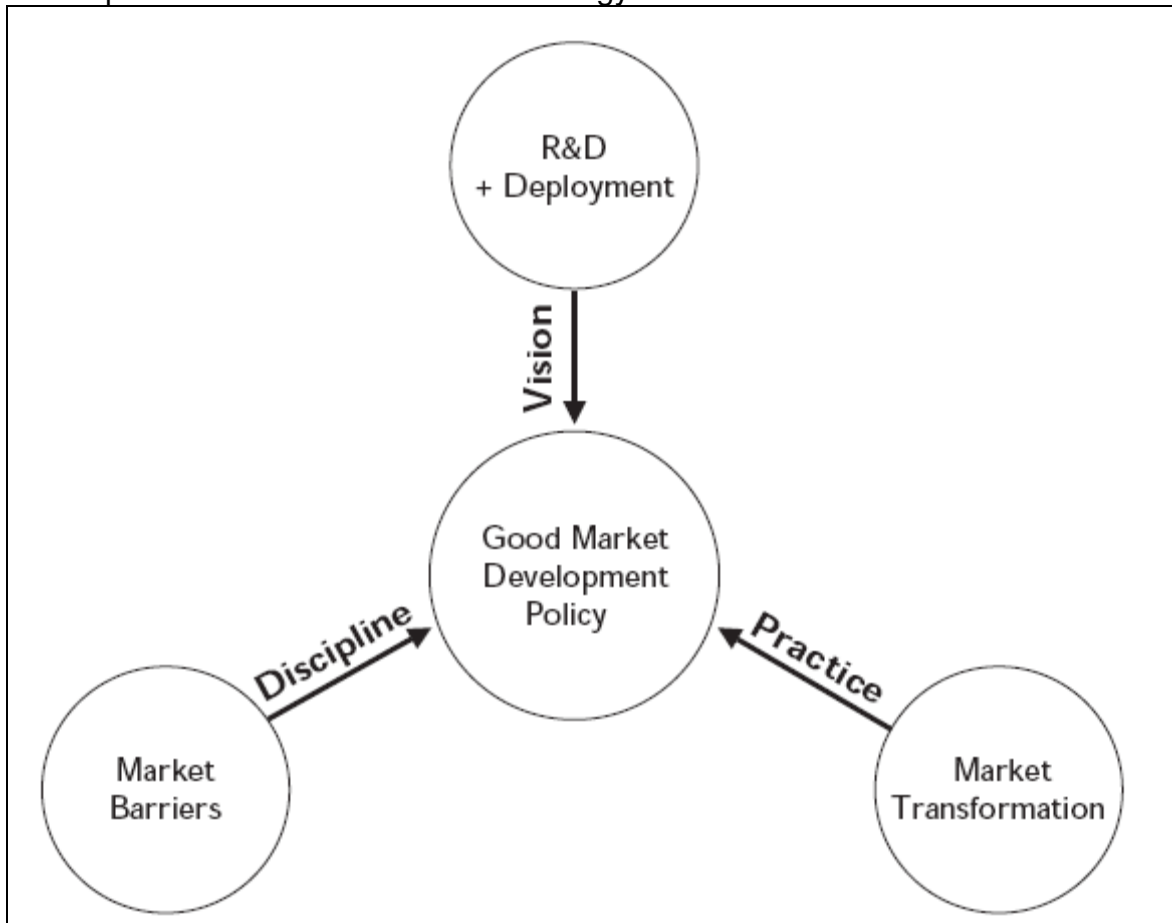
the ***Research, Development and Deployment Perspective***, which focuses on the innovation process, industry strategies and the learning that is associated with new technologies; The strength of the R&D+Deployment perspective is its vision of the future. It focuses on the technology itself, its costs and performance, and the process of market entry through niche markets. ■ invest in niche markets and learning in order to improve technology cost and performance;

■ the ***Market Barriers Perspective***, which characterises the adoption of a new technology as a market process, focuses on decisions made by investors and consumers, and applies the analytical tools of the economist; Through the application of economic analysis, the market barrier perspective improves our understanding of barriers that impede the application of cleaner and more efficient energy technologies and provides a disciplined approach for making decisions about policy interventions. ■ remove or reduce barriers to market development that are based on instances of market failure;

■ the ***Market Transformation Perspective***, which considers the distribution chain from producer to user, focuses on the role of the actors in this chain in developing markets for new energy technologies, and applies the tools of the management sciences. The market transformation perspective encourages sensitivity to the practical aspects of crafting policies that take account of the complex nature of actual markets and produce the desired results. ■ use market transformation techniques that address stakeholders' concerns in adopting new technologies and help to overcome market inertia that can unduly prolong the use of less effective technologies.

A key message developed in this book is that policy initiatives designed to facilitate the adoption of cleaner energy technologies are unlikely to succeed unless policy designers pay attention to each of these three perspectives. It is necessary to:

Development of Market for New Technology



It is useful to distinguish between the different aspects of learning that a deployment programme may trigger. *Technology learning* refers to the progressive reduction in costs and prices and the improvement in performance shown by all technologies as they are adopted through market processes

There are also other types of barriers that may hinder market expansion for those technologies that are already technically mature and cost-efficient – barriers related to information flows, standards, transaction costs, financing and the organisation of market. *Institutional* or *organisational learning* refers to an increase in an organisation's capability for effective action. Applying that idea in this context, market deployment leads to organisational learning for the company developing and promoting a technology, as it learns how to overcome those barriers that are not directly related to the cost or performance of the technology itself.

Have policy measures been designed in ways that make use of market processes and thereby in a competitive environment lead to results that are cost-efficient?

In the 1990s, government energy R&D budgets in IEA countries had a declining trend of, on average, 1.7% per annum, although they increased slightly after 1997. In that decade R&D budgets for fossil fuels and nuclear energy decreased, while those for energy conservation, renewables, power and storage increased. Budgets for fossil fuels declined substantially, at an average annual rate of 12.9%. Coal research declined drastically by 16.5% per annum, its share decreasing from 16.0% in 1990 to 3.7% in 1999. The decline of R&D in oil and gas was relatively modest, at 4.5% per annum. Nuclear R&D (for both fission and fusion) also declined by 3.3% a year, although it still maintained the largest share (47.6%), even at the end of the 1990s. R&D funds for conservation grew considerably, by 10.7% a year, their share increasing from 5.7% in 1990 to 16.6% in 1999. Funds for renewables also increased by 1.9% a year, their share rising from 6.1% in 1990 to 8.5% in 1999. Power and storage R&D made a steady growth at 3.9% per annum, its proportion advancing from 2.8% in 1990 to 4.6% in 1999.

pp. 96

Other recent trends include understanding the importance of innovation, involvement of industries, universities, research institutes, and international co-operation.

Germany. It has decided to phase out nuclear power and it has established ambitious targets to reduce greenhouse gas emissions. While it is not yet clear how nuclear power will be replaced, it is likely that energy efficiency and conservation, co-generation and renewables, as well as fossil fuels, will play a significant role in Germany's energy supply. Germany will gradually phase out **nuclear power** by closing down plants when they reach an average of 32 years of operation. Nuclear power now covers 30% of electricity generation and 13% of total primary energy supply

The federal government introduced the **National Climate Protection Programme** in October 2000 to help meet the national CO₂ reduction target. The eco-tax, promotion of co-generation and renewables, fuel switching, energy efficiency improvements in buildings, and industrial voluntary agreements have made significant contributions to the programme. One of the key instruments developed to internalise external costs is the eco-tax. A key objective of the eco-tax is to reduce greenhouse gas emissions, yet the tax does not reflect the carbon contents of fuels and it does not affect energy users in an equitable manner.

German Energy Agency (DENA) was established in 2000 to promote sustainable energy, mainly through energy efficiency and renewables. The DENA works in close co-operation with the energy agencies of the Länder or with other local contact points that are active in energy efficiency. It is also constantly seeking opportunities for closer co-operation with the industrial and financial sectors in order to be able to provide technical and financial support for projects.

At present, Germany uses a wide range of measures to improve energy efficiency. In the industrial sector the emphasis is on voluntary measures, such as voluntary agreements and third-party financing. The housing sector relies mainly on regulatory measures. One of the key challenges in this sector is to reduce energy consumption in existing buildings.

In 2000, the share of **renewables** (including hydropower) in primary energy supply was 3.4% and in electricity generation 7.3%. The Renewable Energies Act of April 2000 aims to double the share of renewables in total energy supply by 2010 compared to 2000 levels. The national policy on renewable energy is embedded in a European framework, according to which Germany should generate 12.5% of its electricity from renewable energy by 2010

The primary objective of energy R&D is to support energy policy, and the secondary one is to support industrial development and economic growth

In August 2006, Germany implemented a tax on coal, coke and lignite and rescinded tax breaks for biofuels. The tax fully exempts energy-intensive industries - glass, ceramics and cement - as well as domestic burning.

The taxation law implements the European energy taxation directive as national law.

- Such implementation levies a tax on coal for the first time. Hard coal, lignite and coke are taxed when used for heating purposes.
- Taxes on natural gas are raised only as soon as the gas is delivered to the customer.
- Energy sources which are used for power generation are generally exempt from taxation, according to the federal Ministry of Finance.

Under the law, biodiesel is now taxed at euro0.09 per litre, slightly lower than the government first planned. Taxation of biofuels will be extended and raised, reaching euro0.45 per litre for rapeseed biodiesel and ethanol by 2012. To replace biofuel tax exemptions, the German government introduced an obligation on suppliers to ensure a 5.75% of motor fuels by 2010.

Because zero tax incentives on coal and related products are to be abolished, combined cycle gas turbine plants (CCGT) are intended to play a more prominent role in the future, a spokeswoman for the environment ministry said. In contrast to coal or nuclear plants the gas for CCGT plants used to be taxed and only new, very efficient plants were promised an exemption. According to the current bill all input factors for CCGT plants will be tax-free.

Im Durchschnitt betragen die Energiekosten 4-5% der Produktionskosten der deutschen Industrie, von denen die Elektrizitätsausgaben wohl etwa 40% ausmachen. In der Leicht und Dienstleistungsindustrie betragen sie weniger als 1%, in den energieintensiven Industrien wie Stahl, Chemie, Glas, Papier, Zement, 15-25%. Da die energieintensive Industrie gleichzeitig einen relativ hohen Anteil von „Standardprodukten“ produziert, wo die Preiselastizität sehr hoch ist, führen fallende Elektrizitätspreise zu einer Verbesserung der internationalen Konkurrenzfähigkeit der betreffenden Industrie. Dies wirkt sich auf der deutschen Handelsbilanz und der Beschäftigung in der Industrie positiv auswirken.

Greece

It is commendable that the government is making the effort to use such market-oriented instruments as third-party financing to improve energy efficiency in different sectors. It is also encouraging that the government intends to introduce voluntary agreements with industry as a means to exploit energy-saving potential with demand-side measures. Energy can also be saved in the residential sector. But recently proposed measures, such as tighter building codes and building energy certificates, will only reduce energy consumption in the long term. More immediate results could be achieved by modifying energy prices and taxes and by information campaigns. There has been significant progress in promoting the use of public transport

The 1995 Climate Action Plan established a target for increasing the share of renewable energy (including large-scale hydro) in primary energy supply to 10% by 2000. The target was not achieved, and the actual renewables share was 5.2% in 2000. A new indicative target has been set to generate 20.1% of electricity by renewables in 2010

The government recognises that the licensing procedures for renewables are still too complex, and it now plans to establish a “one-stop shop” for permits and licences.

The government should explore possibilities of introducing a green certificate system to reduce the cost of promoting renewables. IEA pp. 135

Electricity prices are distorted. Tariffs in the past were too low to cover the cost of supply, so the government has now announced that it will base tariffs on long-run marginal cost. This may strengthen competition in the market.

UK

The UK has two targets relating to greenhouse gas emissions. It is subject to a binding international target under the 1997 Kyoto Protocol and the European Union’s burden-sharing agreement. This requires a 12.5% reduction in greenhouse gas emissions (six gases) compared with 1990 levels by 2008-2012. In addition, the country has a national target of cutting its carbon dioxide emissions by 20% below 1990 levels by 2010. Largely as a consequence of energy market reform and the resulting “dash for gas” in power generation (the massive construction of gas-fired power plants replacing coal generation), the UK is in the fortunate position of probably being able to meet the Kyoto target. However, meeting the national target will require extra efforts.

To address the potential emissions gap, the government published a new Climate Change Programme in November 2000. This programme contains a large number of additional measures including a Climate Change Levy and a domestic Emissions Trading Scheme.

The Climate Change Levy has a number of questionable design features. The most important such features are that it is based on the energy content of fuels, and that it applies to the business and public sectors, but not to the residential sector. However, the government has a strong commitment to reducing the problem of fuel poverty that affects low-income households in old, poorly insulated buildings. to reflect the carbon content of fuels.

In addition, the government is implementing a Renewables Obligation that will raise the contribution of renewable sources of energy to England and Wales’ electricity supply to 10% by 2010. It expects a voluntary green certificates market to emerge on the basis of this obligation.

To a large degree these measures address the same issues, but their combined application could lead to excessive internalisation of external cost in some areas and insufficient internalisation in others. This could increase the cost of compliance with the government’s greenhouse gas objectives.

The politics and policy of energy system transformation—explaining the German diffusion of renewable energy technology, Staffan Jacobsson, Volkmar Laube; Energy Policy, 2005

While many governments claim to support the diffusion of renewables, the actual rate of diffusion of new technologies in the energy system varies considerably between countries. an ‘economics of innovation’ analysis (linking diffusion patterns to actual policies) with a ‘politics of policy’ analysis (explaining the choice of policies in the larger political context).

Germany the Feed-in Law of 1990 and its successor, the Renewable Energy Sources Act of 2000.

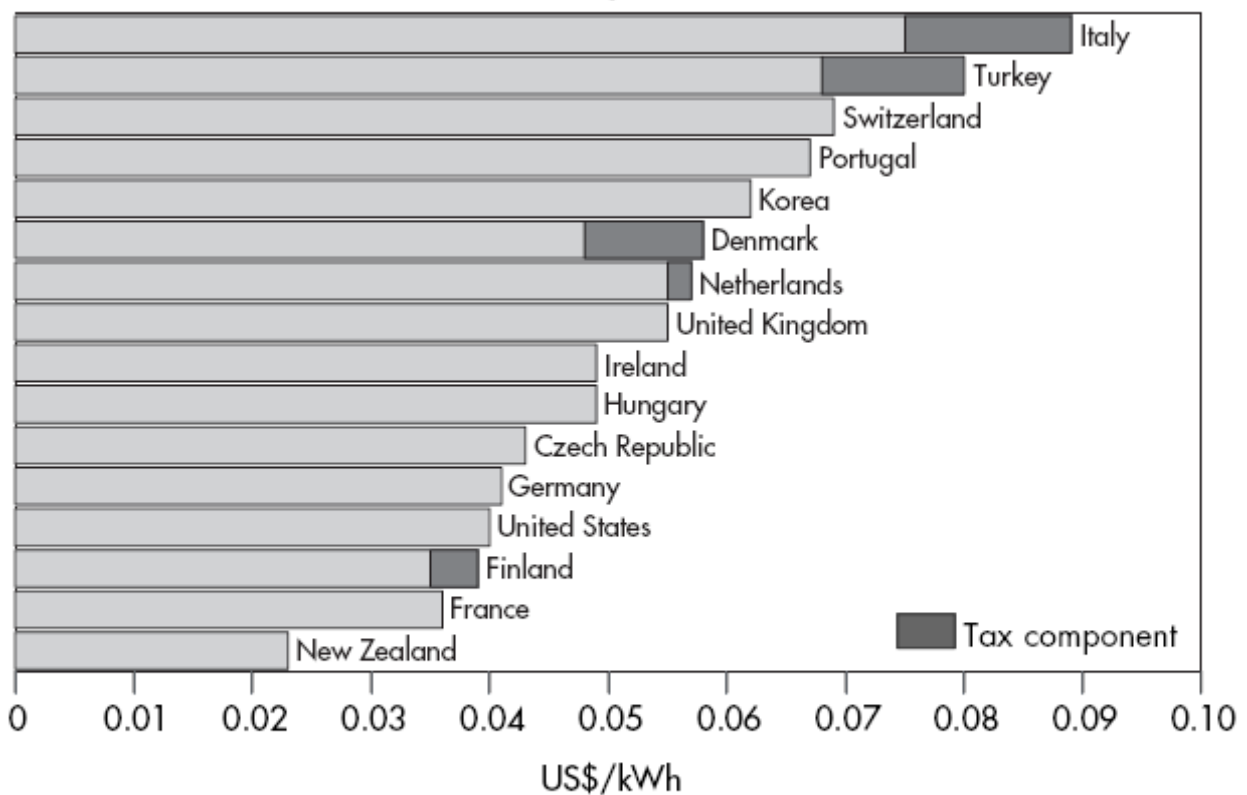
to understand the conditions under which this formative stage, with all its uncertainties, emerges in a specific country. We will outline four key conditions, or features, of early parts of such processes. These are:

- institutional changes,
- market formation,
- the formation of technology-specific advocacy coalitions,
- and the entry of firms and other organisations.

prior investment in knowledge formation must take place and this usually involves a redirection of science and technology policy well in advance of the emergence of markets. Institutional alignment is also about the value base (as it influences demand patterns), market regulations, tax policies as well as much more detailed practices

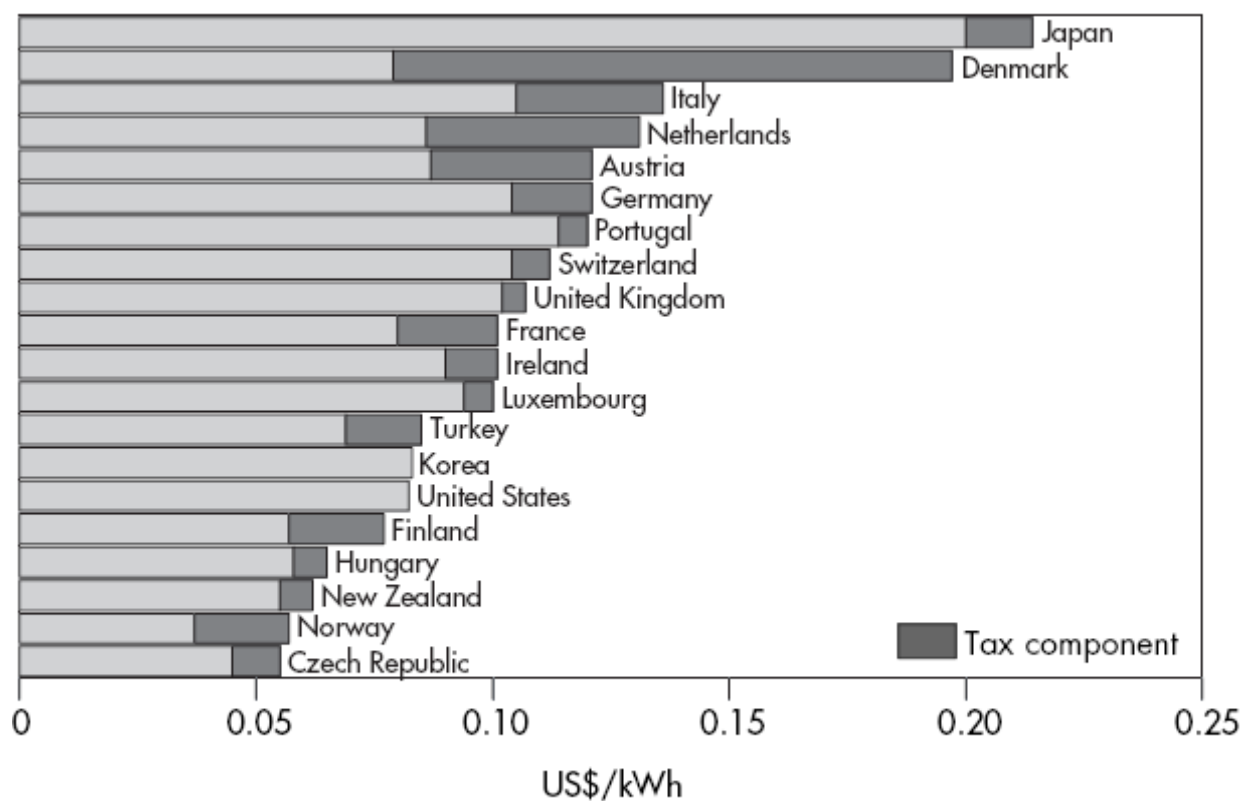
As part of this process,adv ocates of a specific technology need to build support among broader advocacy coalitions to advance the perception that a particular technology,e.g. solar cells or gas turbines,answ ers wider policy concerns. Development of joint visions of the role of that particular technology is therefore a key feature of that process.

Industry Sector



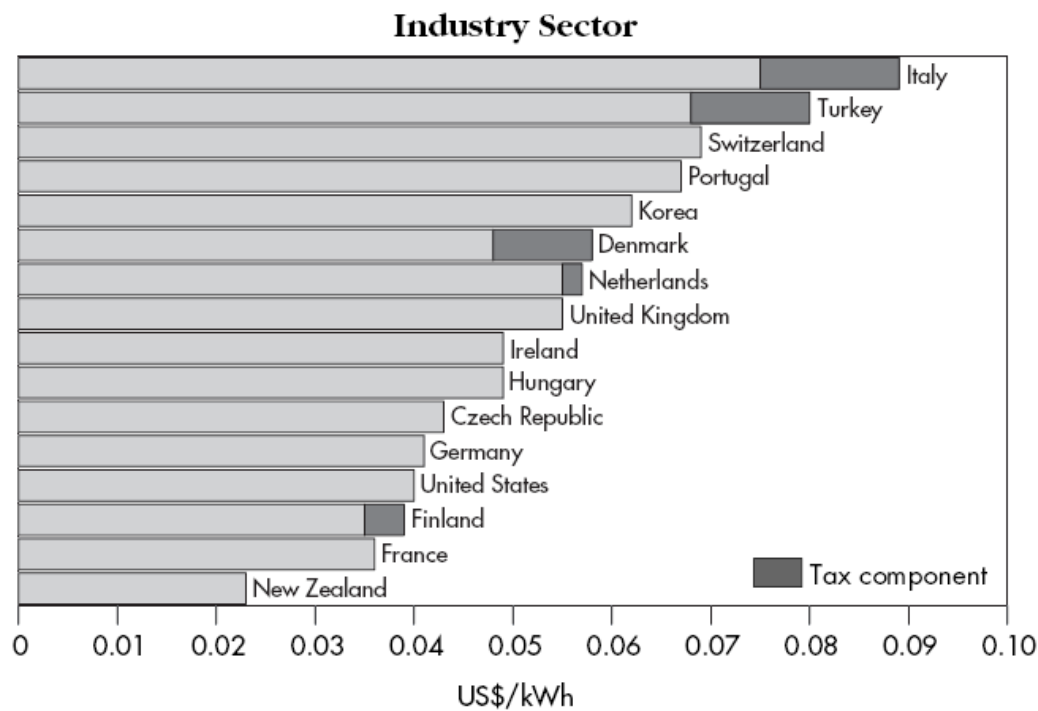
Note: Price excluding tax for the United States. Tax information not available for Korea. Data not available for Australia, Austria, Belgium, Canada, Greece, Japan, Luxembourg, Norway, Spain and Sweden.

Household Sector

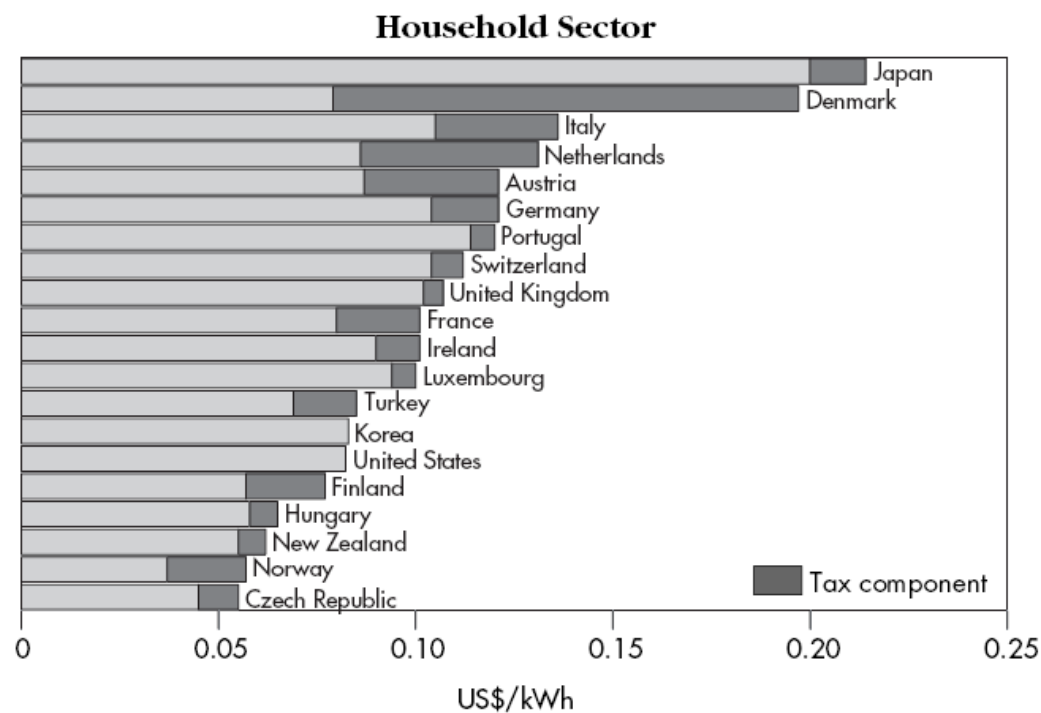


Note: Price excluding tax for the United States. Tax information not available for Korea. Data not available for Australia, Belgium, Canada, Greece, Spain and Sweden.

Electricity Prices in IEA Countries, 2000



Note: Price excluding tax for the United States. Tax information not available for Korea. Data not available for Australia, Austria, Belgium, Canada, Greece, Japan, Luxembourg, Norway, Spain and Sweden.



Note: Price excluding tax for the United States. Tax information not available for Korea. Data not available for Australia, Belgium, Canada, Greece, Spain and Sweden.

RES-E TECHNOLOGIES CONSIDERED					
	Major Strategy	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). FiTs guaranteed for 13 years for plants which got all permissions between 1st of January 2003 and 31st of December 2004 and, hence, start operation by the end of 2006. Investment subsidies mainly on regional level.	No
Belgium	TGC + guaranteed electricity purchase	No		Federal: The Royal Decree of 10 July 2002 (operational from 1st of July 2003) sets minimum prices for RES-E. Except for offshore wind it will be implemented by the regional authorities. Wallonia: Quota obligation (based on TGCs) on electricity suppliers—increasing from 3% in 2003 up to 12% in 2010. Flanders: Quota obligation (based on TGCs) on electricity suppliers—increasing from 3% (no MSW) in 2004 up to 6% in 2010. Brussels region: No support scheme yet implemented.	
Denmark	Partial Tax Exemption + tender	No		Act on Payment for Green Electricity (Act 478): Max combined price for wind power and partial tax exemption of 4.4 ø€/MWh. Minimum price of 1.33 ø€/MWh. Exemption of CO ₂ tax (max 1.33 ø€/MWh) depends on electricity market price. Plans for offshore wind tenders.	No
Finland	Tax Exemption	No	Tax refund	Mix of tax refund and investment subsidies: From January 2003: Tax refund of 0.44 ø€/MWh for wind and of 0.44 ø€/MWh for other RES-E. Investment subsidies (plant <1MW) up to 40% for wind and up to 30% for other RES-E.	No
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 - 4.0 ø€/MWh; biogas - 4.6 ø€/MWh; geothermal - 7.62 ø€/MWh; PV - 15.25-30.50 ø€/MWh; landfill gas - 4.50-5.72 ø€/MWh; wind - 3.05-8.38 ø€/MWh; hydro - 5.40-6.10 ø€/MWh. Investment subsidies for PV, biomass and biogas (biomass and biogas FBEDL 2000 - 2006).	No
Germany	FiTs	No		German Renewable Energy Act: FiTs guaranteed for 20 years ⁶ . In more detail, FiTs for new installations in 2003 are: hydro - 6.65-7.67 ø€/MWh; wind - 6.8-9 ø€/MWh; biomass - 5.8-10 ø€/MWh; landfill gas, sewage gas and mine biogas - 6.65-7.67 ø€/MWh; solar PV and solar thermal electricity - 45.7 ø€/MWh; geothermal - 7.16-8.95 ø€/MWh.	No
Greece	FiTs + investment subsidies	No		FiTs guaranteed for 10 years (at a level of 70-90% of the consumer electricity price) ⁷ and a mix of other instruments: a) Law 2601/98: Up to 40% investment subsidies combined with tax measures; b) CSF II: Up to 50% investment subsidies depending on RES type.	No
Ireland	Tender	No		Tendering scheme – currently AER VI with technology bands and price caps for small wind (<3 MW), large wind (>3 MW), small hydro (<5 MWp), biomass, biomass and biogas. In addition, tax relief for investments in RES-E.	No
Italy	TGC			Quota obligation (based on TGCs) on electricity suppliers: 2% target, increasing annually; TGC issued for all (new) RESE (inc. large hydro and MSW) – with rolling redemption; unclear penalty enforcement and market distortions ⁸ . Investment subsidies for PV (Italian Roof Top programme).	
Luxembourg	FiTs	No	No	FiTs ⁹ guaranteed for 10 years (PV 20 years) and investment subsidies for wind, PV, biomass and small hydro. FiTs for wind, biomass and small hydro - 2.5 ø€/MWh for PV - 5.0 ø€/MWh ¹⁰ .	No
Portugal	FiTs + investment subsidies	No		FiTs (Decree law 339-C/2001 and Decree law 168/99) and about 40% investment subsidies small hydro and wave. FiTs in 2003 - wind ¹¹ - 4.3ø€/MWh - 8.3ø€/MWh; wave - 22.5ø€/MWh; PV ¹² - 22.4ø€/MWh - 41ø€/MWh; small hydro - 7.2ø€/MWh.	
Spain	FiTs	Depending on the plant size ¹³		FiTs (Royal Decree 2618/1998): RESE producers have the right to opt for a fixed price or for a premium tariff ¹⁴ . Both are adjusted annually by the government according to the variation in the average electricity sale price. In more detail (only premium, valid for plant < 50 MW ¹⁵): wind - 2.7 ø€/MWh - PV ¹⁶ - 16.36 ø€/MWh - small hydro - 2.5ø€/MWh - biomass - 2.5 - 3.3 ø€/MWh. Moreover, soft loans and tax incentives (according to "Plan de Fomento de las Energías Renovables") and investment subsidies on a regional level.	1.7 ø€/MWh

RT: Feed-in Tariffs

TGC: Tradable Green Certificates

	Major Strategy	Large Hydro	Small Hydro	'New' RES (Wind On- & Offshore, PV, Solar Thermal Electricity, Biomass, Biogas, Landfill Gas, Sewage Gas, Geothermal)	Municipal Solid Waste
Sweden	TGC	No		Quota obligation (based on TGC) on consumers: Increasing from 7.4% in 2003 up to 16.9% in 2010. For Wind Investment subsidies of 15% and additional FITs ("Environmental Bonus" ¹⁸) in size of 1.9 c€/kWh are available.	No
Netherlands	FITs + tax exemption			Mixed strategy: green pricing, tax exemptions and FITs. The tax exemption for green electricity amounts 2.9 c€/kWh and FITs range from 2.9 c€/kWh for mixed biomass and waste streams to 6.8 c€/kWh for wind, PV, tidal, wave and small hydro.	No
United Kingdom	TGC + investment subsidies	No		Quota obligation (based on TGCs) for all RES-E: Increasing from 3% in 2003 up to 10.4% by 2010 – penalty set at 3.51 £/kWh. Optional to the TGC-system, eligible RES-E are exempted from the Climate Change Levy certified by Levy Exemption Certificates (LECs), which cannot be separately traded from physical electricity. The current levy rate is 0.43 £/kWh. 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 Programme, and the Scottish Community Renewable Initiative).	No

¹ Without efficiency premiums.

² 30.5 €/kWh for Corsica and Overseas Departments.

³ Stepped FIT: 8.38 c€/kWh for the first 5 years of operation and then between 3.05 and 8.38 c€/kWh depending on the quality of site.

⁴ Producers can choose between four different schemes. The figure shows the flat rate option. Within other schemes tariffs vary over time (peak/base etc.).

⁵ 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 1.5% per year.

⁶ Stepped FIT: 8.9 c€/kWh for the first 5 years of operation and then between 6 and 8.9 c€/kWh depending on the quality of site.

⁷ Depending on location (islands or mainland) and type of producer (independent power producers or utilities)

⁸ In general only plant put in operation after 1st of April 1999 is allowed to receive TGCs for their produced green electricity. Moreover, this allowance is limited to the first 8 years of operation (rolling redemption).

⁹ 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).

¹⁰ Only for plants up to 3 MW except up to 50 kW for PV systems.

¹¹ For plants commissioned in 2004 the FIT will be in the range of 45 c€/kWh

¹² Stepped FIT depending on the quality of the site.

¹³ Depending on the size: <5kW - 42 c€/kWh or >5kW - 22.4 c€/kWh

¹⁴ Hydropower plant with a size between 10 and 50 MW receive a premium depending on the farm size according to the formula: Premium (c€/kWh) = 2.9 * (50-plant size in MW) / 40. For plants >50MW the premium tariff is set to 0.6 c€/kWh.

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 For Small Hydro the plant size is limited to 10 MW.

¹⁷ Depending on the plant size: <5kW: 36c€/kWh or >5kW: 18c€/kWh

¹⁸ Decreasing gradually down to zero in 2007

Source: EWEA: Wind energy the facts. Volume 5 Market Development

Denmark has been able to maintain the number of wind power sector jobs at 20,000 due to its export market. According to the BWE (German Wind Energy Association), the German wind energy industry boasted a €5.03 billion turnover in 2005. Half of this figure, i.e. €2.51 billion, is the turnover for exports. The situation is identical when it comes to jobs, with exports now accounting for 31,900 of the 63,800 jobs in the German wind power industry.

Three fuel types contribute to the total biomass electricity generation: solid biomass, biogas and the biodegradable fraction of municipal solid waste. Biomass electricity constitutes 2% of the total EU electricity consumption. Total biomass grew by 18% in 2002, 13% in 2003, 19% in 2004 and 23% in 2005²⁰.

Total installed PV capacity in the EU has been growing at an unprecedented average annual growth rate of 70% over the last five years, from 127 MWp²⁸ in 2000 to 1,794 MWp at the end of 2005. The impressive growth of the total installed capacity in Europe is driven by Germany: 86% of currently installed PV capacity in the EU is in Germany. The other European markets have a completely different dimension. The Netherlands has over 50 MWp installed and Spain 58 MWp.

