

Renewable energies: success stories

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Foreword

This report demonstrates the Agency's determination not only to provide information to support better policy-making, but also to gather and disseminate 'best-practice' information that can help actors on the ground find better solutions for the environment and sustainable development.

Renewable energy is increasingly becoming a vital component of the energy mix of the 21st century, and its successful penetration of the market is already underway in many EU Member States.

This publication examines examples of successful implementation of renewable energy projects through case studies and analysis of EU Member State policies and activities. The experiences described may help policy implementers in the Member States to learn from each other's experiences. We hope these success stories will breed further successes.

I believe that this publication could be useful not only to EU decision makers and policy implementers but also to all countries interested in increasing their levels of renewable energy sources.

The report sheds light on the factors that led to successful implementation of some renewable energy technologies in some EU Member States and emphasizes the wide range of factors that can determine whether projects succeed or not. All examples studied are reported following the same methodology and format, thus creating a framework for reporting on success stories that others could also use as a communication tool for promoting renewables.

This document is also available in electronic format on the Agency's main web site at <http://reports.eea.eu.int/> as well as in EnviroWindows, an EEA web site for gathering and disseminating information on environmental management and best practices, aimed at businesses, local authorities and their stakeholders (<http://ewindows.eu.org/LocalAuthorities/renewables.pdf>). It is my hope that this report will become the seed for the creation of a clearing house for experiences in how best to promote renewable energies at many levels, from national to local. The Agency is offering its electronic space and expertise to anybody who would like to pick up the gauntlet and create a permanent site where success stories on implementation of renewable energies are reported in a standardised way and updated when new data become available.

I would like to thank the manager of this report, Aphrodite Mourelatou, for the valuable work she put into this project; Ecotec Research and Consulting Ltd, who assisted with writing the report; Eurostat, which provided the necessary data; and all others who contributed to the report or reviewed it.

Domingo Jiménez-Beltrán
Executive Director

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Executive summary

Background

This study presents a series of examples of successful renewable energy development in EU Member States. By analysing these cases it seeks to understand the factors that influence the success of renewable energy schemes and to facilitate their widespread penetration in the Member States. The study aims to provide policy-makers and policy implementers with an opportunity to learn from each others' experiences, and thereby to contribute to EU and Member State efforts to meet their renewable energy indicative targets for 2010.

Identifying progress in renewable energy deployment

The study evaluates the rate of penetration in each EU Member State of four renewable energy sources — photovoltaics, solar thermal, wind and biomass (as biomass power, biomass district heating and biofuels) — between 1993 and 1999. For consistency purposes only data from Eurostat (the statistical office of the European Communities) have been used.

For the purposes of this study, two selection criteria have been applied to identify those Member State/technology combinations where renewable energy has penetrated to a greater degree of success than in others:

- An absolute increase equivalent to at least 10 % of the total EU-wide increase in renewable energy output of that particular technology over the period 1993–99. The 10 % threshold has been selected to identify those Member States that made the greatest contribution to the increase in renewable energy output of each technology in the EU.
- A percentage increase of renewable energy output of the examined technology greater than the EU percentage increase for that technology between 1993–1999. This compares the percentage increase of each renewable energy source with the EU-wide percentage increase, and identifies those Member State/technology combinations which exceeded the EU-wide figure.

This approach enables the identification of those Member State/technology combinations where exploitation of the technology was well established in 1993 and continued to expand over the next six years. It also highlights Member States where a technology was in an initial stage of development at the start of the six-year period and achieved a rapid rate of increase in penetration, but still only provides a limited quantity of energy output.

It should be noted that the criteria cannot be used to directly benchmark a country's performance in promoting renewable energies. The study focuses on positive changes during the period studied, and does not compare absolute levels of penetration.

The results of applying these two criteria are summarised in the table below.

Trends in renewable energy penetration, 1993–99

Source: Eurostat.

Technology: Selection criteria (see note 1):	Photo- voltaics	Solar thermal	Wind	Biomass: power	Biomass: district heating (1993–98)	Biomass: biofuels (see note 2)
Austria		✓ ✓		✓	✓ ✓	✓
Belgium				✓		
Denmark		✓	✓	✓		
Finland		✓	✓	✓		
France			✓		✓	✓
Germany	✓ ✓	✓ ✓	✓ ✓	✓		✓
Greece		✓				
Ireland		✓	✓			
Italy		✓	✓	✓	✓	✓
Luxembourg						
Netherlands	✓	✓				
Portugal			✓			
Spain	✓ ✓		✓ ✓	✓		
Sweden			✓	✓	✓ ✓	
UK		✓				

Biomass district heating refers to heat output from heat plants only.

Note 1: Two criteria for selection are used:

- ✓ (left) represents a contribution of at least 10 % of the total EU increase in absolute terms, 1993–99;
- ✓ (right) represents a percentage increase greater than the EU percentage increase, 1993–99.

Note 2: Biofuels only:

- ✓ represents those Member States which indicate that they use biofuels (most do not).

The results show wide variations between the 15 Member States (see Table 3 on page 21).

For most technologies, only two or three Member States contributed more than 10 % (each) of the total new output from the technology:

- Germany and Spain contributed 78 % of new EU output from photovoltaics;
- Austria, Germany and Greece contributed 80 % of new solar thermal installations;
- Denmark, Germany and Spain contributed 80 % of new wind output;
- Finland and Sweden contributed 60 % of new generation from biomass-fuelled power stations (including biomass combined heat and power stations);
- Austria and Sweden dominated the increase in output from biomass district heating installations;
- only four Member States use biofuels to any significant extent; France is the market leader, producing about 40 % of the total.

More Member States, however, were starting to expand their rates of exploitation of certain technologies, and had a percentage increase greater than the EU figure. Indeed, some Member States with low initial levels of renewable energy use demonstrated rapid growth rates even though the actual increase in output achieved was small over the period.

Only a small number of Member State/technology combinations met both criteria. Germany achieved the greatest levels of new renewable energy penetration over the period and met both criteria for all of the technologies studied except biomass. There were also positive combinations in Austria, Spain and Sweden.

Success factors

The study drew on the considerable amount of previous work carried out at EU and Member State level on the barriers that hinder the implementation of renewable energies. It identifies a number of potential success factors likely to have a positive influence on the development of renewable energy technologies.

The study examines the influence of these potential success factors in a series of case studies selected from the Member State/technology combinations that have been identified by applying the selection criteria summarised in the table above. In particular, it examines all Member State/technology combinations that met both of the criteria for successful penetration and the most interesting Member State/technology combinations meeting one of the criteria. Where possible and appropriate, representative examples of renewable energy projects have been used in the case studies.

The following conclusions summarise the results of the analysis carried out, based on the case studies.

No single factor was identified as being of overwhelming significance. It is rather the cumulative benefits of a series of supportive measures that determine the extent to which a renewable technology is successfully exploited. There are, however, certain essential components of successful renewable energy implementation that help to create an environment in which renewable energy exploitation can succeed.

These are described below under the following seven sub-headings: political; legislative; fiscal, financial; administrative; technological development; information, education and training:

Political support

- The EU countries which showed a rapid expansion of renewable energy during the 1990s are most commonly those with long-established policies in support of renewable energy in general or of a particular renewable energy.

Regional energy policies can also contribute towards encouraging renewable energy development. For Member States with a high degree of regional autonomy, such as Austria, Germany and Spain, many regional authorities have brought forward energy plans that are even more supportive towards renewable energy than those at the national level.

Legislative support

- For electricity from renewable sources, the **feed-in law system** has given a great impetus to renewable energy developments, in particular wind energy. This system combines commercially favourable guaranteed feed-in tariffs with an obligation on utilities to purchase renewable electricity at these tariffs.

Denmark, Germany and Spain (all countries using the feed-in law system) contributed 80 % of new wind energy output in the EU-15 over the period 1993–99.

Biomass use in power stations also benefited from feed-in laws, particularly in these same three countries. However, the expansion of biomass power has not been as rapid as that of wind. Biomass use also increased significantly in some Member States without the support of a feed-in mechanism (Finland and Sweden). Successful biomass development benefits from feed-in tariffs but is also closely linked with other success factors, especially the availability of financial support (see below).

The use of photovoltaics expanded significantly in those Member States that provided a high level of support to projects through feed-in arrangements — the most successful being Germany and Spain. However, successful penetration occurred where the feed-in support initiatives were implemented together with capital subsidy programmes to encourage uptake of the technology (again Germany and, to a lesser extent, Spain).

The main alternative to the feed-in mechanism is the **competitive tendering process**. This system was chosen by Ireland and the UK ⁽¹⁾ to support a range of technologies, including wind and biomass, and by France ⁽²⁾ to support wind energy. Developers are guaranteed that, if they win the tender, their power will be purchased at the price they bid in their proposal. This resulted in an increase in capacity of a range of renewable energy technologies in these

(1) The UK is replacing the competitive tendering system with a Renewables Obligation, under which suppliers are legally obliged to provide an increasing proportion of their supplies from renewable sources.

(2) From June 2001 France replaced competitive tendering with a system similar to the feed-in law.

Member States, but not to the same extent as was achieved where feed-in arrangements were available. Compared with feed-in arrangements in other Member States, the competitive nature of the tendering system has offered fewer guarantees to developers that they will receive an acceptable tariff rate for their project.

- Renewable energy power generators need grid access to be able to distribute the electricity generated. This requires the establishment of transparent and reasonable charging structures so they can operate successfully within the electricity supply system.

Member States that took the biggest steps to address problems of grid access achieved the greatest levels of renewable electricity penetration during the 1990s, especially for smaller-scale renewable energy projects.

Grid access is an important component of the recently adopted EU directive ⁽³⁾ on renewable energy in the internal electricity market. The directive requires Member States to take the necessary measures to guarantee the transmission and distribution of electricity produced from renewable sources and encourages such electricity to be given priority access to the grid.

Fiscal support

- Fiscal (taxation) measures are increasingly being used as a mechanism to reward the environmental benefits of renewable energy compared with energy generated from fossil sources.

During the period of this study, at least six Member States — Austria, Denmark, Finland, Italy, Netherlands and Sweden — put in place some form of energy-related taxation which penalises the use of fossil fuels or other environmentally damaging activities. In Sweden, the introduction of taxes on carbon dioxide emissions and energy from which biomass is exempted helped the expansion of both biomass district heating and biomass combined heat and power plants. The taxes made other options, in particular coal-fired district heating and coal-fired combined heat and power plants, more expensive.

An alternative fiscal approach developed in other Member States is to allow various tax exemptions or reductions for individuals or companies who invest in or use renewable-related products or services. The installation of solar thermal water-heating systems has been stimulated by this approach (in Greece, for example). Individual investors in wind energy benefit from tax exemptions in Germany and Sweden, while Dutch companies benefit from accelerated depreciation for investment in energy-saving schemes that include renewable projects.

Biofuels for transport represent a special example of the role of fiscal initiatives to support renewable energy. Some Member States took advantage of opportunities to apply lower fuel excise duty rates to support biofuels. France in particular used this option to stimulate the growth of the EU's largest biofuels industry.

Financial support

- The capital costs of renewable energy projects, which are often high, can be a significant barrier to development, especially for newer technologies. Subsidies or favourable loans for renewable energy developments are common where successful penetration occurs.

Wind energy has become increasingly cost-competitive over the 1990s, and grants are required less often where feed-in arrangements are available. Where such arrangements are not available, subsidies are still the main mechanism for successfully supporting wind energy schemes.

Biomass installations usually still need capital subsidy to be financially viable as they have high capital costs. This is true even in countries with feed-in arrangements. For example, capital

(3) Directive of the European Parliament and of the Council on the promotion of electricity from renewable energy sources in the internal electricity market (2001/77/EC).

grants are provided for biomass power schemes in Germany to augment feed-in tariffs, but for wind power only limited grants are currently provided.

Photovoltaics (PV) is still an immature technology and projects need considerable subsidy. Member States showing significant increases in PV use are those that have established subsidy support mechanisms, usually in association with feed-in tariff arrangements.

Solar thermal installations are not always able to compete on costs with fossil fuel heating sources and require subsidies to achieve a high level of uptake. Substantial subsidies were made available to households or industry in the three Member States showing the greatest level of development of solar thermal power over the period of this study (Austria, Germany and Greece).

Administrative support

- Successful replication of renewable energy projects can be achieved on a wide scale only where there is active support for renewable energy at the level at which individual projects are brought forward for approval. In most cases this is the local or regional level. Administrative support at national level is also an important component for success.

The case studies identified a wide range of ways in which local or regional administrations or municipalities have successfully supported renewable energy uptake, including:

- developing local or regional targets for renewable energy uptake;
- providing planning guidance for locating renewable projects;
- providing funding support for local renewable energy projects;
- improving building regulations to stimulate uptake of photovoltaics or solar thermal installations;
- implementing district heating schemes;
- supporting the development of new indigenous manufacturing capacity.

Some of the projects studied received a strong level of public sector support at regional or local level. This shows the regional or local authorities' appreciation of the benefits that the projects would bring to the local population not only in terms of the environment but also in terms of economic development and employment.

Technological development

- The development of renewable energy technologies requires support at all stages — research, demonstration and implementation — to help achieve strong and competitive indigenous industry capabilities in renewable energy.

Public sector funding to develop renewable energy has been provided over the past 20 years, both by the European Commission and at Member State level. This support has helped to achieve considerable cost reductions and technological improvements. Member States that have focused national research funding support towards specific technologies are now reaping the rewards of this investment. For example, Denmark now has the world's leading wind industry, Finland and Sweden have strong capabilities in biomass technologies, and Germany and the Netherlands are home to photovoltaic cell manufacturing.

Information, education and training

- Activities that raise awareness of the benefits of renewable energy among the general public are a vital component of national, regional and local renewable energy support programmes.

The success of a renewable energy project, and its subsequent replication, ultimately depends on its public acceptability at local level. At this level, communicating the non-energy benefits is an important component in the acceptability of renewable energy, especially its role in providing revenue and local jobs. Cooperative participation in a project can be a successful way of involving the local community in a new renewable energy development. The role of the developer could also be important for public acceptance and requires that developers

work with the local community to provide information about the nature of new renewable energy projects and their potential benefits.

Energy agencies at local or regional level are one of the most successful initiatives to help raise public awareness of the benefits of renewable energy and increase public acceptance of new renewable energy developments. Their role is to stimulate the expansion of renewable energy and energy efficiency in their area through public and private sector initiatives and local community involvement.