5. Member state/technology examples of successful penetration

Photo: Volker Quaschning

Table 2 (Section 3) highlighted the principal Member State/technology combinations that appear to be successful, in terms of rate and/or the amount of increase in output over the six years 1993–99.

The preceding discussion has summarised the key factors that may influence the likely successful penetration of renewable energy technologies. These factors are now assessed in a series of case studies which reflect the successful Member State/technology combinations identified in Section 3. Where possible and appropriate these case studies give representative examples of renewable energy projects.

In this section, case studies are evaluated which demonstrate those Member State/technology combinations that meet **both** the **criteria** for successful penetration. These combinations are listed in Table 5:

Member State/technology combinations meeting both the criteria for successful penetration, 1993–99 Table 5

Country	Renewable energy technology	Applications
Austria	Biomass	District heating
	Solar thermal	Solar thermal collectors
Germany	Photovoltaics	Photovoltaics in urban areas
	Solar thermal	Heating initiatives in various cities
	Wind energy	Wind farms
Spain	Photovoltaics	Grid-connected photovoltaics
	Wind energy	Wind farms
Sweden	Biomass	District heating

In Annex 1 the most interesting case studies of Member State/technology combinations that meet **one** of the **criteria** for successful penetration are evaluated. These combinations are listed in Table 6.

Table 6 **Most interesting Member State/technology combinations meeting one of the criteria for successful penetration**

:

Country	Renewable energy technology	Applications
Denmark	Biomass	Power
	Wind energy	Wind cooperative
Finland	Biomass	Combined heat and power
France	Biomass (biofuels)	Biodiesel
	Biomass	District heating
	Wind energy	Wind developments
Germany	Biomass	Power and district heating
Greece	Solar thermal	Solar hot-water systems
Ireland	Wind energy	Wind farm
Italy	Wind energy	Wind farms
Netherlands	Photovoltaics	Roof-integrated photovoltaics
Portugal	Wind energy	Wind projects
Spain	Biomass	Power
Sweden	Biomass	Power
	Wind energy	Wind farms

5.1. Austria — Biomass district heating

Austria has extensive forestry and other biomass resources that are used as energy resources. Between 1993 and 1998, it achieved significant increases in its level and rate of use of biomass for heat production in general and especially for district heating purposes.

In 1993:	77.1 ktoe
In 1998:	124.6 ktoe
Increase 1993–98:	47.5 ktoe, 62 %

District heating is very common in Austria, and the use of biomass as fuel is increasing. By 2000 there were more than 500 district heating plants (totalling more than 650 MW installed capacity) operating throughout Austria.

Success factors:

- ***Political: National and regional support to expand the use of biomass***

Austria has few indigenous fossil fuel resources, so its energy policy addresses security of supply issues through promoting energy efficiency and reducing use of imported fuels, combined with stimulating the use of renewable energy. Austria's large biomass resources play an important role in increasing the use of renewable energy. The government and, in particular, the regions provide active political support for biomass energy. Several regions have biomass-related targets.

- ***Fiscal: Energy taxes favour renewable energy schemes***

Austria introduced an energy tax on the use of gas (EUR 0.0435/m^3 (cubic metre) + 20 % VAT) and electricity (EUR 0.003/kWh + 20 % VAT) in 1996. The tax applies to small-scale as well as industrial users. Part of the tax revenue is made available to the *Länder* and to the communities for the implementation of energy saving and environmental protection measures, including measures to promote renewable energy.

- ***Financial: Public grants and subsidies for biomass installations***

Support is provided at both the national and regional level for biomass installations, particularly for district heating schemes. Eligible regions have also benefited from EU Structural Funding support targeted at renewable energy schemes including biomass.

The support includes:

— subsidies of 10–30 % of eligible costs through a national environmental support programme;
— regional support plans that provide subsidies of up to one third of the costs;
— local and regional support targeted towards private households to subsidise the cost of connection to heating networks;
— special support programmes by the farmers' association to encourage farmers to invest in biomass plants.

- ***Administration: Long history of public support for and use of biomass as a fuel resource***

Austria has a decentralised population structure and a densely wooded landscape, and has been using wood as an energy resource for centuries. Decentralised heat production from biomass is accepted and promoted by the local and regional authorities.

The local council implements planning decisions at the local level. There can be initial opposition to district heating proposals. In some cases where this occurred, public authorities took the lead and established connections to public buildings to demonstrate the benefits.

- ***Technological development: Indigenous manufacturing expertise***

New technological developments for biomass production processes are supported both within Austrian universities and in association with industry. There is already a well-established local industry that developed to meet the demand for new biomass district heating plants, including boiler and pipework manufacture, and installation services.

- ***Information, education and training: Long history of use of biomass as fuel, benefits to key local economic actors from biomass projects, promotion of benefits from biomass use by energy agencies***

Biomass use is very well established and accepted in Austria, both at the local level for small-scale applications and at the industrial level, due to the country's extensive wood-based industries. At the larger-scale and industrial level, farmers are supportive of new biomass projects because of the additional income that will be generated. Wood users such as sawmills also benefit because they have an additional market for their wood wastes. These actors, in particular the farmers, have been key in increasing public acceptance of biomass projects.

At the local level, most regions carry out active dissemination activities to promote the economic and environmental benefits from using biomass as a fuel by individuals or communities. These activities are usually coordinated through regional or local energy agencies, which place strong emphasis on the importance of institution building and on activities in the information, communications and training sectors. The overall result of these activities is that the general public is well informed about the benefits and use of renewables.

5.2. Austria — Solar thermal

Austria's rapid increase in its use of solar energy for heating purposes demonstrates that solar thermal can provide an important source of energy even in less sunny regions.

In 1993:	24.9 ktoe
In 1999:	62.1 ktoe
Increase 1993–99:	37.1 ktoe, 150 %

One of the most successful regions to encourage solar thermal uptake is Upper Austria. In 1994, the Upper Austrian Energy Plan established targets to reduce fossil fuel consumption, improve energy efficiency and increase the use of renewable energy in the region. These targets, which were met, included reducing domestic energy use by 20 % and increasing the proportion of energy provided from renewable sources to 30 % by 2000. The Upper Austrian Energy Agency has been one of the main promoters of actions to achieve these targets, and has been very successful through a combination of support measures from both national and local sources, combined with a high level of information dissemination activities to raise awareness in the region.

More than 500 000 m^2 of thermal solar collectors had been installed in Upper Austria by 2000 as a result of the energy plan, for space heating and producing hot water, mainly in domestic buildings. By 2000 the region had about 0.4 m^2 installed solar collectors per inhabitant — one of the highest densities of solar collectors per inhabitant in Europe. Similar initiatives are now being implemented in other Austrian regions, supported through local or regional energy plans.

Success factors:

- ***Political: National and regional support towards development of renewable energy***

The Austrian national government's energy policy places a strong emphasis on improving the country's security of energy supply and reducing the amount of energy imports. This, combined with a commitment to environmental protection, has resulted in a long-standing level of political support for renewable energy at the national level and has led to active political support at the regional level. The government also links the benefits of supporting renewable energy to associated socio-economic impacts of job creation and economic benefits to the local economy.

- ***Financial: Loans and grants available through national and regional government***

Financial support for installing solar collectors is available through support programmes both at the national level (targeting companies) and at the regional level (targeting households). This support includes grants to householders and low-interest loans on investments in renewable energy. The high level of financial support available for installing solar collectors has been one of the main reasons for the high uptake of these systems in the Upper Austrian region. Other regions are now following the example of Upper Austria: for example, the town of Feldkirch in western Austria subsidises the installation of solar hot-water collectors by 25 %, while the Municipality of Graz provides EURO 35/m^2 solar hot-water collectors installed.

- ***Fiscal: Energy taxes favour renewable energy schemes***

An energy tax was introduced in 1996 on both small-scale and industrial users of gas and electricity. Part of the revenue from this energy tax is recycled to support various environmental protection measures, including support for renewable energy.

- ***Administration: Active local and regional support towards the installation of solar collectors***

Many of the regional and local administrations have encouraged the installation of solar collectors through active support measures, for example through installing collectors on their own municipal buildings.

- ***Technological development: Support for indigenous solar collector manufacturers and installation industries***

Solar thermal benefited during the 1980s from the establishment of a network of groups throughout the country which provide active support and advice to individuals wishing to install solar water heaters themselves. This initiative encouraged the development of an industry to provide commercial installations. Austria now has a network of companies working in the field of solar collectors, as well as in other renewable energy technologies, which in Upper Austria alone employs more than 1 000 people.

- ***Information, education and training: Positive dissemination and support for renewable energy use through the regional energy agencies***

Regional energy agencies provide expert advice, research and targeted initiatives aimed at promoting national and regional energy policies. In Upper Austria, the agency provides targeted support towards promoting the uptake of solar collectors through a wide-ranging programme. Initiatives include:

— information and training for specialised installers
— marketing activities
— demonstration systems to show successful installations.

5.3. Germany — Photovoltaics

Germany has the highest level of photovoltaics installations in Europe, and the third highest in the world, after the United States and Japan.

In 1993:	3.0 GWh
In 1999:	35.0 GWh
Increase 1993–99:	32.0 GWh, 1 070 %

Many of Germany's regions actively support photovoltaics (PV) as part of their efforts to expand the use of renewable energy. Berlin, for instance, is sometimes referred to as the solar capital because of the rapid increase in PV installations. More than 9 000 m^2 of PV modules have been installed in Berlin, with a total generating capacity of nearly 800 kW. These include the presidential residence, the town hall, and many other ministries and public buildings.

The new Innovation Centre for Environmental Technology in Berlin-Adlershof was developed by the Berlin Energy Agency, and financed through a partnership between the Energy Agency, the local energy provider BTB and the owner of the building. They jointly invested in a solution to cover the working expenses of the solar installation and to sell electricity into the energy grid.

This and many of the other installations in Berlin provide excellent examples of successful PV installations, and of ecological building management.

Success factors:

- ***Political: National and regional support towards the development of photovoltaics***

German energy policy is closely linked with national policies to support climate protection. Renewable energy plays an important part in this policy, and the government has actively supported financial provision towards renewables, both at national and regional levels. Most German regions also have energy policies, targets and support mechanisms designed to encourage the development of renewable energy. PV especially has benefited from support from regional governments. For example, Berlin's energy policy was established in 1994 and amongst other things seeks to increase support for the use of renewable energy and reduce CO_2 emissions by 25 % per person from 1990 levels by 2010.

- ***Legislative: Premium-set tariffs combined with an obligation to purchase provide a stable, commercially favourable market to renewable electricity producers***

The Electricity Feed-In Law supports renewable electricity, including PV, by providing a guaranteed market and fixed price for the electricity produced from renewable energy sources. From 1 April 2000 the tariffs for PV are even more advantageous: they have been raised sixfold from EUR 0.08/kWh (DEM 0.16/kWh) to EUR 0.51/kWh (DEM 0.99/kWh). This rate is proving very attractive: the German government had to limit applications for receiving this new tariff in 2000 because the amount of money set aside for supporting it had already been reached.

- ***Financial: Loans and grants available for photovoltaic schemes***

An important stimulus to developing PV in Germany have been the PV roofs programmes. The 1 000 PV roofs programme started in 1991 and provided subsidies for production costs of PV units of 60 % in the new *Länder* and 50 % in the rest of Germany. The programme was successfully completed in 1996/97. A follow-on 100 000 PV roofs programme started in 1999, which provides EUR 560 million towards supporting individuals and small and medium-sized companies to install grid-connected PV schemes. The recent increase in tariffs available to PV installations and the corresponding rapid increase in the number of installations has meant that the target date for achieving the 100 000 roofs programme has been brought forward by one year to 2003.

The national European Recovery Programme (ERP) for Environment and Energy Savings offers long-term loans with low interest rates for investment in the use of renewable energy. The programme is administered by the federally owned Deutsche Ausgleichsbank (DtA), Bonn. Loans may amount to 50 % of investment costs, and provide favourable interest rates and loan arrangement. This programme provides grants for capital subsidies to households for PV installations.

- ***Technological development: Germany has developed a successful domestic photovoltaics cells and components manufacturing industry***

High levels of federal support for research and development have helped to build a strong and competitive domestic PV industry. Almost one third of the funding support provided from the federal government towards energy research and technology is focused on renewable energy. In 1996 expenditure was approximately EUR 100 million. The majority of the funds are devoted to solar applications, particularly PV. This, combined with the expanding domestic PV market, has made Germany a location of choice for new manufacturing plants. More than half of Europe's PV manufacturing capacity is now located in Germany.

- ***Information, education and training: Local energy agency stimulates private and public interest in photovoltaics***

At the local community level, there is high environmental awareness among German citizens, particularly of energy issues. In addition, energy agencies play an important role in stimulating the demand for PV installations.

In Berlin, for example, the approach is to encourage links between private sector and public organisations to build strong local partnerships to implement PV solutions. To achieve this, the Berlin authorities supported the establishment of an energy agency, in conjunction with developing support programmes. The Berlin Energy Agency is responsible for informally coordinating active links between the Berlin Senate, Berlin businesses and energy utilities to implement new PV projects on new public and private buildings.

5.4. Germany — Solar thermal

Germany is leading the way on solar thermal energy.

In 1993:	21.0 ktoe
In 1999:	75.4 ktoe
Increase 1993–99:	54.4 ktoe, 260 %

Many German municipalities have seen a rapid increase in the uptake of thermal solar installations. Examples of some successful municipalities in south-west Germany include:

— Freiburg: more than 200 domestic installations (2 500 m^2) achieved by 1996;
— Friedrichshafen: nearly 5 000 m^2 of collectors installed to support solar-assisted small-scale district heating and hot-water systems;
— Ulm: installation of a central hot-water system for 38 homes and a district heating system (heat and hot water) for 86 residential units, in which heat from solar collectors is used together with a combined heat and power plant fired by biomass and gas.

These examples illustrate the variety of innovative ways in which German municipalities are promoting a greater use of solar energy for thermal energy requirements. Both small and larger-scale installations (more than 500 m^2) are being established, and interest in large-scale solar heating opportunities is increasing, with most of these installations supplying heat to residential buildings.

Success factors:

• ***Political: National and regional support towards increasing use of solar thermal installations***

Political support from national and regional governments is translated into practical implementation measures in the form of targets, grants, research support and other actions aimed at increasing the level of renewable energy use. Many regions or municipalities have targets for increasing their level of renewable energy use, which often place a strong emphasis on renewable energy and energy savings, linked with climate protection objectives. Regions also see solar hot-water systems as important components in implementing Local Agenda 21 (opportunities for carrying out climate protection initiatives at the local level) in their region.

• ***Financial: Federal government and private sector financial support to solar thermal installations***

A wide range of federal, regional and private sector financial support is available for solar installations. These include:

— Federal government support: The federal government's Solarthermie 2000 demonstration programme subsidised the construction of the long-term hot-water storage and the district heating system in Friedrichshafen, contributing 53 % towards total costs.
— Regional support: In Friedrichshafen, 9 % of total costs came from regional support measures.
— Energy utilities: The role of the local municipal energy company is also important. In Freiburg, for example, the company provided financial support of EUR 230/m^2 (part-financed from EU funds). In Friedrichshafen, the owners and operators of the district heating system have responsibility for overall risk and guarantees of the system.

Local people can also benefit from low interest rates provided by local or regional banks for solar installations. A number of financial institutions in Germany have supported both community- and non-community-based renewable energy projects with favourable financing packages.

• ***Administration: Active support provided from municipalities for solar thermal installations***

One important factor is the role played by both the municipality and the local energy utility in encouraging the uptake of solar heating. The municipality collaborates closely with the utility in establishing and implementing energy planning and municipal energy policy and targets.

- ***Technological development: Quality standards provided to guarantee results from solar collectors***

GRS (Guaranteed Results from Solar collectors) is an initiative established by several municipal utilities in 1993, coordinated by municipalities. Its purpose was to ensure that the annual amount of heat supplied by a solar collector was guaranteed by the manufacturer, thus allowing for precise cost–benefit calculations and ensuring that systems met customer needs. Its application has helped to boost consumer confidence in the quality of the new types of heating systems available in Germany, and in particular those produced by German manufacturers.

- ***Information, education and training: Active promotion of the benefits of solar thermal installations by municipalities, utilities and local energy agencies***

Close collaboration between municipality and utility has led to a combined effort to both disseminate and improve public relations in order to promote renewable energy uptake. Specialist advice centres have been established through local energy agencies to provide technical and practical support to local associations for solar installations, but also to support demonstration schemes.

Public awareness of energy and environmental problems, and the opportunities for renewable energy, is strong in Germany.

5.5. Germany — Wind energy

Germany has established itself as the world leader in wind power, with the help of a feed-in law.

In 1993:	674.0 GWh
In 1999:	5 528.0 GWh
Increase 1993–99:	4 854.0 GWh, 720 %

Germany increased the number of turbines installed considerably during the 1990s. Many of the projects established in Germany before the mid-1990s were small to medium-sized installations, often with a high degree of participation from the local community. One example is the Halde Nierchen wind farm in the state of Nordrhein-Westphalia. This wind farm comprises nine 1-MW turbines. The wind farm was built in 1998, and all power generated from it is sold to the local public utility EBV under the Electricity Feed-In Law.

Success factors:

- ***Political: National and regional support towards wind energy development***

Federal support for renewable energy started more than 10 years ago with the 250 MW Wind Programme. This was initiated in June 1989 as a 100 MW Wind Programme and was extended in February 1991 to 250 MW. The programme's aim was rapidly achieved, and by 1999 Germany had more than 4 000 MW installed capacity. Political support from government is mainly through the feed-in law, grants and research support. Many German regions or municipalities have targets for increasing their level of renewable energy utilisation, including wind energy use.

- ***Legislative: Premium-set tariffs combined with an obligation to purchase provide a stable, commercially favourable market for renewable electricity producers***

The single most important factor for the rapid and successful implementation of wind energy in Germany is its feed-in law. From 1991–2000, the Electricity Feed-In Law provided a guaranteed market and fixed price for the electricity produced from renewable energy sources. Wind energy schemes benefited considerably during the late 1990s from the favourable tariffs available through these support measures, and the feed-in law and its successor, the Renewable Energy Sources Act (2000), continue to be the principal mechanism for achieving the rapid uptake of wind energy in Germany.

Under the feed-in law, operators of the grid were obliged to purchase electricity produced from renewables within their respective supply areas, at agreed and fixed prices. For wind power the price available in 1997 was DEM 0.1715/kWh (EUR 0.088/kWh). In order not to overburden grid operators in areas where there were high rates of renewables generation with having to purchase at premium prices, a limit of 5 % renewable electricity was set from 1998 that applied within each region. Above this mark, operators of the grid were exempted from the obligations of purchase and refund.

As the amount of electricity from renewable sources expanded, a number of regions exceeded the 5 % ceiling. There was also an uneven financial burden between grid operators in regions close to the 5 % ceiling and regions with low levels of renewables generation. In order to address these and a number of other issues the law was replaced by the Renewable Energy Sources Act (2000). This continues to provide a guaranteed market and fixed favourable tariffs for electricity generated from renewable sources. The 2000 Act abolished the 5 % cap and introduced a system that allows transmission grid operators to share amongst themselves the costs of compensation to renewable electricity producers.

- ***Fiscal: Tax exemptions are available to investment in renewable energy technologies***

Private individuals can offset the costs of investment in a wind farm against tax. This makes wind farms an attractive investment option, especially for smaller investors, and can lead to a proportion of the capital costs for new wind farm developments being financed by the general public.

- ***Financial: Subsidies and low-interest loans are available to wind energy projects***

Many German regions provide financial support to renewable energy schemes, including investment subsidy programmes, to implement their energy policies. Nordrhein-Westphalia, for example, actively supports renewable energy, and in 1997 alone provided some EUR 10 million to financially support environmental energy projects, including some wind energy projects.

A number of German financial institutions provide low-interest loans suitable for renewable energy projects. For example, the European Recovery Programme (ERP) — Environment and Energy Savings offers long-term loans with low interest rates for investments in the use of renewable energy. The programme is administered by the federally owned Deutsche Ausgleichsbank (DtA), Bonn. Loans may amount to 50 % of investment costs, and provide favourable interest rates and loan arrangement. Loans to wind energy projects over the 1990–97 period reached DEM 3.48 billion (EUR 1.78 billion) out of the DEM 4.18 billion (EUR 2.13 billion) disbursed to renewable energy projects.

The Halde Nierchen scheme received no grants but does benefit from a soft loan from the Nordrhein-Westphalia regional government under its Rationelle Energie Nutzung (Rational Use of Energy) programme.

- ***Administration: Planning guidance is being developed in some regions to identify areas for wind developments***

Public acceptance is becoming a problem in areas with a number of wind turbines. To help to overcome local opposition to wind power developments, planning guidance is now being developed in some regions to identify areas open to or barred from wind developments. In addition, national land use directives are in preparation to indicate how much renewable energy should be developed in each of the regions, particularly in regions (such as Nordrhein-Westphalia) where there is a high level of wind energy developments.

The planning issues associated with the Nordrhein-Westphalia scheme were complex, largely because the farm is on the border of two regions and so approval from both regions was needed before the developers could go ahead, which took 3–4 years. There are no plans to strengthen coordination within and between the *Länder* of measures to promote renewable energies.

- ***Technological development: A strong and expanding German wind energy industry***

Germany's wind energy manufacturing industry is expanding to meet the increasing demand for domestic installations, both through indigenous companies and through joint ventures, especially with Danish companies. This expansion is made possible because manufacturers are confident of a steady future market based around the continuation of the feed-in law in the Renewable Energy Sources Act.

- ***Information, education and training: Active involvement of locals in wind energy projects***

There is generally a high level of environmental awareness amongst German citizens and an interest in wind energy as an alternative to other energy sources. Wind energy is of especial interest to farmers, who see it as an opportunity to provide an alternative income stream through land rentals or through electricity sales.

Many wind farms are part-financed by local community subscriptions. In the Halde Nierchen scheme, the developer held public meetings in local communities to raise interest in the scheme. Just over 30 % of the scheme subscribers are resident in the local area.

5.6. Spain — Photovoltaics

Electricity from photovoltaics (PV) has recently increased dramatically in Spain, placing Spain among the leaders in PV exploitation in Europe.

In 1993:	1.2 GWh
In 1999:	17.0 GWh
Increase 1993–99:	15.8 GWh, 1 330 %

Spain has high potential for photovoltaic (PV) energy. PV electricity has been expanding rapidly in particular since 1998 when it received increased financial support through national feed-in tariffs. Financial support by regional authorities is also encouraging PV development in some of Spain's 17 autonomous communities.

Success factors:

- ***Political: Support for renewable energy implementation at both national and regional level***

The national Energy Saving and Efficiency Plan (PAEE), 1991–2000, aimed to increase the overall use of renewables by 1.1 mtoe by the year 2000, including an increase in the contribution of non-hydro renewables in electricity generation from 0.5 % in 1990 to 1.4 % in 2000. This support is endorsed and implemented at the regional level. PAEE provided funds for energy projects at national level until 1999, when responsibility for distributing the funds was transferred to each autonomous region. The Plan de Fomento de las Energías Renovables (2000–10) sets out new targets and aims to double renewable energy to 12 % of gross inland energy consumption by 2010.

Regional encouragement of PV energy has been particularly strong in the Canary Islands, Andalucia and Castilla la Mancha regions.

- ***Legislative: Premium-set tariffs combined with an obligation to purchase provide a stable, commercially favourable market for renewable electricity producers***

A series of royal decrees during the 1990s provided support for electricity generation from renewable energy sources, wastes and combined heat and power. The decrees guaranteed the purchase of electricity from renewable sources at a premium fixed price. The 1994 decree determined the fixed tariff for solar electricity at ESP 10.42/kWh (EUR 0.06/kWh). The 1998 decree drastically increased the fixed tariff for solar electricity to ESP 66/kWh (EUR 0.39/kWh) for PV installations smaller than 5 kW, or ESP 36/kWh (EUR 0.22/kWh) for larger installations. The 1998 legislation also provided guaranteed access to the electricity grid, with agreed rates for connection.

- ***Financial: State and regional subsidies available***

The PAEE has provided subsidies in the form of capital grants, initially up to ESP 800/Wp (4.8 EURO/Wp) for grid-connected systems and up to ESP 1 600/Wp (EUR 9.6/Wp) for non-grid-connected systems. Since 1996 PAEE has provided subsidies up to ESP 600/Wp (EUR 3.6/Wp) and ESP 1 200/Wp (EUR 7.2/Wp) respectively. Since 1997 only certain regions of Spain have been eligible for grants.

In addition to PAEE the autonomous regions have established support for investment and financing of renewable energy projects. Programmes such as Prosol and Procasol provide capital incentives for the provision of energy to isolated rural communities, hotels and leisure centres in Andalucia and the Canary Islands. Technologies such as PV home systems are eligible for support under these programmes.

For example in Andalucia, subsidies of EUR 11.9/Wp for non-grid-connected systems are available and EUR 8.92/Wp for grid-connected installations.

- ***Administration: Local involvement in renewable energy planning combined with collaboration among local, regional and national administrations***

Responsibility for renewable energy sources belongs chiefly to the autonomous communities (the regions). In particular, this allows each region to have authority over the various administrative procedures including planning and environmental impact assessments, to implement renewable energy projects.

Successful implementation of PV projects is mostly met where collaboration at all levels of administration (local, regional and national) is achieved.

5.7. Spain — Wind energy

Spain is rapidly becoming one of the leaders in wind power exploitation in Europe.

In 1993:	116 GWh
In 1999:	2 744 GWh
Increase 1993–99:	2 628 GWh, 2 266 %

Spain has high wind energy potential. Wind energy development is expanding considerably, mostly due to financial support through national feed-in tariffs but also because of capital subsidies, in particular at the beginning of a development. Expansion may, however, be held back by lengthy procedures to obtain planning permission.

Navarre was one of the first regions to actively support wind developments, opening the way for other Spanish regions. Spain now has successful wind energy developments in many regions.

El Perdon wind farm is one of the projects developed in Navarre by Energia Hidroelectrica de Navarre (EHN). The first phase, of six 500-kW wind turbines, came into operation in 1994 as an initial demonstration. More turbines were installed in 1995–96, and total installed capacity is now 20 MW. Based on its early successes, EHN is now a leading developer of wind energy projects throughout Navarre and other regions.

Success factors:

- ***Political: Support for renewable energy implementation at both national and regional level***

The national Energy Saving and Efficiency Plan (PAEE), 1991–2000, aimed to increase the overall use of renewables by 1.1 mtoe by the year 2000, including an increase in the contribution of non-hydro renewables in electricity generation from 0.5 % in 1990 to 1.4 % in 2000. This support is endorsed and implemented at the regional level. PAEE provided funds for energy projects at national level until 1999, when responsibility for distributing the funds was transferred to each autonomous region. Spain has already reached the 2000 renewables target. The Plan de Fomento de las Energías Renovables (2000–10) sets a new target of 12 % share of renewables in gross inland energy consumption by 2010.

The regional government of Navarre developed an energy plan in 1996 with the aim that by 2005 all electricity generated in Navarre will come from renewable energy sources, of which about 50 % will be from wind energy.

- ***Legislative: Premium-set tariffs combined with an obligation to purchase provide a stable, commercially favourable market for renewable electricity producers***

The main driving force behind renewable energy comes from a series of royal decrees during the 1990s on support for electricity generation from renewable energy sources, wastes and combined heat and power. The decrees guaranteed the purchase of electricity from renewable sources at a premium fixed price, at 80–90 % of the average electricity tariff from conventional power sources. From 1999, wind electricity producers could receive either the fixed tariff of ESP 10.42/kWh (EUR 0.06/kWh) or the average hourly market price of electricity plus a bonus of ESP 4.79/kWh (EUR 0.03/kWh). The legislation also provides for guaranteed access to the electricity grid, with agreed rates for connection.

- ***Financial: State and regional subsidies available***

The PAEE provided subsidies in the form of capital grants, up to 30 % of eligible costs of the project. In addition, each autonomous region has established relevant support for investment and project financing. Because of the success of wind energy in Spain, support available through the PAEE was reduced during the PAEE period (1991–2000), both for the systems and regions eligible for capital subsidies, and for the subsidy provided per project.

- ***Technological and industrial development: A thriving wind manufacturing industry has been established in the region***

Decreasing costs of investment and operation, and the greater maturity of the technology, have greatly helped the development of Spain's wind energy industry.

Navarre is a highly industrialised region, and support for new wind energy developments was seen to provide not only environmental benefits but also economic benefits through new employment and general economic development. As a result of the high level of new wind farm developments in Spain, especially Navarre, Gamesa Eolica is now the major manufacturer of turbines in Spain and one of the world market leaders in the sector.

The installation of the first phase of the El Perdon wind farm led to the set-up of three factories in Navarre — one for blades, another for towers and a third for turbine assembly. The wind industry in Navarre now provides employment for over 1 000 people in the region. EHN has expanded its operations to other regions of Spain, installing 211 MW new wind capacity during 1999 (total capacity reaching 418 MW in that year). The aim for 2000 was to install a further 480 MW, and to achieve 1 000 MW new capacity each year between 2001 and 2003.

- ***Administration: Local involvement in renewable energy planning***

Responsibility for renewable energy sources belongs chiefly to the autonomous communities (the regions). This allows each region to have authority over the various administrative procedures, including planning and environmental impact assessments, when renewable energy projects are implemented.

The Navarre regional government actively supported the development of procedures to authorise wind farms in the region. It established the public–private company EHN to develop the region's renewable energy resources. EHN's shareholders include the government, the regional electricity supply company, local industry and the regional bank. In June 1996, the government of Navarre approved EHN's Wind Power Development Plan for the region, with a target to install 575 MW by 2010.

- ***Information, education and training: Active promotion of the benefits of renewable energy by wind energy developers***

Wind energy developers, including EHN, actively carry out consultations with a very wide range of interested parties before establishing new projects. Consultees vary widely and include municipal councils, conservationists and mountaineering organisations. There are also ongoing campaigns both by the private developers and by the municipalities to provide information to the general public about the benefits of wind energy and the status of the region's energy plan, to ensure continued public awareness and support.

5.8. Sweden — Biomass district heating

Forestry is one of the most important natural resources in Sweden, which has a long history of making use of this resource for fuel.

In 1993:	365.9 ktoe
In 1998:	571.3 ktoe
Increase 1993–98:	205.4 ktoe, 56 %

District heating systems are widespread in Sweden, with over one third of the total domestic heat market supplied from district heating. There are nearly 200 plants, and biomass is one of the main fuel sources. Biomass as a fuel source for district heating plants has been increasing steadily over the past two decades, particularly to replace electricity for heating. Biomass resources now meet more than 50 % of the fuel supply to district heating networks.

Success factors:

- ***Political: Support for renewable energy use, especially biomass***

The overall objective of Sweden's energy policy is to secure the long- and short-term energy supply on economically competitive terms, with an emphasis on sustainable development. Sweden has a policy to prevent an increase in carbon dioxide emissions, and it has also made commitments to phase out its nuclear generation capacity.

Long-term support for research and development into new and renewable energy technologies, and a greater use of renewable energy, are two principal means of achieving these aims. Biomass especially plays a vital role. Sweden has a policy objective to replace electric domestic heating with combined heat and power or district heating systems, especially making use of biomass for fuel.

- ***Fiscal: Tax system benefits biomass use***

Biomass is exempted from the energy tax, the carbon dioxide tax and the sulphur oxides tax. The increase in biomass district heating has been greatly helped by the introduction of carbon and energy taxes as their application made other options, in particular coal-fired district heating plants, more expensive.

- ***Technological development: Active development and promotion of biomass technologies***

Swedish research and development actively supports technological developments in renewable energy. Biomass research, development and demonstration receive total funding of about SEK 400 million (EUR 35 million) per year from the government. Electricity companies and other industries also provide funds. The main areas of support are combustion and conversion technologies, demonstration of pre-competitive technologies, fuel production, harvesting supply programmes and ash recycling.

- ***Administrative: Municipalities actively support the establishment of biomass district heating systems***

Development of biomass district heating systems is primarily the responsibility of each municipality. Most domestic district heating systems are owned and operated by municipalities, or by private companies on their behalf. Biomass-fuelled district heating provides economic and environmentally sustainable heating for domestic and industrial use, whilst at the same time providing economic benefits through employment of the local population and a disposal option for sawmill wastes. A number of municipalities have recognised the socio-economic and environmental benefits from biomass district heating and are proactively promoting biomass-fuelled systems.