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Good Energy Projects in Europe

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Examples of Projects Suitable for
Structural and Cohesion Funds



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WWF European Policy Office, January 2005

Introduction

The EU has defined an indicative long-term global temperature target of not more than 2°C above pre-industrial levels.¹ The German Advisory Council on Global Change has also recently proposed the same global temperature target and a CO₂ concentration target of 450 parts per million of CO₂ (ppm), based on an extensive evaluation of limits to climate change for ecosystems, food production, water availability, economic development and human health². In order to achieve this, the world will have to reduce emissions far more substantially than the 8% by 2008-2012 mandated (for the EU) by the Kyoto Protocol, by 2020 the EU needs to reduce its emissions by around 30%.

The energy sector is responsible for approximately 30% of the EU's CO₂ emissions and thus can play a significant role in meeting the necessary reduction strategy. This can be achieved; both by reducing the level of energy consumed and by switching to sustainable energy systems that do not produce significant levels of CO₂.

In July 2004 the European Commission published its draft legislative proposals on cohesion policy reform. This reform will affect the distribution of €336.1 billion for projects over the 2007-13 period. Under the Convergence objective of Structural Funds, through the Cohesion Fund, a specific budget for investment in both energy efficiency and renewable energy has been established.³

Historically, renewable energy and energy efficiency have not received significant funding from Structural Funds or Cohesion Fund programmes. Therefore, the creation of a specific priority for the support of renewable energy is a welcome development to stimulate this sector.

The May 2004 EU Communication on electricity from renewable sources shows that in recent years there has been a considerable increase in the use of renewable energy⁴. However, it suggests that the current increase in growth will, without further policy initiatives from Member States, only result in 18-19% of electricity from renewable sources by 2010, rather than the 21%

¹ Decision No 1600/2002/EC of the European Parliament and of the Council of 22 July 2002 laying down the Sixth Environmental Action Programme of the European Community, OJ L242/1, 10th September 2002.

² WGBU (German Advisory Council on Global Change) "Climate Protection Strategies for the 21st Century: Kyoto and Beyond" Special Report, Berlin 2003.

³ Cohesion policy: the 2007 watershed: Inforegio, Fact Sheet 2004: European Union Regional Policy.

⁴ Communication From The Commission To The Council And The European Parliament The share of renewable energy in the EU Commission Report in accordance with Article 3 of Directive 2001/77/EC, evaluation of the effect of legislative instruments and other Community policies on the development of the contribution of renewable energy sources in the EU and proposals for concrete actions. May 2004

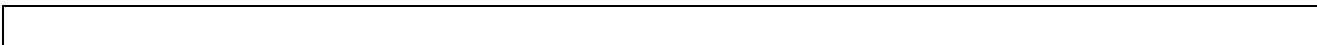
target of the directive⁵. The Communication further notes that some renewable energy technologies, such as wind power, are in line to meet and even surpass the targets of the Directive, while others, in particular biomass are not being developed as envisaged and will require additional policies or measures to meet the required level.

During 2005 the EU institutions are expected to adopt a Directive on Energy Services, which will set a target to increase the efficiency of Europe's economy. To enable this target to be met further investment in energy efficiency must be allocated.

The key targets and objectives in the renewable energy and energy efficiency sector that the EU have set, which will be assisted by further funding for these sectors from Structural Funds and the Cohesion Fund, are:

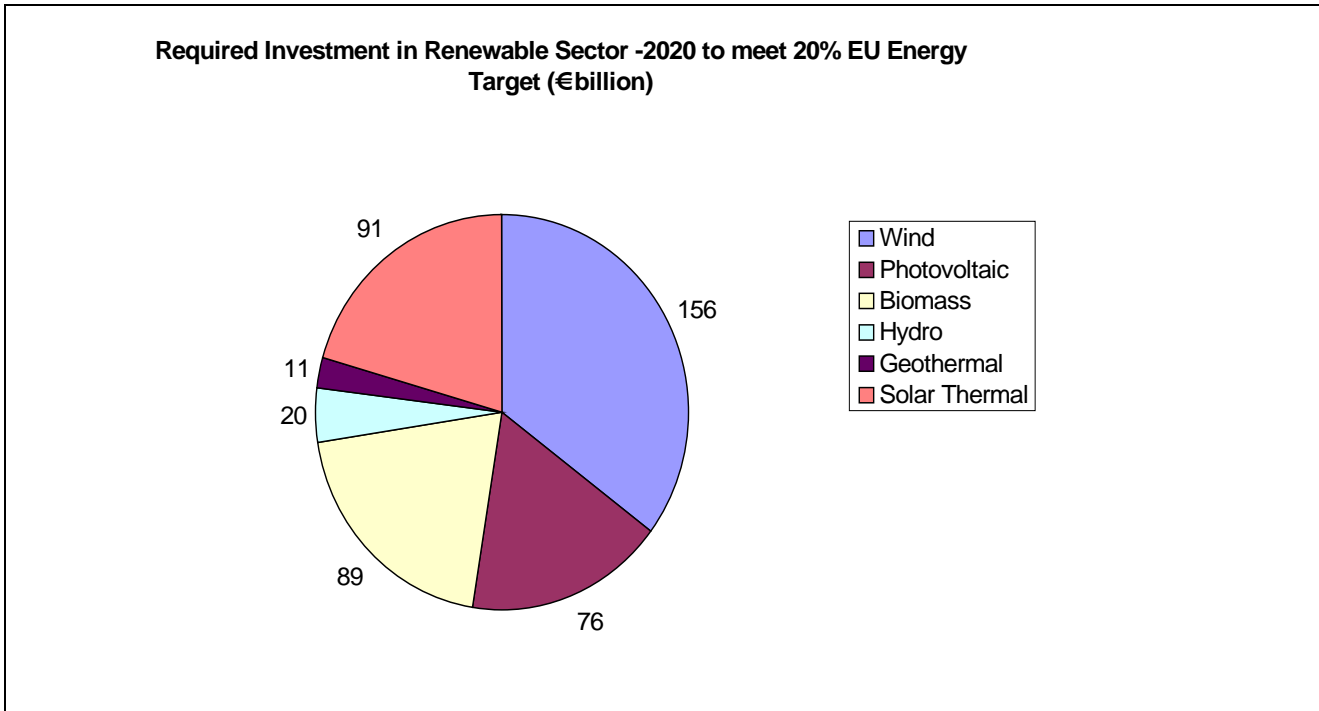
- Renewable Energy Directive 2001: to establish a framework to increase the share of green electricity from 14-22% of gross electricity consumption by 2010.
- Directive on liquid biofuels 2003: to establish a framework to enable targets of 2% by 2005 and 5.75% by 2010 to be met.
- Directive on Energy Performance of buildings, 2002, savings potentials of 22%.
- Directive on Promotion of Energy End-use Efficiency and Energy Services, current under debate in EU institutions, a 1% increase in efficiency per year.

Furthermore, it has been estimated that in order to enable the EU to produce 20% of its energy by renewable energy 2020, there will need to be €443 billion of investment in the sector⁶. This will require investment in all types of renewable technology and size of projects. The figure below estimates the investment required in the different renewable technologies. As renewable energy technologies create higher employment rates than other energy technologies it will result in the creation of around 2 million full time jobs by 2020.



⁵ Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001, on the promotion of electricity produced from renewable energy sources in the internal electricity market, Official Journal of the European Communities, L283/33, recital 1.

⁶ Renewable Energy Target for Europe, 20% by 2020: European Renewable Energy Council, January 2004, page 14. EREC Refer



Source: EREC 2004

This paper details a number of sustainable energy projects across the EU, some of which that have received EU funds. These projects show that sustainable energy technologies can be developed across the EU using a variety of different technologies and provide energy, income and jobs without significantly impacting on the environment. Given the thousands of renewable energy and energy efficiency projects that now exist in Europe there are no doubt hundreds of equally viable and pioneering projects. However, this is not the key point. What is important is that renewable energy and energy efficiency projects are technologically viable, environmentally sustainable and economically competitive and only lack, if anything, the political will to enable the growth in their sectors to continue and escalate.

The development of a new budget line item for Structural Funds and Cohesion Funds specifically for the development of renewable energy should build on the existing experience to rapidly develop and implement sustainable energy systems in Europe.

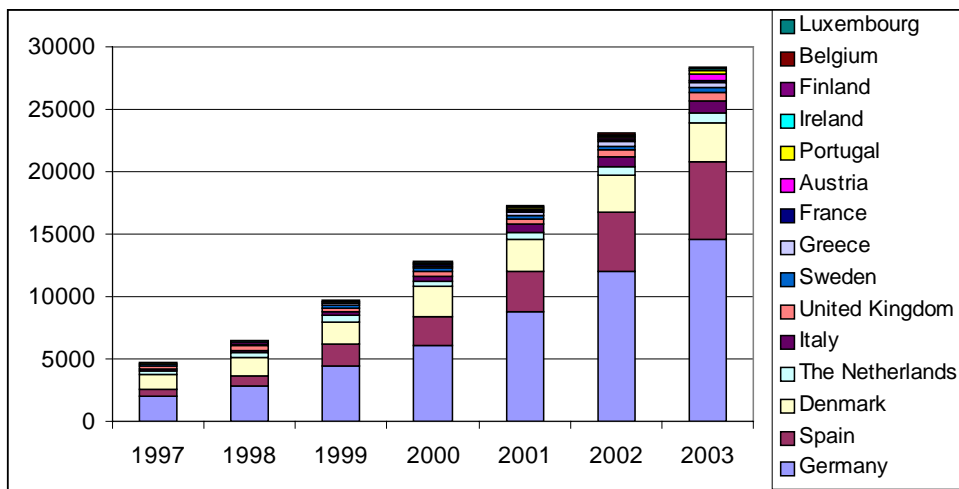
Index

<u>Introduction</u>	2
<u>Index</u>	5
<u>Wind Power</u>	6
<u>Projects that have already received Structural Funds.</u>	6
<u>Monte Chaos: Portugal</u>	6
<u>Greece:</u>	7
<u>UK: Welsh offshore Wind:</u>	8
<u>Other Suitable Projects:</u>	9
<u>Pori On Shore Wind Farm: Finland</u>	9
<u>Copenhagen Offshore Wind Farm: Denmark</u>	9
<u>Arklow Offshore Wind Farm - Ireland.</u>	10
<u>Small Scale Hydro</u>	10
<u>Projects that have already received Structural Funds.</u>	11
<u>Greece:</u>	11
<u>Other Suitable Projects:</u>	12
<u>Cottbus: Germany</u>	12
<u>Solar Thermal</u>	13
<u>Suitable Projects</u>	13
<u>Solar assisted District Heating: Germany</u>	13
<u>Andasol- Spain</u>	14
<u>Solar Photo Voltaic</u>	15
<u>Suitable Projects</u>	15
<u>German Government Support:</u>	15
<u>Geothermal</u>	16
<u>Suitable Projects</u>	16
<u>Ferrara- Italy</u>	16
<u>Lund- Sweden</u>	17
<u>Biomass</u>	17
<u>Projects that have already received Structural Funds.</u>	17
<u>UK - Welsh Wood Energy Scheme :</u>	17
<u>Other Suitable Projects</u>	19
<u>Güssing (Burgenland)</u>	19
<u>Energy Efficiency</u>	19
<u>Suitable Projects:</u>	20
<u>Ekodoma-Latvia</u>	20
<u>Energaiia- Portugal</u>	20
<u>Funding Mechanisms</u>	21
<u>Bulgarian Renewable Energy and Energy Efficiency Credit Lines:</u>	21
<u>Education and Demonstration:</u>	23
<u>Projects that have Already Received Structural Funds</u>	23
<u>UK: Eden Project:</u>	23
<u>Conclusions and Recommendation</u>	24

Wind Power

Wind energy is the fastest growing renewable energy source in Europe. During the past decade the annual growth rate globally has been 30%, seeing a rise from 2.5 GW in 1992 to 40 GW in 2003, with three quarters of this growth being in Europe. According to the European Wind Energy Association (EWEA), current growth projects will see wind energy contributing 12% of the EU-15's electricity by 2020⁷. The graph below shows the growth of wind power in Europe.

Wind energy capacity growth in EU15 1997-2003 (MW)⁸



Furthermore, the European wind industry has 90% of the world equipment market with nine of the world's ten largest wind turbine manufacturers are based in Europe. The industry employs 72,000 people, up from 25,000 in 1998. While costs per kWh have fallen by 50% over the last 15 years.

The use of wind can be further accelerated especially if the potential for off-shore wind, which is estimated to be up to 3,000 Twh/year, were it to be even partially captured. Structural Funds can and should be used to finance the development of new wind capacity and in particular to connect these facilities to the grid.

Projects that have already received Structural Funds:

Monte Chaos: Portugal⁹ 10

⁷ Wind Energy: The Facts, An Analysis of Wind Energy in the EU-25: European Wind Energy Association, Executive Summary, VI.

⁸ COMMUNICATION FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT The share of renewable energy in the EU Commission Report in accordance with Article 3 of Directive 2001/77/EC, evaluation of the effect of legislative instruments and other Community policies on the development of the contribution of renewable energy sources in the EU and proposals for concrete actions. May 2004

This was the first wind farm to be built and operated in Portugal and came into operation in 1992. The entire wind farm consists of 12 Wind World W-2800 turbines made in Denmark, each are 150 kW. Each turbine is 31 m high and has a rotation diameter of 28 m, which means that each blade sweeps 612 m² of air, giving a total of 7 344 m² for the farm as a whole. The turbines are distributed in three groups of four. They are interconnected and are managed using a fibre optics system. At the time this was leading edge technology making it possible to command and control the turbines from a distance, even from as far away as Denmark, since the system operates across more than 3,000 Kms.

The wind farm generates a current of 380 volts collected by three transformer stations, where the voltage is converted into 15 000 volts and injected into the network managed by the EDP, the national electricity company. The maximum power of each generator is 150 KW/hour, which is attained when the wind speed reaches 11-12 m/s or 40 km/hour. The annual output of the wind farm is around 2.5 million KWh. This is equivalent to 218 Tonnes of Oil Equivalent (Toe) per year and represents 2535 tons of CO₂ savings per year.

The project is part funded by the European Regional Development Fund (through the Valoren programme). Work began in April 1991 and within six months the first electricity was generated. The total cost of the project was Euro 280.000, of which 190.000 was from the EU (in 1992 prices).

In the decade since the project was realised the wind sector has developed almost beyond recognition and this development would nowadays not be remarkable. Furthermore, it is important to recognise that renewable energy projects have a proven track record for receiving funding from Structural Funds.

Greece¹¹:

In the early 1990s, due to lack of exploitation, that Government decided to promote wind technology and with European Union assistance, set up a programme to establish wind parks. Financial incentives to attract private investors proved to be very successful, with the private sector contributing 60% of the total cost of the projects.

The proposals were assessed on the basis of a series of criteria relating to technical aspects and the choice of sites. Some of these criteria included: exposure to prevailing winds, open location, proximity to a local electricity distribution system,

⁹ http://europa.eu.int/comm/regional_policy/projects/stories/details.cfm?pay=PT&the=20&sto=97&lan=5

¹⁰ http://erg.ucd.ie/public/pdffiles/res/case_studies/we_20.pdf

¹¹ http://europa.eu.int/comm/regional_policy/projects/stories/details.cfm?pay=GR&the=20&sto=822&lan=5

distance from houses, and respect for archaeological heritage and nature preservation. Of the 19 projects approved, 15 have been successfully completed, providing a total installed power of 119.2 megawatts. 12 projects were located in the department of Euboea, two in the Dodecanese and one in the Cyclades Islands. Inspection of completed projects has shown that in general they have achieved their energy objectives. Twenty-one permanent jobs have been created and a number of temporary jobs for local residents were also created during the construction.

The total costs of these projects were Euro 127.993 million, of which Euro 38.4 million came from Structural Funds:

Within the old Member States, Greece is one of two countries that have been identified by the European Commission as unlikely to meet the target of the electricity from renewable energy directive. Despite growth in the renewable and in particular wind power sector, the current forecasts suggest that much more needs to be done. It is therefore essential that similar projects be replicated. Furthermore, many of the barriers that stifle the introduction of renewables in Greece are to be found in other countries and in particular in new Member States of the EU.

UK: Welsh offshore Wind¹² ¹³:

The feasibility assessment of the Ryhl Flats off-shore wind farm is currently being undertaken. If established, this would comprise around 30 turbines generating between 60 and 100MW of clean energy. This would help meet the region's target of increasing to 5 % the share of energy produced from renewables by 2008. The total cost of the project is around £110 million (€160 million) The completed wind farm would be likely to generate output equivalent to 1.5% of Welsh electricity demand. This feasibility project was approved in June 2002 for ERDF funding, which will fund £313,000 from a total of £1,640,000.

Across the European Union around 587 MW of offshore wind is currently deployed with a further 30 GW of installed capacity in various stages of planning and development¹⁴. In the coming decade the development of offshore wind will be crucial if the EU is to meet its targets for the increased use of renewables and also its Kyoto CO₂ reductions commitments. Structural Funds can and should be used to part-fund the infrastructure or the site preparation and development. Given the relative infancy of the technology financial assistance through the Structural Funds programme could make a crucial difference.

¹² <http://www.wefo.wales.gov.uk/default.asp?action=projectdetail&ID=86&ProjectID=53810>

¹³ <http://www.fhc.co.uk/cowl/>

¹⁴ British Wind Energy Association: <http://www.bwea.org/offshore/worldwide.html>

Other Suitable Projects:

Pori On Shore Wind Farm: Finland¹⁵

Pori is the tenth largest city in Finland, located in the Gulf of Bothnia. In 1997 it joined the Energy-Cities network and the Cities for climate protection. In 1993 the first wind turbines were construction and on the basis of this experience in 1999 construction began on, at the time, Finland's largest wind farm and an information centre on wind energy and renewables.

Eight 1 MW turbines were constructed at a cost of €8.5 million. The Finnish Government provided subsidies of around 33% of the total costs. One year after completion the turbines were generating nearly 18 000 MWh of electricity, which the resultant avoidance of 12,700 t of CO₂, 50 tSO₂ and 40tNox per year.

The information centre construction costs were €255,000 and in the first two years of operation had 10 000 visitors. Two permanent jobs have been created, one for the visitor centre and the other for maintenance of the facility. Plans are being developed for the expansion of the facility.

Renewable energy is not without environmental impacts and particular concerns, usually visual, have been raised across Europe about the use of wind power. These concerns have often resulted in the delay or even cancellation of many economically and technically viable wind energy projects. Every attempt should therefore be made engage the local public in the issues, to allow discussions on the wider advantages of wind power. The construction of an information centre at this site is an important element of this public information campaign.

Copenhagen Offshore Wind Farm: Denmark¹⁶

Within the next decade utilities plan to develop 750 MW of offshore wind in Denmark. One such project is the construction of a 40 MW project, outside the Copenhagen harbour.

The groundbreaking aspects of the project are not restricted to the technology, but also its ownership structure, as 50% is owned by a co-operative and 50% by the local utility. Initially the shares on the co-operative were restricted to local inhabitants, but this was then open to all citizens.

Project Specification: Twenty 2 MW turbines were placed 2 km outside the Copenhagen harbour. The inauguration of the site took

¹⁵ <http://www.managenergy.net/products/R136.htm>

¹⁶ <http://www.managenergy.net/products/R435.htm>

place in May 2001. Details of the production from the turbines can be found at <http://www.middelgrund.com/>, but the annual production is around 90 GWh per year. The total cost of the project is €45 million, with electricity production costs expected to be €5.3 per kWh.

This project is of particular importance as it has a novel ownership structure, being jointly owned by the local population and utility. This type of co-ownership is relatively prevalent in Denmark and is often given as one of the reasons for the high level of market penetration of wind power¹⁷.

Arklow Offshore Wind Farm - Ireland¹⁸.

Airtricity first made an application to the Department of Marine and Natural Resources in June 2001 for a 200 turbine windpark (nominal 500 MW capacity). A foreshore lease was granted in January 2002, making this project the largest off-shore project with planning consent in the world. The total cost of the project is expected to be €700 million and could provide 10% of Ireland's power needs.

The first phase of this project has seen the Arklow wind farm, which is 10km off the coast of Ireland house the world's largest offshore turbines; each 3.6 MW turbine is over 120 m high, and the total installed capacity of the facility will be 25 MW. The project was undertaken jointly by the turbine manufacture GE and the utility Airtricity and will produce sufficient electricity for 16 000 households.

The scale of this project and the groundbreaking technology make this project of particular importance. In particular, this project would, if fully implemented significantly assist Ireland in meeting its renewable energy and CO₂ targets.

Airtricity announced in November 2004 that they planned to build a £480 (€690 million) million wind farm in Scotland's Upper Clyde Valley. The proposed 173 turbine wind farm, which will create 500 MW of installed capacity will produce more than 270 jobs and enough electricity to power up to 441,000 homes. The company say the project will mitigate 1.7 million tonnes of carbon dioxide - the equivalent to taking more than 400,000 cars off the road¹⁹.

Small Scale Hydro

¹⁷ <http://www.ontario-sea.org/CommunityWind/CommunityWind.html>

¹⁸ http://www.airtricity.com/download/1/Arklow_infosheet_Sept.pdf

¹⁹

Hydropower is a proven technology that already contributes 22% of the World's electricity. Small-scale hydro power plants, which are defined as smaller than 10 MW, are prevalent across Europe, with nearly 18 000 installations, with an installed capacity of 12.5 GW. The current electricity produced from these facilities is approximately 40 TWh, however, according to the European Small Hydro Association, this could be increased to 51.5 TWh by 2015 and 60 TWh by 2020-30 (in the EU-15)²⁰.

Projects that have already received Structural Funds:

Greece²¹:

In Greece, hydroelectric power stations produced 3,693 Gwh of electricity in 2000, from with a total of 4,145 Gwh from renewables as a whole (including biomass, wind energy, solar power stations, photovoltaic solar arrays, geothermal energy, etc). Most of this hydroelectric power is generated by large power stations.

However, the full potential of these large power stations has already largely been exploited or they are confronting environmental problems that limit further expansion. Even though water is a renewable resource the construction of hydro electric schemes can have significant environmental implications. However, small hydroelectricity power stations have so far been relatively unexploited, and they have a number of potential advantages over larger stations. In particular they do not require the construction of large-scale and expensive infrastructure, they are well suited to the needs of rural areas, and potentially, they have a much lower impact on the environment.

For this reason the Greek authorities decided to launch projects for small-scale hydroelectric power stations as part of the European Union supported programme for developing renewables. The private sector, which was given financial incentives to implement the projects, contributed 55% of the total cost. Although projects were planned throughout the country, they tended to be concentrated in regions with high hydroelectric potential. The nine projects that were completed successfully in the 1994-1999 period, with a total installed power of 11.5 megawatts, are situated in the departments of Ioannina (Anatoliki, Anthochori, Mikro Peristeri and Distrato), Arta (Theodoriana), Karditsa (Vatsounia), Serres (Agkistro) and Laconia (Selegoudi). The energy targets of these plants have been largely achieved. The construction work created temporary local employment and led to 12 permanent jobs.

The Anatoliki micro power station in Epirus is fairly typical of

²⁰ BlueAGE Blue Energy for A Green Europe Strategic study for the development of Small Hydro Power in the European Union ESHA - European Small Hydropower Association

²¹ http://europa.eu.int/comm/regional_policy/projects/stories/details.cfm?pay=GR&the=20&sto=819&lan=5

these smaller plants. It has an installed capacity of 700 kilowatts, for an output of 460 litres/second and with an installed capacity of achieves an annual electricity production target of fourGW/h. Difficult meteorological and geological conditions and obstacles delayed the completion of a connecting line with the electricity mains until late 1999. However, the implementation of these projects, despite the difficulties, has promoted the transfer of experience and encouraged new applications for licences to build and run small hydroelectric power stations. The total coat of the project was €17.19 million with €5.8 million coming from EU sources.

The development of small scale hydro schemes often require different financial packages than more traditional (larger) hydro schemes. Therefore this Greek project is a good example of how the group development of a series of smaller projects can function and highlights the overall contribution that a number of smaller projects can play to meet a country's energy needs.

Other Suitable Projects:

Cottbus: Germany²²

In the town of Cottbus in the Basse-Lusace region the Spree River has been exploited for 400 years. In 1995 the municipality decided to build a 'run of the river' hydroelectric power plant. By December 1996, the hydro facility was producing 2500 MWh per year and replacing alternative power which would have had emissions equivalent of 2 000t of CO₂, 14.2 t of So₂ and 5.6 t of Nox.

The electricity produced is sold a 0.077€/KWh, in line with the feed-in Law in Germany. The total investment was €2.23 million, of which 57% came from the European Commission's Thermie programme the rest coming from local government or the energy utility. It is estimated that only 60% of the hydro power resources in Germany are fully exploited and this project offers an opportunity to be significantly replicated.

The upgrading of existing facilities and schemes will both increase the efficiency and often reduce their environmental impact. This scheme highlights both this potential and the fact that it can be widely replicate across Europe, offering a clean source of power and employment.

²² <http://www.managenergy.net/products/R125.htm>

Solar Thermal

Within the EU-15 there are approximately 14 million m³ of solar thermal collectors, however the technical capacity is far higher. According to the European Solar Thermal Industry Federation (ESTIF) the technical potential is 1400 million m³, which would result in the equivalent annual yield of 682 TWh/y or 58.7 Mtoe, approximately 6% of the current EU energy consumption. The ESTIF have a target of 100 million m³ of solar thermal by 2010, however, in order to reach this target a programme of proactive policies to support solar thermal will be needed as the current growth forecast fall short of the requirement²³.

Suitable Projects:

Solar assisted District Heating: Germany²⁴ 25

Germany's first solar-assisted district heating projects were carried out as part of the governmental programme 'Solarthermie-2000'. In the first projects at Ravensburg and Neckarsulm were used largely as test facilities to assess that the roof integration and safety devices of large collector areas, as well as the system technology for solar-assisted district heating systems were adequate. The first pilot plants in Germany with solar-assisted district heating and seasonal heat storage were ready to operate in autumn 1996 in Hamburg and Friedrichshafen and in January 1999 in Neckarsulm.

This experience was used to develop district heating schemes across Germany. The table below gives details of four such projects.

The table below gives the most important technical data of the 'first-generation'-projects.

²³ Sun in Action II, A Solar Strategy for Europe, European Solar Thermal Industry Federation: <http://www.estif.org/139.0.html>

²⁴ <http://www.managenergy.net/products/R430.htm>

²⁵ <http://www.itw.uni-stuttgart.de/ITWHomepage/Sun/englisch/projects/overview.htm>

	Units	Hamburg	Friedrichshafen	Neckarsulm, Phase 1	Chemnitz (partially built)
Housing area		124 terraced single-family houses	planning: eight multi-family houses with 570 appartements	six multi-family houses, commercial center, school, etc.	planning: one office building, one hotel and one warehouse
Heated living area	m ²	14,800	39,500	20,000	4680
Total heat demand	MWh per annum	1610	4106	1663	1. stage: 573
Solar collector area	m ²	3000	5600	2700	540 vacuum tubes
Heat storage volume	m ³	4500 (hot-water)	12,000 (hot-water)	20,000 (duct)	8000 (gravel-water)
Heat delivery of the solar system	MWh per annum	789	1915	832	1. stage: 169
Solar fraction	%	49	47	50	1. stage: 30
Cost of the solar system (excluding subsidies)	Million Euro	2.2	3.2	1.5	1. and 2. stage: 1.4
Solar heat cost (excluding VAT and subsidies)	Euro/MWh	256	158	172	1. and 2. stage: 240

Andasol- Spain^{26 27}

The 50MWe Andasol plant is located in the community of Aldeire in the Marquesado valley in the Province of Granada, Southern Spain. Thanks to the high altitude (1,100 m) and the desert climate, the Marquesado Valley offers exceptionally high annual direct solar radiation of 2,200 kWh/m²yr. The 549'360m² parabolic trough solar field is arranged in 168 parallel loops. It will occupy approximately. 200 hectares of land. It will generate live steam of 100 bar/371°C to the reheat steam turbine with a cycle efficiency of 38%, gross. With an annual direct normal radiation of 2,200 kWh/m² per year, the Andasol plant will generate almost 182 million kWh per year of clean solar electricity.

Using solar beam radiation as it's primary energy, the solar plant will avoid approximately 172,000 tons of CO₂ annually in Southern

²⁶ <http://www.solarpaces.org/AndasolPaperZurich2002-04-01.pdf>

²⁷ http://www.flagsol.com/andasol_project_RD.htm

Spain otherwise being emitted by coal and heavy fuel oil operated power plants in the region. It is estimated that the market potential for similar parabolic trough technologies in similar conditions in Spain, Greece, Portugal and Italy if fully exploited is 7 GW with a result saving of 12 million tons of CO₂ per year.

It is expected that the project will cost €200 million and create 55 permanent jobs. Construction at the site began in 2004 and is supported by the European Commission.

The climate and geography of this project's location make it particularly suitable for solar-thermal production and highlight the potential for solar thermal within the EU for large-scale energy production. As noted a number of Southern EU countries also have the potential to exploit this resources and so this project should act as a demonstration for the relatively large scale exploitation of solar thermal power.

Solar Photo Voltaic

Solar PV is a flexible technology, which enables energy generation to be incorporated into the construction of existing or new buildings in addition to larger scale purpose built installations. The EU-15's current forecast is for the installation of 3 GWp. This is an ambitious target given that production in 2000 was only 58 MWp. However, in Germany as a result of the Federal support programmes the annual growth rate between 2000-5 is expected to be 27.5% enabling Germany alone to achieve an installed capacity of 15 GW by 2020 with an associated job creation of up to 130 000 jobs²⁸.

However, Luxembourg now has the highest volume of installed capacity per inhabitant and if this level was replicated across the EU it would result in around 3.6 TWh/year being produced²⁹. Currently, in most circumstances Solar PV is not competitive with conventionally produced electricity. However, its unit costs are falling year by year, with technological improvements and economies of scale.

Suitable Projects:

German Government Support³⁰:

²⁸ Solar Generation: Solar Electricity for over 1 billion people and 2 million jobs by 2020. Greenpeace and European Photovoltaic Industry Association, October 2001.

²⁹ Status Report 2004, End-use Efficiency and Electricity from Biomass, Wind and Photovoltaics in the European Union. European Commission Directorate-General Joint Research Centre, EUR 21297, page 92.

³⁰ PV Status Report 2003: Research, Solar Cell Production and Market Implementation in Japan, USA and the EU: European Commission, JRC, Institute for Environment and Sustainability, September 2003.

The 2000 German Renewable Energy Sources Act guaranteed a feed in tariff for 20 years for solar PV, which is currently 45.6 ct./kWh (2003). Every year this guaranteed feed-in tariff is reduced by 5% for new PV systems in order to put pressure on the reduction of the price for PV systems. In addition, the Kreditanstalt für Wiederaufbau (KfW), a public bank, gave loans with reduced interest rates to buyers of PV systems under the so-called 100 000-roof programme, which ended on 30 June 2003. With these mechanisms a market for PV systems was generated. As a result of the EEG Act, PV systems with a total of 199 MWp were installed in Germany between 1999 and 2002. This is equivalent to approximately 20% of the world market and makes Germany the biggest net importer of solar cells and modules, due to its not yet existing own production capacities. The new production facilities of RWE-Schott Solar, Q-Cells AG and Deutsche Cell GmbH will ease this situation. Between January and 31 August 2003 the KfW has granted loans for 115 MWp under this programme.

The German solar homes scheme has been remarkably successful in stimulating the development of solar PV and should be a role model for other schemes across Europe. As a result of the scheme Germany has 70% of the EU's installed capacity.

Geothermal

The potential for geothermal energy is limited by the geology, but is a none-intermittent base load renewable energy that can form a fundamental part of the renewable energy mix. Currently, geothermal provides around 3.4 Mtoe to the EU energy supply and within the framework of the 2001 renewable electricity Directive is supposed to provide 4.7 Mtoe by 2010. To enable this target to be reached an accelerated growth period will be needed over the next years³¹.

Suitable Projects:

Ferrara- Italy³²

Ferrara's energy system integrates geothermal, CHP and gas fired power stations to create an efficient heat and power sector. The geothermal power is supplemented by a CHP plant, which creates district heating for over 400 buildings from the private and public sectors. The geothermal power provides two thirds of the total heat.

The total cost of the project was €72 million and has led to an annual saving of 9 000 toe with a emissions reduction of: 21 300

³¹ Renewable Energy Target for Europe: 20% by 2020, European Renewable Energy Council, May 2004, page 4.

³² <http://www.managenergy.net/products/R453.htm>

tons CO₂; 17 ton Nox; 9 ton So₂. The power facility now employs 45 people.

Lund- Sweden³³

In the mid 1980s the municipally owned utility of Lund began to exploit geothermal energy. By developing the geological conditions and pumping hot water from 800m underground, the utility is able to produce 40% of its heat demand by geothermal energy. Over the first five years of operation the average annual emissions reductions have been: CO₂ -580 000 tons; So₂ -4 000 tons; NoX-1400 tons. Furthermore, a reduction in the use of oil was around 200 000 m³ per year. The total cost of the project was €12.1 million, spread over a three year period.

Biomass

Biomass energy offers a flexible and relatively easy mechanism to move away from dependency on fossil fuels, with the associated reduction in environmental pollution and increased energy security. Analysis from WWF and the European Biomass Association (AEBIOM) shows that 15% of electricity demand in OECD-Europe could be met by biomass generated power by 2020 with the correct political and industrial frameworks. This programme as well as providing power to over 100 000 million homes would reduce annual Co₂ emissions by 1 800 million tonnes but also help in the creation of 400 000 jobs³⁴.

However, currently the use of biomass for electricity production is not as prevalent as was envisaged and to reach the targets of the RES directive there will need to be an 18% per year growth, from 43 TWh in 2002 to 162 TWh in 2010. This will require a doubling of the current growth pattern. Currently it is estimated that the existing policy measures will only result in between 65-91 TWh by 2010 and therefore additional measures must be implemented³⁵.

Projects that have already received Structural Funds:

UK - Welsh Wood Energy Scheme^{36 37}:

³³ <http://www.managenergy.net/products/R445.htm>

³⁴ Biopowerswitch: A Biomass Blueprint to Met 15% of OECD Europe Electricity Demand by 2020. May 2004. <http://www.panda.org/downloads/europe/biomassreportfinal.pdf>

³⁵ Status Report 2004: End -Use Efficiency and Electricity from Biomass, Wind and Photovoltaics in the European Union, European Commission, Joint Research Centre, Euro 21297, 2004 page60

³⁶ <http://www.wefo.wales.gov.uk/default.asp?action=projectdetail&ID=86&ProjectID=54949>

³⁷ <http://www.forestry.gov.uk/forestry/infid-5wres1>

The project received a grant of £4.3 million (€6.2 million) from ERDF Funds in February 2004, from a total project cost of £11 million (€15.8 million) to create a wood energy business. This is a "path-finding" project. Its prime aim is to establish a sustainable and renewable wood heat industry within the Objective 1 West Wales & The Valleys area and the Powys Objective 2 area, based on low-grade softwood and hardwood and clean co-products from sawmills and other timber processing businesses.

This Wood Energy Business Scheme (WEBS) will provide appropriate projects with grant support to facilitate the installation and operation of wood-fuel powered heating and power generation plant, and equipment for initial the processing of round-wood into chip and pellet form. By doing so it will provide the pump-priming impetus for development of a viable supply infrastructure. This in turn provides a real incentive for landowners to bring woodland back into management, with associated environmental benefits, and potential rural employment prospects.

Perhaps even more importantly, WEBS will help stimulate 'carbon-neutral' heat and power generation, and allow wood-fuel to make a valuable contribution towards the Welsh Assembly and UK Government's ambitious targets for renewable energy. This includes a commitment to provide 10% of UK energy requirements from 'renewables' by 2010, and 20% by 2020.

The scheme will provide grants towards the initial capital cost of relevant plant and equipment, typically boiler systems, drying facilities, and wood-chipping/pelleting machinery, to businesses able to provide a detailed business case for a wood fuelled system of between 40kw and 2Mw capacity. This will typically be small to medium public buildings, schools, hospitals, leisure centres etc. It will also support district heating or Combined Heat and Power installations which supply heat to a number of buildings, and power to the National Grid. The percentage grant available will depend on the strength of the case for support and the actual location, but will be potentially as high as 50%.

In order to ensure sufficient supplies of fuel are available before the private sector supply comes on stream, Forestry Commission Wales has agreed to allocate 100,000 tonnes of small round wood from its own felling programme in the initial years of the scheme.

This is a remarkable project which stimulates local business, creates employment and utilises a natural resources which would otherwise have been largely wasted. Similar projects are being developments in other EU countries, for example in Slovakia and Germany.

Other Suitable Projects:

Güssing (Burgenland)³⁸

A plant was constructed by Güssinger Fernwärme GmbH with EU support between 1995 and 1999 in which certain technological innovations relating to a biomass heating plant were applied for the first time in Austria. Under this project, forest cuttings from the commercial forests of the Burgenland region are used to supply public and private customers with remote heating energy.

The project represents a model for the exploitation of alternative energy sources and improves the quality of life in the region. Regional competence in the domain of "renewable energies" is further enhanced. The biomass heating plant in Güssing operates with new "fluidised bed gasification" technology to generate electricity and heat from biomass in which force-heat coupling is implemented using gas motors. The total project cost is €7.9 million, of which the EU is contributing €1.3 million.

Energy Efficiency

The European Commission conservatively estimates that by using currently available technologies, 20% of the EU 15's energy consumption can be saved at no or little cost. In Central Europe the saving potentials are even higher as the countries in the region use at least twice as much energy per unit of GDP as the EU-15 average. Conservative estimates suggest that up to 30% of energy can be saved economically, even considering the region's lower energy prices. The further harmonisation of the enlarged EU's energy prices will increase this potential.

Despite this, measures on a regional, national and local level have not been effectively introduced to capture this potential. All too often energy efficiency measures have not been given the priority they need. In addition inadequate funding, lack of staffing and failure to implement national and EU regulations have resulted in slow progress in this fundamentally important area.

Consequently, ambitious new policies and measures must be rapidly implemented and enforced across the EU and in particular in Central Europe to enable efficiency improvements to be urgently achieved. A EU-driven aggressive energy conservation and efficiency policy will benefit both the region's and the EU's economic competitiveness and security of supply.

³⁸ http://www.eee-info.net/index_e.html

Suitable Projects:

Ekodoma-Latvia³⁹

The energy and lighting sector of many parts of Central Europe are inefficient. The town of Tukums became Latvia's first efficient lighting project to set up a specific Energy Service Company (ESCO) in 1991. The twelve-year project will result in increased efficiency, increased suitable lighting and decreased emissions.

The main elements of the project were to change the lighting (positions, efficiency and protection mechanism) for the main streets and those in the centre of the town. This required replacement in 77 km of streets. In addition the lighting distribution systems was upgraded.

The total cost of the project was €784 000, of which €395 000 came from the Tukums Council; €127 000 from the Nordic Development Bank; €136 000 from the Latvian Environmental Investment fund; and €132 000 from the Latvian Hipotek Bank.

As a result of the project the annual energy use has decreased by 70% with a reduction in emissions of 365 tonnes of CO₂ per year. In Latvia alone there are 500 municipalities in which the project could be replicated.

As noted the levels of energy use in old Member States is higher than in existing Members and many measures can be introduced to increase the efficiency level. In particular the use of ESCOs offers an opportunity for energy saving measures to be introduced at little financial risk to the energy user. The municipal lighting system offers a particular opportunity in that it can be widely and rapidly be replicated across the region.

Energaiia- Portugal⁴⁰

Public lighting systems are a constant demand on energy systems and local authorities budgets. It is estimated that 2% of a cities electricity consumption is accounted for by public lighting. In the case of the city of Vila Nova de Gaia in Portugal, it accounts for 23 GWh/year at a cost of €2 million per year.

A four-stage project has been developed significantly the local authorities lighting bill has been developed and will require:

- Evaluate public lighting conditions and appropriateness of available technology

³⁹ <http://www.managenergy.net/products/R318.htm>

⁴⁰ <http://www.managenergy.net/products/R584.htm>

- Introduce a pilot project and assess the result of introduction of flux control systems.
- Develop financial model for project implementation
- Introduce changes and run public information campaign.

The flux control technology has been introduced, this allows a reduction in voltage and therefore power use at periods of low use or necessity. This can result in a reduction of 40% of energy use. The introduction of this equipment cost €250 000 and lead to an annual saving of €50 000, thus the pay back period will be 5 years.

Funding Mechanisms

Despite the lack of inclusion of all environmental external costs into the price of energy⁴¹, renewable energy projects are often and increasingly competitive with conventional energy sources. However, there are a number of instances where specific financial assistance can and should be given to support the technologies in specific instances. An example of such a financial support mechanism is outlined below.

Bulgarian Renewable Energy and Energy Efficiency Credit Lines⁴²:

There is significant potential for improvement in energy efficiency in Central Europe, for example Bulgaria's energy intensity is more than seven times the OECD average, almost three times the rate in Poland and twice that in Romania. However, energy conservation investments can be small and are hampered by a number of market imperfections.

The Bulgarian Renewable Energy and Energy Efficiency Credit Line (BEERECL) has been established to support industrial energy efficiency and small renewable projects in the private sector. The facility was designed using funding from the Kozloduy International Decommissioning Support Fund (KIDSF). The KIDSF was established by the EBRD in May 2002 to assist with the closure of the oldest, first generation Soviet designed blocks of the Kozloduy Nuclear Plant in Bulgaria (see www.ebrd.com/enviro/nuclear/new/sofia.pdf). Contributors are the

⁴¹ COMMUNICATION FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT The share of renewable energy in the EU Commission Report in accordance with Article 3 of Directive 2001/77/EC, evaluation of the effect of legislative instruments and other Community policies on the development of the contribution of renewable energy sources in the EU and proposals for concrete actions. May 2004

⁴² <http://www.beerecl.com/index.htm>

European Union, Austria, Belgium, Denmark, Greece, Ireland, Spain, Switzerland, the Netherlands and the United Kingdom.

The EBRD designed the BEERECL to support Bulgaria's new energy law. Among others, the facility will demonstrate the benefits of rational energy use, build expertise among participating banks and sub-borrowers (including small and medium-sized enterprises), and increase financial intermediation targeted at energy utilisation.

The BEERECL provides project sponsors with the following benefits. Initially the fund had approximately €10 million, from the Kolzoduy closure plan. However, the fund is used to as leverage for other commercial funds and which is used to create around five times more funding. The advantages that this credit line can bring are:

- Assistance with loan applications to participating Banks
- Advice on preparing business plans for lowering production energy costs and/or earning money from renewables.
- Rehabilitation and modernisation assets

In addition, project sponsors receive an incentive grant upon project completion (validated by independent energy expert). This grant offers:

- Industrial energy efficiency projects - 7.5% of the loan principal
- Small renewable projects - 20% of the loan principal.

Projects eligible for loans from the participating Banks under the BEERECL facility are:

Industrial Energy Efficiency, such as:

- co-generation
- heat and steam recovery
- automation and control systems
- upgrade/replacement of utilities
- fuel switching (coal/oil to gas)
- process optimization

Renewable Energy, such as:

- biomass
- biogas
- wind
- run-of-the-river hydro
- geothermal
- solar

Education and Demonstration

Projects that have already Received Structural Funds:

UK: Eden Project⁴³:

The Eden project started in 2001 and demonstrates the diversity and uses of plants from across the World. The £86 million (€130 million) project was co-funded with £12.4 million (€20 million) of Structural Funds.

It is estimated by the Centre that since their conception they have generated £462 million in economic impact for the local economy, with 5 million visitors and creating 380 permanent full time jobs with an addition 220 jobs during the peak season. The centre demonstrates the role and need to plants across the world and the role that they play in modern society, not just with food production, but for materials, energy production and medicines.

Although no specifically established to promote renewable energy the centre does promote the wider use and protection of plants. Furthermore, they are looking to further expand and are currently investigating the potential for generating their power needs from biomass.

⁴³ <http://www.wefo.wales.gov.uk/default.asp?action=projectdetail&ID=86&ProjectID=54949>

Conclusions and Recommendation

The use of renewable energy and energy efficiency measures will inevitably increase in the coming years and decades. The question is how rapidly this will occur and this may depend on the extent of State support on a national, regional or international level. Current forecasts suggest that the existing policies and measures being implemented on a national and international level are insufficient even to reach the indicative targets of the RES Directive, whereby 12% of the EU's energy (or 21% of its electricity) comes from sustainable sources by 2010. Consequently, additional measures must be introduced.

Through its Structural Funds and Cohesion Fund programmes the EU can significantly assist the development of these sustainable energy technology to the benefit of the environment, supply security and economic competitiveness.

Structural Funds have been already used across the EU, in both old and new Member States, to support renewable energy and energy efficiency projects. Analysis undertaken by the European Renewable Energy Council suggest that over the next decades up to €433 billion will be needed in the renewable energy sector, to enable 20% of the EU's energy to come from these sustainable energy sources. Furthermore, excellent energy efficiency projects have also been developed, in particular in the new Member States of the EU, where the savings potential are even greater than in older EU States.

The appropriate use of Structural Funds and Cohesion Funds can make a significant contribution to the required investment in these sectors over the next few years. To enable this to happen a number of factors should be considered when reviewing renewable energy and energy efficiency projects. All projects that use the Structural and Cohesion Funds must ensure that there is public support, a limited environmental impact and are exploiting truly sustainable energy sources.

Furthermore priority should be given to projects that can show to have the following additional elements.

Local Involvement:

The local involvement and support for a particular project is of vital importance and proactive steps must be taken and should include:

Local involvement in planning: The support of the local public is fundamental to any project; therefore extensive consultation must be made with potentially affected communities at an early stage.

Local Ownership: Creating shareholders amongst the local community have been shown to increase the support for renewable energy schemes and should be encouraged.

Information Centres: Giving the local population a permanent opportunity to understand the renewable energy or energy efficiency scheme both encourages acceptability of particular projects and the wider development of sustainable energy systems. Furthermore, it can encourage tourism and thus aid the development of the economy.

New Technology:

If the rapid development of renewable energy technologies is to continue then it requires the operational experience of new facilities. Structural Funds have been already used in the development and deployment of cutting edge technology and this practice must be encouraged and accelerated.

Energy Efficiency:

Assessing the energy efficiency potential of particular energy systems should not be limited to ESCOs or niche energy efficiency schemes, however, important these are. Rather all Structural Funds projects should include an energy audit and the findings implemented.

Energy Efficiency in New Member States.

New Member States use energy less efficiently than the EU-15 average. Therefore priority must be given to increase the efficient use of energy in these and the applicant countries, both to increase their economic competitiveness and reduce the environmental impact of energy use. ESCOs have been shown to be a valuable tool to capture this energy saving potential and their use should be encouraged, both by making the necessary capital available but also by creating the required market framework.

Heat Production from Renewables:

The opportunity to increase the use of renewables from biomass must be capitalised on. This can either be through the dedicated renewable energy district heating systems or by fuel switching at existing facilities. Such projects have already been implemented using Structural Funds and have shown to significantly reduce the use of conventional fuels.

Innovative Financial Schemes:

The use of specific funds for the development of renewable energy and energy efficiency must be encouraged. These funds can and do stimulate the development of smaller sustainable energy projects.

Public Awareness:

Projects that encourage wider understanding of the benefits and possibilities of renewable energy schemes should be funded. This can either be through information centres associated with existing renewable energy projects or via public information campaigns run by Government or Non-Government Organisations.