


May 2008

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# Operations Evaluation

## Evaluation of Renewable Energy Projects in Europe

Synthesis Report


Operations Evaluation

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**NOTICE**

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TABLE OF CONTENTS


| | | |
|---|---|---|
| **EXECUTIVE SUMMARY** | | **I** |
| **TABLE OF RECOMMENDATIONS** | | **IV** |
| **1.** | **INTRODUCTION** | **1** |
| 1.1 | BACKGROUND | 1 |
| 1.2 | APPROACH AND METHODOLOGY | 2 |
| **2.** | **POLICIES & STRATEGIES – RELEVANCE** | **3** |
| 2.1 | EU POLICIES OVERVIEW | 3 |
| 2.2 | MEMBER STATES POLICIES OVERVIEW | 4 |
| 2.3 | EIB POLICIES OVERVIEW | 5 |
| 2.4 | RELEVANCE OF THE PROJECTS | 5 |
| **3.** | **PROJECT PERFORMANCE** | **6** |
| 3.1 | EFFECTIVENESS | 6 |
| 3.2 | EFFICIENCY | 7 |
| 3.3 | SUSTAINABILITY | 9 |
| 3.4 | ENVIRONMENTAL IMPACT | 11 |
| 3.5 | OVERALL PROJECT RATINGS | 12 |
| **4.** | **EIB CONTRIBUTION** | **12** |
| 4.1 | FINANCIAL VALUE ADDED | 12 |
| 4.2 | OTHER CONTRIBUTION | 13 |
| **5.** | **EIB PROJECT CYCLE MANAGEMENT** | **13** |
| 5.1 | PROJECT IDENTIFICATION AND APPROVAL | 13 |
| 5.2 | PROJECT IMPLEMENTATION/ FINANCING ARRANGEMENTS/ MONITORING | 13 |

APPENDICES:

APPENDIX 1 : Types of Renewable Energy
APPENDIX 2 : Evaluation process, criteria and methodology
APPENDIX 3 : Member state policies and objectives for RE

# GLOSSARY

## GLOSSARY OF TERMS AND ABBREVIATIONS

| | |
|---|---|
| CCGT | Combined Cycle Gas Turbine |
| CDM | Clean Development Mechanism |
| CO2 | Carbon Dioxide |
| COP | Corporate Operating Plan (EIB) |
| EBRD | European Bank for Reconstruction and Development |
| EC | European Community |
| EIA | Environmental Impact Assessment |
| EIB | European Investment Bank |
| EIRR | Economic Internal Rate of Return |
| EIS | Environmental Impact Statement |
| EU | European Union |
| EUR | Euros (European currency) |
| EV | Evaluation Unit (EIB) |
| FIRR | Financial Internal Rate of Return |
| GEEREF | Global Energy Efficiency and Renewable Energy Fund |
| GHG | Greenhouse Gas |
| GL | Global Loan |
| JI | Joint Implementation |
| MW | MegaWatt (1,000,000 Watts) |
| PCR | Project Completion Report |
| PM | Particulate Matter (e.g. PM10 ~ particles under 10 microns) |
| RE | Renewable Energy |
| RECs | Renewable Energy Certificates |
| RO | Renewables Obligation |
| ROC | Renewable Obligation Certificate |
| SSE | Scottish and Southern Energy |
| USD | United States Dollars |

## EXECUTIVE SUMMARY

### Introduction

This ex-post evaluation covers EIB financing of selected Renewable Energy (RE) projects in Europe over the period 1995 to 2006. The evaluation assesses the projects against the EIB's standard evaluation criteria (Relevance, Effectiveness, Efficiency, Sustainability and Environmental Impact)[1], together with the Bank's contribution to, and performance in, these projects.

The projects evaluated include onshore and offshore wind energy projects, biomass energy projects, geothermal energy projects and small-scale (<10MWe) hydro-electricity projects. No qualifying projects in the solar, except under GL, wave- or tidal-energy categories were financed by the Bank during the period covered by this evaluation, although some solar-energy projects have been approved which are not yet near completion.

Some of the Bank loan operations included in the assessment were structured as a portfolio of sub-projects, containing two or more of wind, hydro-electricity, geothermal or biomass generation schemes. This is often the case for EIB operations with energy utilities in Europe. In these cases, each of the relevant RE sub-projects has been treated as a separate project for the purpose of this evaluation. In consequence, the evaluation covers eleven Bank loan operations, featuring sixteen RE projects.

### Policy Context/Relevance

#### *European Policy context*

The development of renewable energy (RE) is now a central aim of the European Commission and the majority of the European (EU) member states. RE development supports policy goals relating to the reduction of $CO_2$ emissions and therefore climate change mitigation, energy supply security, energy supply diversity, environmental sustainability and economic competitiveness. The Commission and some member states have also recognised the need to support the development of new and innovative technologies associated with the renewable energy sector. The promotion of new energy technologies can provide opportunities for employment and market development, as well as meeting energy sector goals.

During the period covered by this evaluation, the relevant EU policy was the target set by the 1997 EC White Paper on Renewable Energy Sources of increasing RE's share of the then 15 member states' energy supply to 12% by 2010. In parallel, the 1997 UN Kyoto Protocol on global warming set a target of reducing greenhouse gas emissions by 5.2% of 1990 levels by 2012. The EU15 supported this objective and, in 2005, introduced the Emission Trading Scheme (EU ETS).

Consequently, the **EU Member States** have launched many different RE policies, which coincide with their national priorities. During the period covered by this evaluation, some had RE targets and some not, and some provided support mechanisms for RE and some not. The development of RE in each country is likely to reflect to some extent the support mechanisms that member states adopt, and these have included to date:

- fixed feed-in tariffs;
- tradable green certificates;
- capital grants and subsidies;
- other fiscal incentives (tax relief, capital allowances etc).

The realisation of renewable energy generation on the scale envisaged within the EU is expected to require a significant level of public-sector financial support. At the EU level, the currently relevant targets are those set by the European Council of 8/9 March 2007 relating to RE, climate change and energy efficiency However, there is no common EU energy policy, and member states have significantly different views on the appropriate priorities in the area of energy policy. This is in contrast to the situation in, for instance, the transport sector, where there is an agreed EU Common Transport Policy.

[1] See Appendix 1 for definitions.

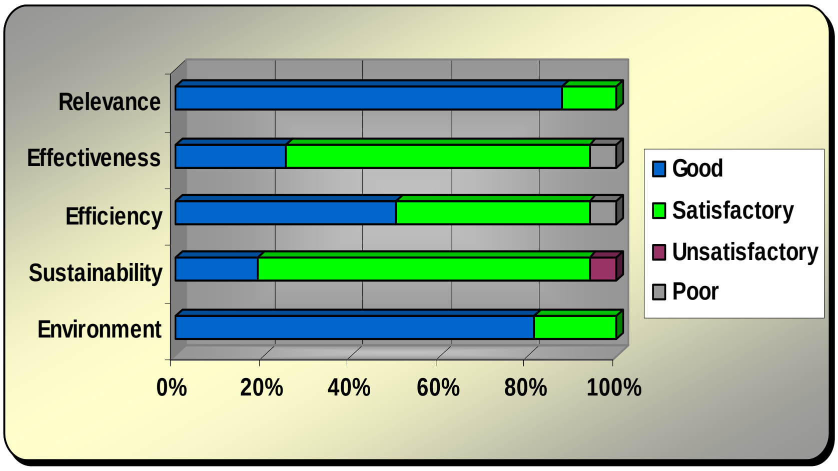
*EIB Policy context*

During most of the period covered by this evaluation the EIB did not have a specific target or policy for RE lending. There was an accepted practice over the period 1995 to 2004 of allowing higher-than-usual (i.e. higher than for fossil-fuel fired projects) unit-cost estimates for RE projects to pass the Bank's appraisal process. In 2004, the Bank introduced its first target relating to RE: that 50% of lending for electricity generation must be RE lending.

There is a distinct difference between the first half of the period reviewed and the second: RE lending averaged 590 MEUR/annum from 2001 to 2006, compared with an average level just over 235 MEUR/annum between 1995 and 2000.

Looking ahead of the period covered by this evaluation, EV acknowledges that Renewable Energy is now placed at the centre of EIB's priority related to energy. Selection criteria have been reviewed and refined for each sub sector while new targets were introduced. This new strategy should give a satisfactory answer to the weakness observed in this report and no further recommendation, related to EIB strategy, is requested.

**Project Performance**




Given the characteristics of the projects financed, Relevance is logically rated mostly good; the impact on the reduction of $CO_2$ emissions is the main positive element. All but 1 of the 16 projects evaluated achieved their objectives. They have sometimes faced delays in gaining the required local planning permits.

Effectiveness is Good for 4 projects: 3 have met their objectives and were delivered under project budget and one is exceeding the production objectives. For one onshore wind farm, management has not reacted effectively when facing delays and costs increases.

Efficiency: eight projects are achieving high profitability, in combination with significant economic benefits from the avoidance of high priced fossil fuel and the added economic benefit of reducing $CO_2$ emissions. Other projects are rated satisfactory, based on similar economic benefits and lower profitability indicators. The same wind project as above is rated poor: generation output is not met and discounted generating cost is too high.

With the exception of the onshore wind farm (a significant redesign of the scheme is likely to be required), all projects evaluated are rated positively for the Sustainability criterion. The majority of this sample of RE projects would not have been financially sustainable without special tariff structures or subsidies. Results are positive as all projects but one, are below the new threshold use by the EIB for the discounted generating cost.

The potential for significant positive environmental impact associated with renewable energy projects is widely recognised. Environmental impact appraisal procedures for all the evaluated projects were in conformity with the EU, national and Bank guidelines at appraisal. Two offshore wind farms are considered as demonstration projects for their handling of environmental impacts.

This evaluation demonstrates this time again the importance of effective management, which can overcome the difficulties which projects are facing. Those projects, obviously environ-mental friendly, are nevertheless increasingly facing difficulties in gaining permits, particularly for wind energy. Subsidies are not always a satisfactory long term answer.

**The role of the EIB**

The Bank is a leading European lender to the renewable energy sector. The key characteristics sought and valued by the project promoters relate to the financial value-added pillar i.e. derive from the provision of low interest rates, extended loan and grace periods, and flexibility on the timing of the loan drawdown.

A number of promoters commented that engaging with the EIB had the effect of drawing in other sources of finance, particularly where new and innovative technologies were being developed and potentially viewed as requiring a higher risk rating. The role of the EIB in this case provides some level of comfort to other lenders, enabling the projects to receive additional funding.

Some project promoters commented favourably with respect to the detailed engineering knowledge base that the EIB brought to the renewable energy projects. This aspect could be further developed through increased actions for dissemination of expertise.

The appraisal process of the Bank is considered as comprehensive, well-structured and systematic. Monitoring has to be improved, in particular when dealing with framework or programme loans; this means a strict control about respecting requirements, as changes in the investment program are acceptable, but with the adequate information provided to the Bank.

# TABLE OF RECOMMENDATIONS

| | EV Observations & Recommendations | Response of the Operational Departments |
|---|---|---|
| **1.** | **Observation:** The importance of Bank multi-project (i.e. framework or programme) operations with the major European energy utilities in the Bank's RE portfolio is evident, and this pattern is likely to be equally present in the future. The current Bank practice on project completion reporting (monitoring) is to await completion of the last sub-project before compiling completion report (final project monitoring step). This often results in feedback on the RE components having to await the final completion of, say, a small non-renewable component such as electricity transmission or distribution (see § 5).<br><br>**Recommendation:** For all significant RE sub-projects in framework or programme loan operations over the next few years, the Bank should require annual RE sub-project progress or completion reporting prior to overall loan operation completion reporting. | Today, there are very few multi-project operations with major energy utilities that combine RE and non-RE projects.<br><br>Nonetheless, a substantial part of the Bank's financing of renewable energy corresponds to framework or programme operations regrouping several small to medium size RE projects (normally of the same type of RE). Normally, the promoters of such project should provide to the Bank a progress report at least once per year. |
| **2.** | **Observation:** The evaluation has shown that all of the projects resulted in significant CO2 emission reductions relative to a non-RE comparator, but no quantitative assessment was made of this (see § 3.4).<br><br>**Recommendation:** The Bank could make an ex-ante CO2 tonnage reduction estimate at the appraisal stage, and require some monitoring on it. The value added of such an exercise should be studied. | The economic assessment of RE projects carried out by PJ compares the project with the fossil fuel alternative, including external environmental costs, notably related to reduction of emissions of pollution (CO2, SO2, NOx and dust).<br><br>The carbon footprinting of the Bank's projects is a broader issue raising a number of complex methodological issues. These are currently under consideration. |
| **3.** | **Observation:** Although onshore wind energy is a well-known RE technology, the evaluation shows that more difficulties are encountered within this sub-sector (see § 3.1.1 and 3.3.1). One could in particular emphasize the difficulties related to administrative authorisations and planning.<br><br>**Recommendation:** This merits careful appraisal and monitoring for onshore wind energy projects regardless of how well known to the Bank the promoter is. Particular attention should be given to the authorization process and its follow-up ; in particular when the Bank's decision is taken at an early stage. | This is current practice.<br><br>The Bank's experience does not suggest that wind energy presents more difficulties in the authorization process than other energy facilities. |

| | EV Observations & Recommendations | Response of the Operational Departments |
|---|---|---|
| **4.** | **Observation:** The evaluation has revealed a high degree of promoter satisfaction with, and strong project performance indicators in support of, the Bank's role in enabling technically innovative investment projects in the RE sector, particularly for biomass and offshore-wind (see § 5).<br><br>**Recommendation:** This would suggest that the Bank should continue to take a leading role in disseminating the technical experience gained in the RE sector to clients and stakeholders. It is significant that wave and tidal energy technology will employ offshore engineering expertise similar to offshore wind (and derived largely from the offshore oil and gas industry). The Bank should equally disseminate its experience to date in the solar-energy sector. | **Agreed**. The dissemination of the experience and expertise gained in the RE is normally taking place through our contacts with clients and stakeholders. This is particularly important in our involvement in less developed RE markets (notably outside the EU) and with other financial intermediaries. The new PJ division created recently (dealing with RE and energy efficiency) should support the dissemination of information inside and outside the EIB. |

# 1. INTRODUCTION

## 1.1 BACKGROUND

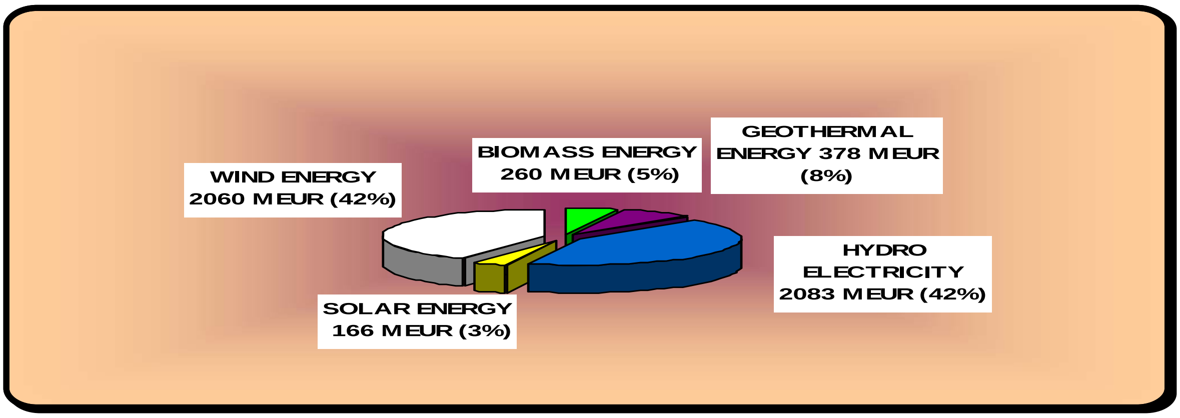
EV presented its "Strategy for the Next Five Years" to the Management Committee and Board of Directors Board in July 2005 (CA/388/05). The evaluation of "Renewable Energy Projects" was included in EV's Rolling Work Programme for 2006-2007.

The development of renewable energy production resources contributes to a number of key EU energy objectives. These include: security of supply, where the focus is on reducing the dependence on imported hydrocarbons (oil and gas) and the exposure to both political and economic risks; environment, where the EU wishes to demonstrate leadership in tackling climate change; and international competitiveness, where the development of renewable energy is intended to put EU industry at the forefront of the rapidly growing low-carbon technology sector.

This ex-post evaluation covers EIB financing of selected Renewable Energy (RE) projects during the period 1995-2006. All of these projects produce usable energy, in the form of electricity or heat.

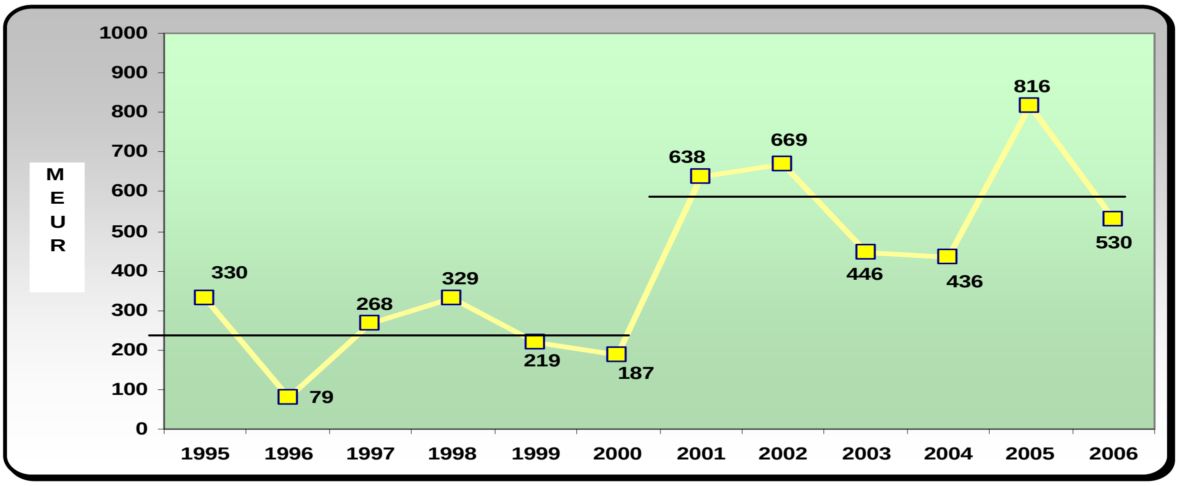
Hydro-electricity and Wind-energy represent 84% of the total EIB RE portfolio in the period covered by this evaluation. Consequently, Geothermal-, Biomass- and Solar-energy each represent a very small proportion of the portfolio.

The distribution is depicted in the following chart:



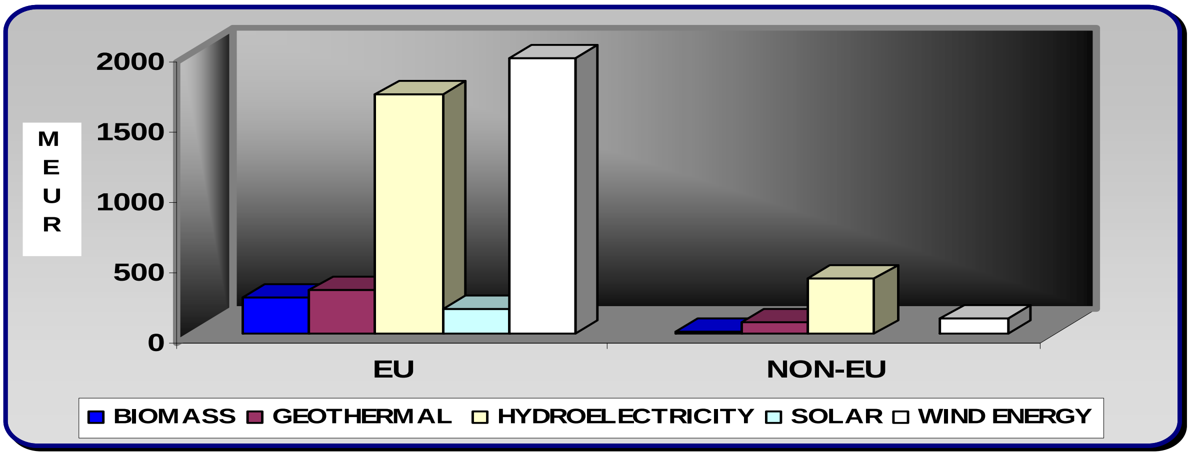

During the period 1995 to 2006, a total of 63 RE individual loans were signed for a total amount of MEUR 4947. Signatures have shown a significant degree of annual variation, in both directions, during the time period analysed. There is, however, a distinct difference between the first half of the period reviewed and the second: RE lending has averaged around 590 MEUR/annum since 2001, compared with an average level just over 235 MEUR/annum between 1995 and 2000.

The following graph presents the overall signature trend of RE projects between 1995 and 2006.



The project portfolio includes projects in 29 different countries, including 13 EU countries, 2 neighbouring countries along with small volumes in other countries outside the EU. 59% of the number of projects (83% of the amount signed) are based in EU countries; 41% of the number of projects and 17% by value were RE operations with neighbouring countries or other countries outside the EU.

The distribution by geographic mandates and RE sub-sector is summarised in the following chart:




The distribution of the wind-energy and hydro-electricity projects is relatively wide. However, the other three sub-sectors (biomass, geothermal and solar) feature in only one or two countries each, given the relatively small sample available.

### 1.2 APPROACH AND METHODOLOGY

The evaluation has two primary functions. Firstly, to provide information to the Bank's governing bodies on performance and, secondly, to constitute a learning experience to provide assistance to the Bank's operational departments, thereby increasing the Bank's value added in future operations.

The focus of the evaluation is on the Relevance and performance (Effectiveness, Efficiency, Sustainability, Environment - see Appendix 2 for definitions) of the projects - the Bank's standard evaluation criteria - as well as the Bank's contribution and performance in these projects. In particular, the project analysis has focussed on assessing the environmental impact, effectively the environmental benefit, of renewable energy projects when compared to energy generated using fossil fuels.

The definition of renewable energy (RE) used in this evaluation comprises five sub-sectors of EIB energy lending for energy production activity, namely:

**Hydro-electricity; Solar-energy; Wind-energy; Biomass-energy; Geothermal-energy** (see Appendix 1, where a description is provided for each sub-sector).

The comparison of ex-post results with the expectations and objectives at appraisal is the main basis for the evaluation of the operations. In accordance with the Bank's evaluation procedures, individual projects are rated in four categories: "Good", "Satisfactory", "Unsatisfactory" and "Poor". Internal EV staff were supported by external consultants for the in-depth evaluation of eleven selected renewable energy loan-operations (project portfolios), featuring a total of 16 relevant RE projects. The relevant operational departments were consulted in the evaluation at all stages.

The 16 RE projects selected (see Table below) provide examples of a broad spectrum of renewable energy type including: wind; geothermal; hydro; and biomass. They are also representative of a range of loan sizes, with the majority in the "small" and "medium" categories. The one "large" loan operation consisted of a number of smaller sub-projects, which were aggregated into a single loan. The geographical coverage included the UK and Scandinavia in northern Europe, and Italy and Portugal in southern Europe. One project was reviewed from outside the EU. Of the 11 loan operations reviewed, one is still in progress, although the key RE elements have been completed.

| PROJECT | | Loan Operation | |
|---|---|---|---|
| **No** | **RE Type** | **Type** | **Size*** |
| **1** | Wind farm | Investment loan | Medium |
| **2** | Wind | Investment loan | Medium |
| **3** | Biomass | Investment loan | Medium |
| **4** | Wind | Combined programme loan | Medium |
| **5** | Hydro | | Medium |
| **6** | Wind | Investment loan | Small |
| **7** | Wind | Combined programme loan | Large |
| **8** | Hydro | | Large |
| **9** | Geothermal | | Large |
| **10** | Hydro | Combined programme loan | Small |
| **11** | Wind | | Small |
| **12** | Wind | Combined programme loan | Small |
| **13** | Geothermal | | Small |
| **14** | Geothermal | Investment loan | Small |
| **15** | Biomass | Investment loan | Small |
| **16** | Biomass | Investment loan | Small |

*Loan size – small <€100 million, large >€250 million.

## 2. POLICIES & STRATEGIES – RELEVANCE

***RELEVANCE*** *is the extent to which the project objectives are consistent with EU policies, country priorities as well as EIB strategies, as defined by the EIB governing bodies.*

### 2.1 EU POLICIES OVERVIEW

The EC White Paper on Renewable Energy Sources, published in 1997, set out a comprehensive strategy and action plan to achieve the goal of increasing renewable energy's share of the EU's total energy supply to 12% by 2010. In order add further impetus to reach the 12% target, the Commission then implemented two key Directives as part of its renewable energy policy:

- *The Directive on the Promotion of Electricity from Renewable Sources (2001/77/EC)* has a target to establish a framework to increase the share of green electricity from 14% to 22% of gross electricity consumption by 2010.
- *The Directive on the Promotion of the Use of Biofuels for Transport (2003/30/EC)* proposes a target of 5.75% substitution for the share of biofuels used in the road transport sector by 2010.

The 1997 United Nations Kyoto Protocol on global warming set a target of reducing greenhouse gas emissions, mainly CO2, from the developed world by 5.2 percent of 1990 levels by 2012. The EU-15 supported this and committed to reducing its greenhouse gases by eight percent of 1990 levels by 2008-2012, and introduced an emissions trading scheme (ETS) in January, 2005, to support this objective.

The Commission and some member states have also recognised the need to support the development of new and innovative technologies associated with the renewable energy sector. The promotion of new energy technologies can provide opportunities for employment and market development, as well as meeting energy sector goals. Investment in renewable energy technology is therefore consistent with EU climate change policy, its long-term energy security objectives and is also consistent with the principles of research, development and innovation (RDI) investment enshrined in the EU's Lisbon Strategy - the subject of a recent EV Report in November 2007.

Over the last decade or two, the European Commission and a large number of member states have introduced various policies and programmes that seek to encourage and promote the development of the renewable energy sector. At the EU level, the currently relevant targets are those set by the European Council of 8/9 March 2007 relating to RE, climate change and energy efficiency. The key targets set can be summarised as "The Three Twenties Policies", i.e.:

20% of EU energy consumption to be from RE sources by the year 2020;
20% improvement in energy efficiency in the EU by the year 2020;
20% reduction (relative to 1990) in greenhouse gas emissions in EU by 2020.

The realisation of renewable energy generation on the scale envisaged within the EU is expected to require a significant level of public-sector support. However, there is no European Union (EU) Common Energy Policy, and member states have significantly different views on the appropriate priorities in the area of energy policy, a situation which is in contrast to the situation in, for instance, the transport sector, where there is an agreed EU Common Transport Policy.

## 2.2 MEMBER STATES POLICIES OVERVIEW

As discussed above, there is no European Union (EU) Common Energy Policy, and Member States (MSs) have significantly different views on the appropriate priorities in the area of energy policy. Consequently, the EU MSs have launched many different RE policies, which coincide with their national priorities. During the period covered by this evaluation, the setting of RE targets and/or of support mechanisms was not a common feature to every EU Member State.

The development of RE in each country is likely to reflect to some extent the support mechanisms that MSs adopt, and these have included to date:

- fixed feed-in tariffs;
- tradable green certificates;
- capital grants and subsidies;
- other fiscal incentives (tax relief, capital allowances etc).

Most of the countries which have set RE targets have adopted a mix of support measures tailored to their own political and geographic circumstances. While some have included capital grants and various enabling tax policies, the principal support policies for renewable generation have been feed-in tariffs and market-based green certificate systems. The majority of MSs have opted for feed-in tariffs, which guarantee a price for renewable electricity generation, usually with prices differentiated by technology to reflect the higher costs of certain options such as solar PV. Germany, for example, is a world leader, in terms of installed wind capacity, with 5.5% of total electricity consumption supplied by this source. This growth has been driven by an extremely generous tariff system providing investors with sufficient confidence for long-term investment. In contrast, quota-based certificate systems, such as the UK's Renewable Obligation (RO) provide an obligation on suppliers to meet a defined share of their supply from renewable sources (with a buy-out option). The market identifies which technologies are developed at least cost. Ireland, the UK and France have also made use of a competitive tendering process, in which project developers bid to develop tranches of renewable capacity, grouped by technology.

With the diversity of approaches observed between the Member States, the relative merits of feed-in tariffs versus market-based approaches have been the subject of much debate. A more extensive discussion of the mechanisms and the various member states RE-policy approaches is provided in Appendix 3.

## 2.3 EIB POLICIES OVERVIEW

During most of the period covered by this evaluation the EIB did not have a specific target or policy for RE lending. There was an accepted practice over the period 1995 to 2002 of allowing higher-than-usual (i.e. higher than for fossil-fuel fired projects) unit-cost estimates for RE projects to pass the Bank's appraisal process.

In 2004, the Bank introduced a target relating to RE lending: that 50% of lending for electricity generation must be RE lending (based on a 525 m annual loan target for the period 2002-2006 set in 2002). In 2005, the Bank adopted some extended criteria to enable higher levels of RE lending, particularly RDI (Lisbon)-related RE lending. In 2006, the Bank initiated an in-depth energy policy review process conducted in close collaboration with the European Commission, resulting in a revised Bank policy in 2007, and the adoption of these new objectives in the Bank's corporate operational plan (COP).

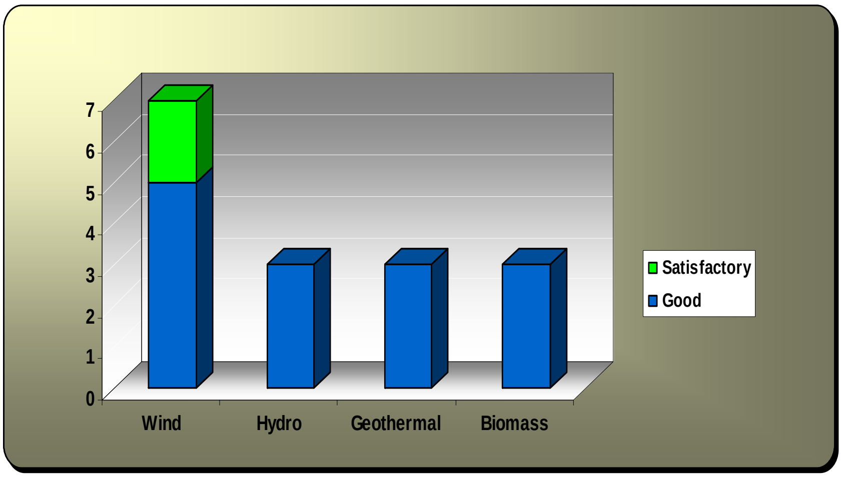
Given the lack of EIB comprehensive strategy during the period assessed, more attention is given to the new developments.

Renewable energy is currently placed at the centre of the EIB's corporate operational plan (COP) for 2007-2009, with significantly increased targets for renewable project lending. The EIB COP 2007-2009 target for RE is EUR 600-800 million per year, with a related target of 50% of EIB lending to electricity generation associated with RE technologies. This compares with an annual average of about 235 million between 1995 and 2000 and an average of about 600 million between 2001 and 2006. These targets are a minimum and will be raised in the next COP[2]. EIB may finance up to 75% of RE projects' cost, as compared to its usual limit of up to 50% of project costs, when a genuine acceleration effect in financing is demonstrated.

The selection criteria for RE projects have been reviewed and refined for each specific sub-sector (i.e. mature RE technology including onshore-wind and hydro-electric and emerging RE technology including off-shore wind and photovoltaics). The emerging RE technologies will be presented within a framework of research, demonstration and innovation (RDI), comparable with other investments supporting the Lisbon Strategy. The specific RE measures complement and reinforce the Bank's other new initiatives in the area of climate change mitigation, including targeted carbon-funding mechanisms.

The current agreed EU policy context, which is relevant for RE lending operations of the EIB is the "The Three Twenties Policies", referred to at the end of Section 2.1 above.

## 2.4 RELEVANCE OF THE PROJECTS




All 16 projects evaluated have a positive rating (good or satisfactory) for the Relevance (consistency with EU, EIB and national policy priorities) criterion. 14 were rated good and 2 satisfactory. The results confirm that the Bank's lending for renewable energy is strongly consistent with, and supportive of, the achievement of the renewable energy policy objectives of the EU, the EIB and the Member States.

2 COP 2008-2010 targets are set up at EUR 900/1000 million per year while the outturn for 2007 was EUR 2100 million.

The projects also contribute to the growing EU renewable energy knowledge database. This knowledge database will benefit future projects by providing more cost effective development solutions or promoting innovative technology designs. The results conclude that there is a strong positive relationship between the Bank's investments in renewable energy and the achievement of the renewable energy policy of both the EU and Member States.

By increasing the energy produced from indigenous renewable sources, the projects contribute towards achieving a number of important objectives of EU Energy Policy, including reducing the dependence on imported fossil fuels (i.e. increased security and diversity of energy supply in the EU), reducing the $CO_2$ emissions from energy generation (climate change objectives) and in some cases furthered the Lisbon RDI objectives.

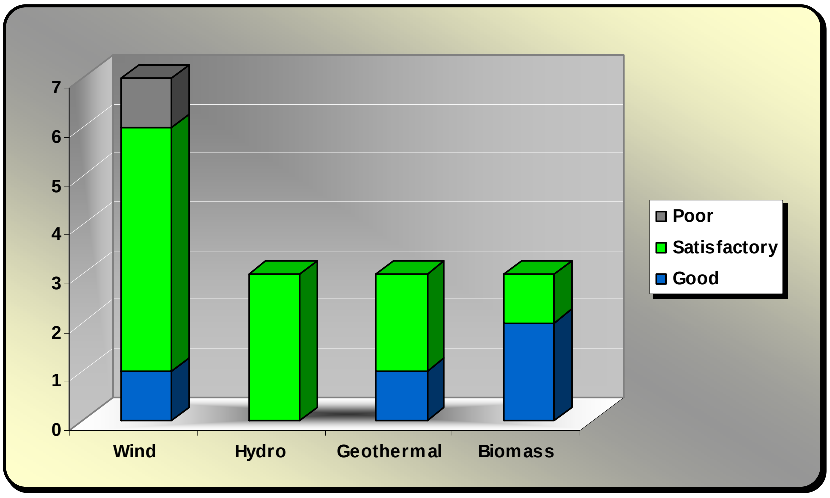
All projects were/would be eligible for EIB funding under the Bank's recent Energy Action Plan, which was based on the EU Green Paper on Energy Policy[3]. A number of projects also meet other EIB eligibility criteria e.g. providing electricity at reasonable costs to support economic growth in Objective 1 areas (ultra peripheral regions) and other regional policy objectives of the Bank. All projects evaluated comply with national policy objectives.

## 3. PROJECT PERFORMANCE

*Project performance, relating to EIB's second pillar of value added, is assessed using four core evaluation criteria, namely Effectiveness, Efficiency, Sustainability and Environment, which are all rated individually.*

### 3.1 EFFECTIVENESS

*Project Effectiveness rates the extent to which project objectives have been achieved, based on the following parameters: a) <u>implementation</u>: the evaluation looked at completion information: coherence with the technical description, timing, costs and procurement, b) <u>operation</u>: management and organisation of project operations, cooperation and coordination with counterparts.*




#### 3.1.1 Wind

a) <u>Implementation</u>: One onshore wind project experienced a significant delay, due to problems in planning permit process (project No 6). In addition the availability of wind, by far below initial expectations (even when compared to EIB's worst-case scenario), decreased with the construction of another wind park in a close location. Two projects required technical redefinition during implementation due to use of innovative and unproven technology (projects 1 & 2, both offshore wind), and in both case this was successfully accommodated in close consultation with the Bank and without serious delays.

For all projects, <u>procurement</u> was undertaken in accordance with EU and EIB guidelines. For 3 projects (1, 2 and 11), out-turn <u>costs</u> were below that anticipated during appraisal. Project 11 had a significant cost increase but this was as a result of funding an increase in the capacity from 8MWe to 10MWe, and the unit cost outcome is as per the original prediction.

3 On 8 March 2006, the EU Commission presented a Green Paper entitled "A European Strategy for Sustainable, Competitive and Secure Energy" where renewable energy sources play a significant part in achieving sustainability and security of supply.

b) Operation: In general, wind-farms do not employ significant staff numbers in the operational phase. All projects appear to be managed appropriately and are operating as planned, with the exception of project No 6.

In conclusion, one project (N° 6) has to be rated poor, while 5 projects are satisfactory; project 2 (rated good) was completed within budget and has demonstrated effective project management, able to overcome difficulties.

**On-Shore Wind farm**

**This wind farm, of a relatively small size (60 turbines), has been facing various difficulties, some of them becoming more frequent for on-shore projects.**

**Considered as risky at appraisal stage (the Bank already lowered the expected load factor from 32 to 24%), the project suffered from a poor project planning and lengthy administrative decisions; it resulted in wrong positioning of turbines (too close to each other) and in overspending. In addition, efficiency was negatively impacted by the close implementation of another wind park.**

**Load factor is now only 16%; the financial sustainability of the project is at risk.**

#### 3.1.2 Hydro-electricity

a) Implementation: All 3 projects have experienced minor delays. For all projects, procurement was undertaken in accordance with EU and EIB guidelines.

b) Operation: All projects appear to be managed appropriately, and are operating as planned.

#### 3.1.3 Geothermal

a) Implementation: 2 Projects (No 9 and 14) experienced minor delays. For all projects, procurement was undertaken in accordance with EU and EIB guidelines.

b) Operation: All projects appear to be managed appropriately. Two are operating as planned, and one better than planned, hence the good rating.

In conclusion, 2 projects are satisfactory; one project (14) is rated good: it was completed within budget time and cost while the generation of electricity exceeds the project' objectives.

#### 3.1.4 Biomass

a) Implementation: Project 3 experienced minor delays due to changes in project scope during implementation and was slightly above budget, hence the one satisfactory rather than good rating. For all projects, procurement was undertaken in accordance with EU and EIB guidelines.

b) Operation: All projects appear to be managed appropriately and are operating as planned.

In conclusion, two projects are successful under all terms and are rated good.

### 3.2 EFFICIENCY

*Efficiency considers whether the project objectives are achieved in a cost effective manner.*

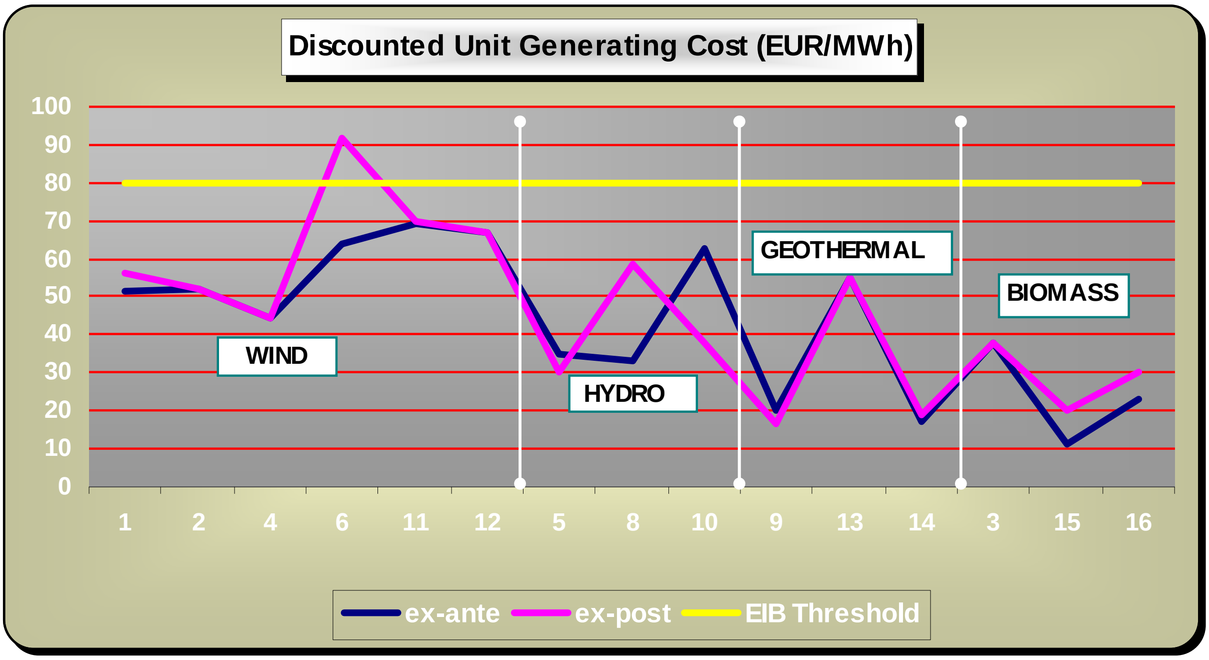
#### 3.2.1 Economic evaluation

The accepted practice in the Bank, as in other IFIs, is to appraise energy generation/production projects by comparing the discounted unit generation cost to a benchmark comparator (least-cost or opportunity-cost methodology). The EIB has recently (2007) adopted as its economic least-cost comparator an opportunity cost of 80 EUR/MWh, which takes into account all economic costs associated with representative fossil-fuel alternatives (combined cycle gas turbine (CCGT) and clean-burn coal). However, all the evaluated projects were appraised by the Bank prior to adoption of that comparator, when benchmarks in the range of 40-70 EUR/MWh were considered that included environmental externalities based on approximated values. Given the diversity of the 16 projects considered, some of which jointly produce heat alongside electricity, and many of which were components within programme-loans, some of the ex-ante appraisals did not feature ex-ante unit cost estimates. The majority of the programme-loan sub-projects have not been subjected to project-specific ex-post unit-cost appraisal by the promoters or the Bank.

Recent reviews of the Bank's energy and environmental policies will result in a more rigorous assessment of the economic unit costs in the future, as more accurate (and higher) economic values will be placed on key climate change factors.

### 3.2.2 Discounted Unit Generating Cost

The economic comparison between projects is based on the Discounted Unit Generating Cost, which has been estimated for each (except one) operation evaluated. The issue of financial sustainability, incorporating special-tariffs, subsidies, etc., is reported separately in Section 3.3 below. This graph is also referring to the new comparator utilised by the Bank.




Wind projects are the worst performing under the criteria of discounted financial unit generating cost. The range, ex-post, lies between 44 and 92 EUR/MWh (one operation, combining many sub-projects, is not presented). Slight increases can be observed due to some unusual difficulties. One project (No 6) shows a clear "poor" result with outputs largely below the expectations; in this case, the discounted generating cost exceeds both the comparator used at the time of appraisal and the new, higher comparator of 80 EUR MWh.

For hydro-electricity, geothermal and biomass projects, all have performed as planned, and it is worth noting that the range of unit cost outcomes possible for each of the three technologies is very wide (from 16 EUR/MWh to 55 EUR/MWh in the case of geothermal). One hydro-electricity operation (with many sub-projects) shows an increase in the discounted financial unit generating cost, mainly due to higher investment costs ; load factors are better and improve the appreciation on this operation.

### 3.2.3 Financial Performance of the projects, including subsidies

As competitive fossil-fuel fired generation costs/prices in Europe over the period in question (largely a period of relatively low oil, gas and coal prices) ranged around 25 – 35 EUR/MWh, it is clear that the vast majority of the RE projects evaluated could not compete without subsidy of some form. Two geothermal projects could. In fact, as the third geothermal project was on an island, where alternative generating costs are much higher than in a large mainland European network, and where the appropriate comparator is probably small-scale diesel generation, one could say that all three geothermal projects were competitive without subsidy. For the wind, hydro and biomass projects, all would have required subsidy, apart from possibly the biomass project No 15. In particular, none of the wind projects could have been competitive without subsidy.

**Biomass: Combined Heat and Power Plant**

**Objective: secure efficient, renewable production of heat and electricity, by substituting renewable biomass source to coal.**

**Implementation is satisfactory, with all objectives achieved on time and within cost estimates.**

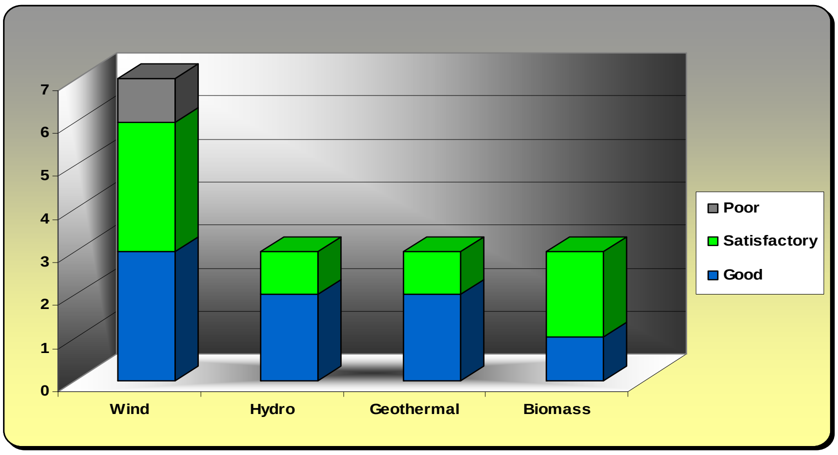
**Supply of biomass: woodchips are found in this region for 70%-80% of quantities received; the rest is supplied by ship from surrounding countries. Supply is secured through medium-term contracts. Biomass costs are relatively high.**

**The discounted generating cost is estimated in the range of 20-30 EUR/kWh; the project is economically fully justified. Financially, the project is only viable because of "indirect" subsidies. In this country, a high tax on fossil fuels (including coal) is applied, which raises energy prices. This project is delivering at a price estimated to be some 20% lower than other fuel sources.**

**Environmental impact: apart from reductions (in $CO_2$, Nox and $SO_2$ emissions) due to the substitution of biomass to coal/fuel, another induced effect is the reduction of emissions in the activities of mining and transportation of coal. By-products are recycled (ash into fertilizers, etc.).**

### 3.2.4 Overall Efficiency performance

Eight projects were rated "good" for achieving high profitability, in combination with significant economic benefits from the avoidance of high priced fossil fuel and the added economic benefit of reducing $CO_2$ emissions. Seven projects were rated "satisfactory". One project (6), which is a wind project, was rated "poor" as the anticipated generation output was not met.




## 3.3 SUSTAINABILITY

*The sustainability criterion examines the probability that the resources are sufficient to maintain the outcome achieved over the economic life time of the projects, and that any risks need to be or can be managed. For this evaluation, the risks associated with sustainability have been grouped under a) physical and operational and b) financial.*

### 3.3.1 Wind

a) physical and operational: Most of the projects had some technical difficulties during implementation. These were generally minor and resolved during the project-commissioning period for the onshore wind farms, with one exception, project No 6, where further technical revision is likely to be required. For project No 1, implementation delays reflected technically innovative solutions, project design changes were implemented in collaboration with the Bank's services, a small cost increase resulted, but the project is rated satisfactory.

b) financial: all of the projects, including project 6 (special tariff received in first 8 years of operation is EUR 123/MWh) to date, appear financially sustainable, given special tariffs or subsidies or fiscal incentives put in place. Projects 1 and 2, both offshore wind projects, experienced some financial instability during project implementation as a result of the cancellation of the renewable energy certificates (RECs) scheme applying at appraisal. The national government has now implemented schemes to stabilise the affect of the removal of RECs, and this should ensure the long-term security of the two projects.

### 3.3.2 Hydro-electricity

All three projects appear to be technically and financially sustainable. Although the unit costs of project No 8 are quite high, the special tariff available is also high. The EU's Water Framework Directive may impact adversely on hydro-projects generally as it may impose restrictions on the abstraction of water from rivers and thus energy production and revenues.

### 3.3.3 Biomass

a) physical and operational: All three biomass projects are satisfactory. The main physical and operational risk issue is that of long-term biomass fuel availability. All three projects are in Scandinavian countries with a diverse local supply of wood-derived biomass, so that the risk is considered manageable. In fact, project 16 has invested significantly to increase its long-term biomass supply security by developing a logistics base for the delivery of the wood pellets fuel. It has also invested in local domestic heating systems and bio-pellet burners for private customers to maximise the competitiveness of the wood pellet production operation.

b) financial: The main financial risk derives from the future biomass fuel price uncertainty, and this is also considered manageable. Ex ante, all three projects required subsidies to be financially viable.

### 3.3.4 Geothermal

a) physical and operational: In one project (No 14), the energy generation performance has exceeded the ex-ante forecast, and this is considered to be sustainable. The other two projects, both components of program loans, are considered satisfactory.

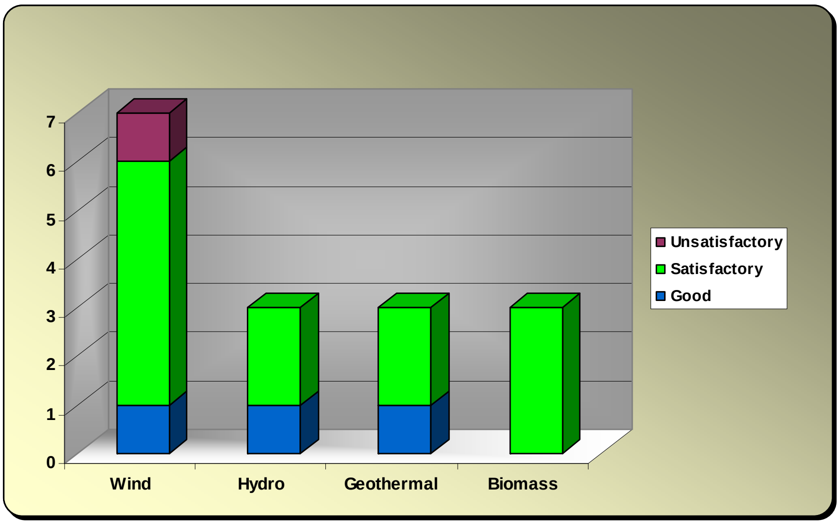
b) financial: Two of the projects could be financially sustainable without subsidy, projects 9 and 14. The third, project 13, clearly required special tariffs to be financially sustainable.

### 3.3.5 Overall Sustainability Performance

With the exception of one project, a positive rating was achieved for all the projects, with respect to the sustainability criteria.

The use and usefulness of special tariff structures or subsidies to promote renewable energy investment is discussed extensively in Appendix 3.

A criticism leveled at a number of renewable tariff structures applying in member states is that the mature renewable technologies, such as hydro-electricity and wind farms, should not attract large subsidies, and should be encouraged to compete in an open market.

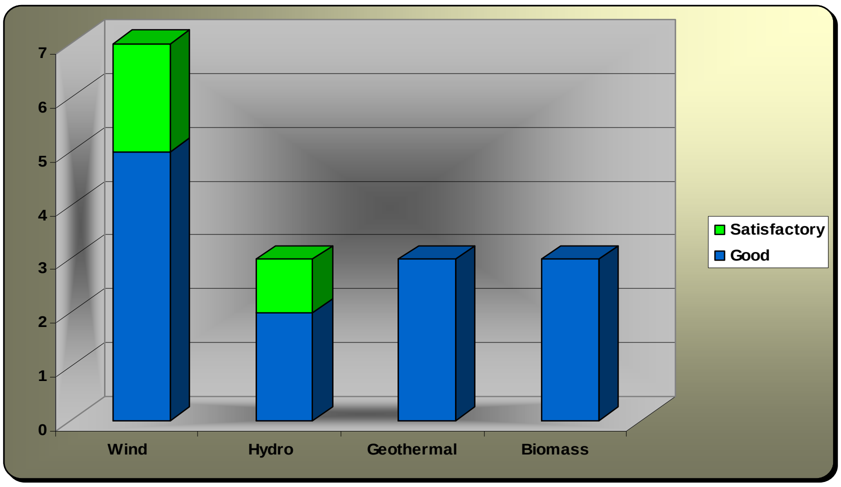



As discussed above in this section of the evaluation dealing with sustainability, the majority of this sample of RE projects would not have been financially sustainable without special tariffs or subsidies.

## 3.4 ENVIRONMENTAL IMPACT

*Environmental and social impact assesses the project from an ecological point of view. This criterion examines the immediate impact of project implementation and operation, but also extends to the wider view of the project and its long term consequences on carbon emissions and other air pollutants, energy efficiency, green spaces, involvement of local communities, transport, local employment, social cohesion, etc. where these are relevant.*

*Consideration of environmental factors is already included within the internationally agreed criteria of relevance, effectiveness, efficiency and sustainability. They are repeated here separately firstly to emphasise the importance the EIB attaches to environmental and social matters, and to clearly distinguish environmental factors from those other considerations taken into account when rating relevance, effectiveness, efficiency and sustainability.*




The potential for significant positive environmental impact associated with renewable energy projects is widely recognised. Environmental impact appraisal procedures for all the evaluated projects were in conformity with the EU, national and Bank guidelines at appraisal. A formal Environmental Impact Assessment (EIA) or Environmental Impact Study (EIS) was required for 11 of the total of 16 projects. Those projects that did not require a formal EIA or EIS generally required some element of abatement or mitigation at the design stage. Projects 10 and 11 were sanctioned by the Regional Government Agency.

### 3.4.1 Wind

Four projects required a formal EIA; in all cases conclusions are implemented and monitored. Three other projects have received all local and regional approvals as required; monitoring is considered as satisfactory. For 2 offshore wind farms, the project preparation (and implementation) studies included a comprehensive assessment of the environmental impact on birds and marine mammals (see box), which has become best practice for this type of projects.

**Case study: Off-Shore Wind farm**

**As part of the EIA process and due to the special status of a "demonstration programme", a comprehensive environmental measurement and monitoring programme was initiated to investigate the effects on environment, and in particular on birds and marine mammals, of all phases, which are classified as follows:**

***Potential impacts during construction:***

1. ***Alteration of the sea bed;***
2. ***Sediment spill and increased turbidity;***
3. ***Noise;***
4. ***Disturbances due to construction***

***Potential impacts during operation:***

1. ***Noise and vibration from the turbines;***
2. ***Electromagnetic fields;***
3. ***Physical presence of the turbines;***
4. ***Disturbance due to maintenance operations;***
5. ***Introduction of hard substrate, due to scour***

**All potential impacts above were assessed through modelling and specific monitoring of flora and fauna that are sensitive to one or more of the impacts, e.g. 46 species of fauna and fish, birds' mammals were monitored and recorded. The monitoring took place during two years.**

**The environmental impacts were all temporary (mostly during construction) and there is no indication that the wind park is causing any environmental damage during its current operation.**

### 3.4.2 Hydro-electricity

Those projects, often of a small size, did not require a formal EIA. Local agreements were obtained or EIS, for new schemes, were performed. In all cases, adequate measures were taken; in general these schemes conform to the "EU Water Framework Directive" (2000/60/E).

### 3.4.3 Geothermal

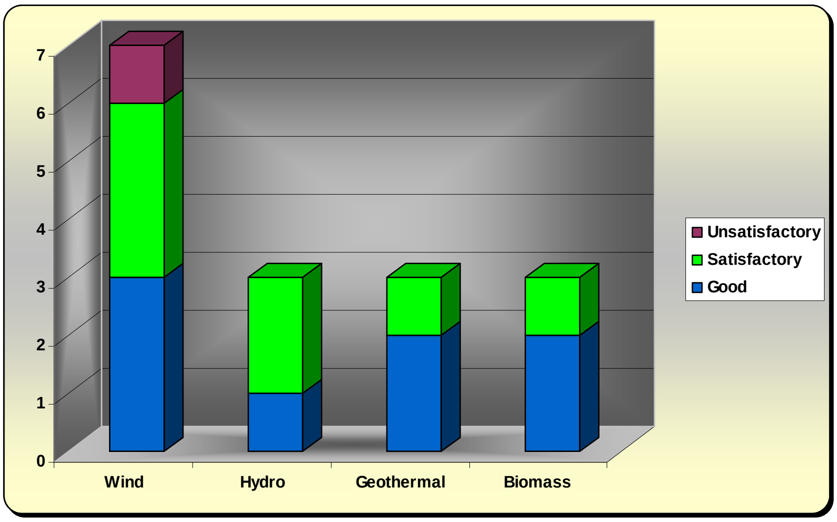
One project required an EIA the conclusions of which were implemented and monitored. A second project (within the EU) received all required local agreements; new abatement technology was added to reduce emissions of odorous steam ($H_2S$) and of mercury. The third project (outside the EU) follows local regulations and/or EU standards; the environmental impacts are strictly monitored, reported and published; it includes regular monitoring of biological and chemical composition of the adjacent lake.

### 3.4.4 Biomass

All 3 projects have been the object of formal EIA or EIS (with public consultations). They all conform to the prescriptions. For one project, potential waste streams are reused either as fertilizers (ash) or as gypsum itself. Each of the projects involved the direct use of solid biomass in the form of combustible solids i.e. wood in some form or other, and are located in Scandinavian countries with diverse wood-related industries. The net environmental benefits are usually clearer, and greater, in such cases than when field crops are grown specifically for combustion, and were very clear in the case of the three projects evaluated. Thus, the three biomass projects evaluated are all appropriately located, and all have been appropriately implemented, from an environmental impact perspective.

### 3.5 OVERALL PROJECT RATINGS

The overall ratings confirm that the Bank is financing renewable generation projects, which are generally performing well against the Bank's own criteria. Relatively minor deficiencies are linked to modest cost overruns and implementation delays, mainly in relation to gaining development permits and the under-achievement of initial objectives. The under-performance of one project is the illustration of all what can be wrong with onshore wind farms.




## 4. EIB CONTRIBUTION

**Project ratings: 50% good – 50% satisfactory**

The main contribution of the Bank is to provide a range of financial resources that met with the requirements of the project promoter. Many of the promoters commented on the positive impact to their projects of the flexibility and favourable interest rates afforded by the Bank. The majority of project promoters also commented that the EIB provided important non-financial inputs to their projects.

### 4.1 FINANCIAL VALUE ADDED

The Bank is one of the leading European investment bodies providing loan funding to the renewable energy sector. The key characteristics sought and valued by the Project promoters lie in the provision of low interest rates, extended loan periods and grace periods and flexibility on the timing of the loan drawdown.

A number of promoters commented that engaging with the EIB had the effect of drawing in other sources of finance, particularly where new and innovative technologies were being developed and potentially viewed as requiring a higher risk rating. The role of the EIB in this case provides some level of comfort to other lenders, enabling the projects to receive additional funding.

### 4.2 OTHER CONTRIBUTION

All the project promoters interviewed as part of the review process commented favourably with respect to the detailed engineering knowledge base that the EIB brought to the renewable energy projects. For the majority of the projects, the rigorous framework of the EIB project appraisal was seen as a positive process, imparting valuable knowledge and experience in both the technical assessment and detailed project management. The majority of the promoters stated that they had learned from their exposure to the Bank's project assessment processes.

## 5. EIB PROJECT CYCLE MANAGEMENT

Many of the Project Promoters have worked with the Bank on a range of previous projects, and the Bank has developed good long-term relationships in the renewable and fossil fuel energy sector. The overall performance of the Bank in the management of the project cycle is shown in the adjacent figure.

**Project ratings: Good: 25%**
**Satisfactory: 56%**
**Unsatisfactory: 19%**

The Bank should seek to improve the reporting received from its clients in particular in the case of framework-type loans. Lack of information can be connected to project failure (see project No 6). By compiling more detailed information in the Project Completion Report, the Bank could improve dissemination of positive experience, both internal and external.

### 5.1 PROJECT IDENTIFICATION AND APPROVAL

The majority of the project portfolios were analysed in detail at the appraisal stage. The initial screening process contributed positively to the final focus on a range of sub-projects with a sound economic, technical and financial basis. As stated earlier, a number of the projects contained several sub-projects, which extended across the range of generating types including wind-, hydro-, geo-thermal and biomass. This approach obviously adds to the complexity of ex-ante as well as ex-post evaluation on a loan-operation-specific basis, and it is noted that the Bank's standard monitoring documentation is loan-operation-specific rather than sub-project specific. Annual reporting on RE components should be required.

The appraisals were generally comprehensive, well structured and systematic. The appraisal process was reasonably short, with an average timescale estimated between six and seven months.

Technical expertise provided by the EIB during project appraisals was considered as being particularly valuable. Two operations were considered as "demonstration projects" and the Bank could use these cases for an increased dissemination of its knowledge. The environmental requirements were well understood. The timescale for implementation was under-estimated on a small number of projects, particularly onshore wind portfolio loan operations.

### 5.2 PROJECT IMPLEMENTATION / FINANCING ARRANGEMENTS / MONITORING

The projects were implemented satisfactorily and the feedback from the promoters confirm that this is the case. A small number of the promoters found the EIB procedures cumbersome and quite lengthy although the general timescales were deemed acceptable. There was no evidence of particular problems associated with the loan drawdown on the projects. Changes to the project scope, especially on portfolio loan operations, were always accommodated by the Bank after consultation, but not always documented immediately.

The project review, follow-up and monitoring of the projects has been excellent for the single-project loan operations. In contrast, the multiple sub-project, or portfolio, nature of some of the programme-loan operations has resulted in many cases in long delays for project completion reporting while awaiting the completion of the last sub-project – often not an RE component of the loan operation in question. Regardless of the familiarity with the borrower in these cases, some RE projects require closer monitoring than others, and Bank loan contracts should cater for this requirement.

This was one of the consistent findings in the evaluation, and it resulted in extensive re-definition and confirmation effort during the evaluation exercise. As programme (portfolio) loan operations are likely to continue to feature strongly in the Bank’s RE operations in the future, more regular reporting (in particular on sub projects) should be ensured, as a normal feature of this type of operation.

# TYPES OF RENEWABLE ENERGY

### Renewable Energy from Wind

In the past air-flows (wind) have been utilised to produce usable energy via windmills, which were used by millers, sawyers, etc. to replace human physical effort. Modern-day wind turbines are the equivalent of these windmills, and range from around 600kWe to up to 5 MWe of rated power, although turbines with rated output of 1.5–3 MWe have become the most common for commercial use. Areas where winds are stronger and more constant, such as offshore and high altitude sites, are preferred locations for wind farms. Wind power is the fastest growing of the renewable energy technologies, though it currently provides less than 0.5% of global energy. Due to the intermittency of wind resources, most deployed turbines in the EU produce an average quantity of electricity that would be equivalent to 25% of the hours in a year working at nominal capacity (a load-factor of 25%) but, under favourable wind regimes, some reach 35% or higher.

Generation costs for turbines with 20% or higher load-factor range from around 40 to 80 EUR per MWh, and at current fossil fuel prices should be competitive without subsidy.

The net environmental impact has to be assessed on a case by case basis as there are some negative impacts associated with wind-farms (noise, visual, bird-damage, aircraft-navigation interference, CO2 emissions in manufacturing, construction and maintenance (large cranes or helicopters required to access turbines), oil/hydraulic-fluid leakage during operation, etc.). Nevertheless, the positive impacts, relative to fossil fuel fired alternatives, usually offset these.

### Renewable Energy from Water (Hydro-electricity)

Hydroelectric power now supplies about 715,000 MWe or 19% of world electricity. Apart from a few countries with an abundance of it, hydro power is normally applied to peak load demand because it is readily stopped and started. Hydroelectric power can be far less expensive than electricity generated from fossil fuels or nuclear energy. The chief advantage of hydroelectric (dams) is their ability to handle seasonal (as well as daily) high peak loads. When the electricity demands drop, the dam simply stores more water (which provides more flow when it releases). Not all hydroelectric power requires a dam; a run-of-river project only uses part of the stream flow and is a characteristic of small hydro-electricity projects (<10MWe). In practice the utilization of stored water in river dams is sometimes complicated by demands for irrigation, or river management, which may occur out of phase with peak electrical demands.

Generation costs for small-scale hydro-electric projects range from around 30 to 100 EUR per MWh, and can often be competitive without subsidy. However, most of the potential for exploitation of this resource within the EU has already been realised.

The net environmental impact again should be assessed on a case by case basis as there are negative impacts (CO2 emissions during construction, downstream river-flow disruption, aquatic eco-system, etc.). However, for small-scale, run-of-river hydro-electricity projects these negative impacts are limited.

### Renewable Energy from Geothermal sources

Geothermal energy is energy obtained by tapping the heat of the earth itself, usually from kilometers deep into the Earth's crust. It is expensive to build a power station but operating costs are low resulting in low energy costs for suitable sites. The geothermal energy from the core of the Earth is closer to the surface in some areas than in others. Where hot underground steam or water can be tapped and brought to the surface it may be used to generate electricity. Such geothermal power sources exist in certain geologically unstable parts of the world such as Iceland, New Zealand, United States, the Philippines and Italy. Iceland currently produces continually from around 170 MW of installed geothermal power, and heats around 85% of all houses through geothermal energy. Some 8000 MW of capacity is operational in total worldwide.

Generation costs for geothermal energy projects vary widely, but in geologically suitable locations range from around 15 to 80 EUR per MWh, and can often be competitive without subsidy.

The net environmental impact has to be again assessed on a case by case basis as there are negative impacts (local land stability during/after construction; emissions of small amounts of steam, $CO_2$, $NO_x$ and sulphur during operation). However, these negative emissions impacts are typically only 5% of the levels associated with a fossil-fuel alternative.

**Renewable Energy from Biomass**

**Biomass** refers to living and recently dead biological material that can be used as fuel or for industrial production. Most commonly, biomass refers to plant matter grown for use as biofuel, but it also includes plant or animal matter used for production of fibers, chemicals or heat. Biomass may also include biodegradable wastes that can be burnt as fuel. It excludes organic material which has been transformed by geological processes into substances such as coal or petroleum. Direct use of solid biomass is usually in the form of combustible solids, either wood, the biogenic portion of municipal solid waste or combustible field crops. Field crops may be grown specifically for combustion or may be used for other purposes, and the processed plant waste then used for combustion. Most sorts of biomass can actually be burnt to heat water and to drive turbines.

Generation costs for biomass energy projects vary widely, and range from around 25 to 90 EUR per MWh. These projects can often be financially competitive without subsidy, but it is often not possible to accurately estimate the full life-cycle economic cost of the biomass production process.

The net environmental impact has to be assessed on a case by case basis as there can be negative impacts, especially where crops are specifically grown for biomass energy generation or conversion to biofuels. Though biomass is a renewable fuel, and is sometimes called a "carbon neutral" fuel, its use can still contribute to global warming. This happens when the natural carbon equilibrium is disturbed; for example by deforestation or urbanization of green sites.

**Renewable Energy from Wave, Tide and Solar sources**

RE from wave motion harnesses the horizontal movement of the oceans/seas i.e. captures part of the energy in waves. RE from ocean/sea tidal movements harnesses the vertical movement of the oceans/seas i.e. captures part of the energy in tidal motions. Solar energy refers to energy that is collected from sunlight. Solar energy can be applied in many ways but, in particular, to generate electricity using photovoltaic cells; heating water; and generating electricity using concentrated solar power (use of large mirrors).

Generation costs for each of theses technologies are either highly uncertain and untested (wave and tidal), or very high and financially uncompetitive currently (solar). For instance, current generation costs for photovoltaic-cell solar energy projects range from around 300 to 500 EUR per MWh.

The net environmental impact of wave, tidal and solar projects will also require case-by-case evaluation, as each technology has associated negative impacts. For all three, the major issues will include the environmental impact of the equipment manufacture, installation and maintenance phases, and the land/sea eco-system impact of the project.

# EVALUATION PROCESS, CRITERIA AND METHODOLOGY

In accordance with EV's Terms of Reference, the objectives of this evaluation are threefold:

- to assess the quality of the operations financed, which is assessed using generally accepted evaluation criteria, in particular those developed by the Evaluation Cooperation Group, which brings together the evaluation offices of the multilateral development banks. The criteria are:

  a) **<u>Relevance</u>** corresponding to the first pillar of value added*:* is the extent to which the objectives of a project are consistent with EU policies, as defined by the Treaty, Directives, Council Decisions, Mandates, etc., the decisions of the EIB Governors, as well as the beneficiaries' requirements, country needs, global priorities and partners' policies. In the EU, reference is made to the relevant EU and EIB policies and specifically to the Article 267 of the Treaty that defines the mission of the Bank. Outside the Union, the main references are the policy objectives considered in the relevant mandates.

  *b)* Project performance, measured through **<u>Effectiveness (efficacy)</u>, <u>Efficiency</u>** and **<u>Sustainability</u>** – second pillar of value added*.*

  <u>Effectiveness</u> relates to the extent to which the objectives of the project have been achieved, or are expected to be achieved, taking into account their relative importance, while recognising any change introduced in the project since loan approval.

  <u>Efficiency</u> concerns the extent to which project benefits/outputs are commensurate with resources/inputs. At ex-ante appraisal, project efficiency is normally measured through the economic and financial rates of return. In public sector projects a financial rate of return is often not calculated ex-ante, in which case the efficiency of the project is estimated by a cost effectiveness analysis.

  <u>Sustainability</u> is the likelihood of continued long-term benefits and the resilience to risk over the intended life of the project. The assessment of project sustainability varies substantially from case to case depending on circumstances, and takes into account the issues identified in the ex-ante due-diligence carried out by the Bank.

  Evaluations take due account of the analytical criteria used in the ex-ante project appraisal and the strategy, policies and procedures that relate to the operations evaluated. Changes in EIB policies or procedures following project appraisal, which are relevant to the assessment of the project, will also be taken into account.

  <u>Environmental Impact</u> relates to all the possible areas of impact, including earth, air, noise, water, flora, fauna etc. Environmental effectiveness and sustainability should be included.

- to assess the EIB performance and contribution:

  **<u>EIB Financial value added (Third Pillar of value added)</u>** identifies the financial value added provided in relation to the alternatives available, including improvements on financial aspects as facilitating co-financing from other sources (catalytic effect).

  **<u>Other EIB contribution (optional)</u>** relates to any significant non-financial contribution to the operation provided by the EIB; it may take the form of improvements of the technical, economic or other aspects of the project.

  **<u>EIB Management of the project cycle</u>** rates the Bank's handling of the operation, from project identification and selection to post completion monitoring

# MEMBER STATE POLICIES AND OBJECTIVES FOR RE AS OBSERVED IN THE PERIOD COVERED BY THE EVALUATION

The EU Member States have launched many renewable energy policies, which coincide with their national priorities e.g. the Kyoto targets are often incorporated into new legislation to promote the increase of renewable electricity and district heating.

The mandate for the development of renewable sources (20% by 2020) is set at the EU level. However, this EU renewable target is translated into a range of national targets by the various Member States which reflects their individual position with respect to the current energy mix. This currently allows the process/achievement of the renewable targets to the individual Member States. However, in January 2008, the Commission have called for an overarching framework for renewable energy generation, established through a new directive on the use of all renewable energy resources. The implication is thus that whilst the individual targets are set by each Member State, the means and framework to reach these targets will be agreed at the EU level.

The development of renewable energy will also be determined by the support mechanisms that Member States adopt. Member States have developed national targets for renewable energy and a range of supporting policies and measures, including:

- fixed feed-in tariffs;
- tradable green certificates;
- capital grants and subsidies;
- other fiscal incentives (tax relief, capital allowances etc).

Most countries have adopted a mix of support measures tailored to their own political and geographic circumstances. Whilst most EU Member States have developed grant programmes and various enabling tax policies, the principal support policies for renewable generation have been feed-in tariffs and market-based green certificate systems.

The majority of Member States have opted for feed-in tariffs, which guarantee a price for renewable electricity generation, usually with prices differentiated by technology to reflect the higher costs of certain options such as solar PV. In contrast, quota-based certificate systems, such as the UK's Renewable Obligation (RO) provide an obligation on suppliers to meet a defined share of their supply from renewable sources (with a buy-out option). The market identifies which technologies are developed at least cost. Ireland, the UK and France have also made use of a competitive tendering process in which project developers bid to develop tranches of renewable capacity, grouped by technology.

Several Member States have revised or supplemented their primary renewable energy policies over the past three years (2005-2007) including:

- **Portugal** adopted a new tariff calculation formula that accounts for technology, environmental impacts, and inflation.
- **Italy**'s new national feed-in tariff for solar PV, became operational in 2005, with a first 100 MW of allocations subscribed soon after.
- **UK** developed a market-based scheme via the Renewables Obligation, renewable generators are eligible to qualify for renewables obligation certificates (ROCs) which can then be traded across the UK.
- **Denmark** adopted the Energy Supply Bill in 1999, which fundamentally changed the domestic supply system and included provisions to further increase the supply from renewable sources. These targets were subsequently revised down in 2002 to achieve more modest growth.

- **Sweden** has introduced renewable energy certificates (RECs) in addition to developing punitive tax regimes for energy generation by coal.

- **Iceland** has set up an Energy Fund to distribute grants and loans to further develop technologies associated with geothermal energy.

- The **Czech Republic** has adopted a new law that establishes feed-in tariffs for all renewable technologies.

- **Austria** has supplemented its feed-in-tariffs with additional support of over €190 million in investment subsidies through to 2012.

- **France** has extended its feed-in law to cover re-powered and renovated facilities exceeding €800-1000 per kW of new investment.

- **Ireland** replaced its competitive tendering system with a new feed-in policy and established new tariffs.

- **The Netherlands** has revised feed-in tariffs recently.

With the diversity of approaches observed between the Member States, the relative merits of feed-in tariffs versus market-based approaches has been the subject of much debate.

Feed-in tariffs, which offer guaranteed, reliable, long-term prices for renewable electricity, have generally delivered the most capacity installed. Germany, for example, is a world leader, in terms of installed wind capacity, with 5.5% of total electricity consumption supplied by this source. This growth has been driven by an extremely generous tariff system providing investors with sufficient confidence for major long-term project lending. Similarly, Spain and Denmark, with the EU's second largest share of installed wind capacity, have also provided generous feed-in tariffs. Tariffs can also encourage the uptake of emerging technologies: Italy's solar PV tariff scheme has led to an extremely rapid growth in project development.

The use of green certificate systems has been driven by increased reliance on market-based policies in EU countries, such as the UK and the Netherlands. In order to deliver least cost renewable project development and encourage market competition, the UK first moved from a feed-in tariff system to the use of competitive tendering. This change failed to deliver the planned capacity increases however, largely as a result of participants bidding at increasingly marginal prices, resulting in failed investments and project cancellations. Ireland experienced a similar situation and has subsequently moved to a feed-in tariff system.

The introduction of green certificates has had mixed results. For example, although the UK has the most advantageous wind regime in Europe, it has experienced only limited capacity growth under the RO. Investors have repeatedly expressed concern over the unpredictable prices associated with scheme and the lack of a long-term revenue guarantee. Although the UK Government has subsequently revised RO targets further to 2015, the present expansion in offshore wind has required the provision of large capital grants. It remains difficult for generators to obtain power purchase contracts to sell electricity for more than 10 years, without providing large discounts on prices, which makes securing finance more challenging. In addition, the RO has failed to encourage the commercial deployment of innovative technologies such as solar PV, wave and tidal generation.

Although feed-in tariffs have successfully delivered capacity, they are often criticised for not being in conformity with the concepts of EU energy market liberalisation and therefore a cost-effective climate policy. As fossil fuel prices increase, the price differential between subsidized renewable generation and fossil fuel generation becomes problematic: there is increasing pressure in Spain and Germany, for example, to revise support levels downwards as mature renewable technologies become able to compete with conventional electricity sources. There is increasing concern that such support is providing 'windfall' revenues to developers and investors. There is also evidence that feed-in tariffs have resulted in wind capacity being developed in locations with poor or sub-optimal wind resources, most notably in Germany, where actual generation from wind projects has not always matched the proportional expansion in capacity.

The European Commission has published a report on the functioning of the Renewables Directive and on the potential harmonization of the various support schemes. It concluded that it was not advantageous to harmonise the support mechanisms at this stage. The Commission's analysis shows that, for wind energy, systems that currently use feed-in tariffs have demonstrated the best performance. However, commentators have suggested that any future policy harmonisation is likely to favour a market-based based trading system based around the EU Emission Trading Scheme (ETS). The ETS is a scheme which is designed to be flexible enough to ensure that renewable energy sources are developed in those locations where natural resource allocations were greatest, and thus where market forces should ensure that they were most cost-effective. They would therefore have the lowest development and technical risk profile and could, theoretically, deliver the EU's renewable targets at a reduced cost.

A wider appreciation of the "lessons learned" from the operation of the EU ETS would need to be considered in detail, before an EU-wide renewable trading scheme could be considered by Member States. Furthermore, whereas climate change acts at a global level, aspects of renewable energy generation have significant implications at the regional/national scale, including the important issues of national energy security and regional economic development. For as long as Member State approaches to renewable policy are dictated by national/local market conditions and the pattern of national resource availability, is it likely that the development response will remain distinctly national, under the umbrella of EU-level renewable energy and climate change targets.

A particular challenge will be the development of enabling policies within the emerging markets of Central and Eastern Europe, where renewable energy is at an early stage of development. With the adoption of the EU framework for renewable energy, all new Member States have now set targets for higher levels of renewable power generation by 2010. The "enabling" regulatory frameworks have been implemented, although in several of the countries the details are still under development with the result that a significant number of projects (particularly in the wind sector) are waiting to obtain approvals to proceed. There are a small number of CHP (combined heat and power) schemes proposed currently, but there is little evidence of any significant-scale development of the biomass or bio-fuel sectors, and generation from wind power remains low [4].

Regulatory reforms to support renewable energy in the economies in transition, including Former Soviet Union (FSU) countries, are largely absent outside the EU-27. Many of these countries are still dealing with basic energy sector reforms. Together with low wholesale energy prices, the commercial environment for developers and private investors remains poor.

As policies continue to address the need to comply with EU legislation, a range of approaches are likely to be seen in the EU accession countries, probably led by a preference to develop feed-in tariffs. These can provide the reliable long-term price guarantees required by investors to exploit the largely untapped renewable resources in these countries. Joint Implementation (JI), offering a further source of revenue through creation of carbon credits, will also create additional incentives for project lenders.

4 UNECE, 2007: "Delivering Energy Efficiency" at http://www.unece.org/env/efe/wgso/Belgrade/documents/WGSO/WGSO-4/WorkingPapers/WGSO-4.2007.14.e.pdf

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