## Chapter two

## Promotion of renewable energy sources in the European Union

The driving forces behind the development of renewable energy sources in Europe have been linked with key priorities of the European energy policy (e.g. security of supply and reduction of GHG emissions) and the Lisbon strategic goal to transform the European area into one of the most competitive and dynamic markets in the world that is capable to deliver sustainable economic growth. It is commonly believed that an increase in the renewable energy share in the Community's energy mix will make a significant contribution in achieving these goals. In 1997, the European Commission (EC) has set an ambitious target of 12% share of renewable energy in gross inland consumption by 2010[1]. Since then, the EC has initiated a series of initiatives in order to provide a favourable framework to develop renewable energy sources at European level and worldwide.

As this paper addresses exclusively the deployment of renewable energy sources for electricity supply (therefore does not take into consideration potentials for renewable heating and cooling), this chapter focuses on the EC Directive on the promotion of electricity produced from renewable energy sources (RES-E)[2] and on lessons learnt from the experience of the EU-15 with implementing RES-E policies and the RES-E Directive. The chapter finishes with an overview of the main policies aiming at promoting the electricity generation from renewable energy sources in the NMS.

### *2.1. The Renewable Directive and its implications*

In 2001 the European Union adopted the Directive for promotion of electricity from renewable energy sources (RES-E), known as the RES-E Directive. The objective of the RES-E Directive is to increase the electricity production from renewable energy sources up to 22% from the

[1] COM (97) 599, *White Paper laying down a Community strategy and action plan,* www.europa.eu.int
[2] Directive 2001/77/EC of the European Parliament and of the Council , 27 September 2001, on the promotion of electricity produced from renewable energy sources in the internal electricity market, OJ L283/33,27.10.2001

total electricity consumption by setting minimum national targets[3] by 2010 and to mandate the European Governments to take the necessary steps to address potential barriers in promoting RES (e.g inadequate legislative frameworks, lack of investments, administrative, etc). The Renewable Directive is a welcome complement to the Electricity Directive[4] which, through its requirements (e.g. unbundling, third party access, etc), increased transparency in electricity markets and opened up a window of opportunity for new entrants to compete against incumbent integrated companies thus creating further scope for RES-E development. The Renewable Directive aims to ensure a stable environment for investments in renewable energy sources and a long-term, large scale deployment of these sources. Among those requirements, the most notable are:

a. the implementation of attractive support schemes that should be designed in such a way to provide the most efficient outcome (Art.4);
b. the issuance of guarantees of origin (Art.5)
c. the removal of administrative barriers (Art.6)
d. to guarantee access to the grid (Art.7)

### ***Emerging support schemes for the development of renewable energy sources***

The main idea behind the RES-E Directive is to induce a substitution of fossil fuels with more sustainable sources of energy. In other words, renewables policies should have a very specific goal: to induce investments in sustainable generation capacity.

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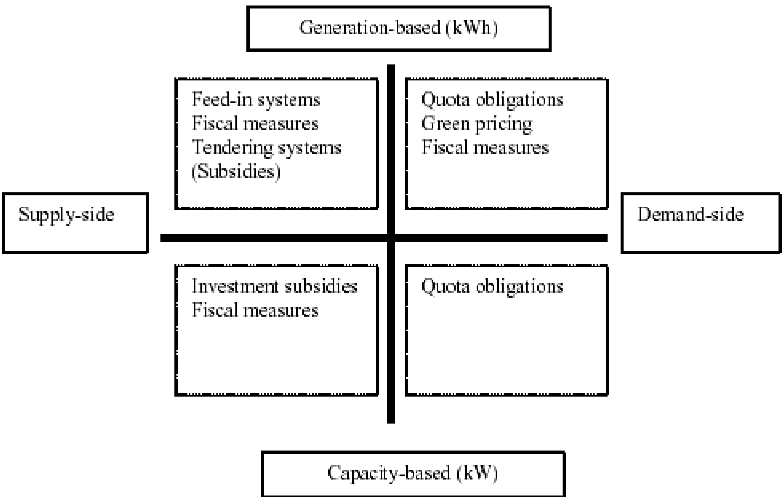
[3]Article 3.2 of the Renewable Directive defines targets as "*future consumption of electricity produced from renewable energy sources in terms of percentages from electricity consumption*". For the purpose of this Directive, by electricity consumption it is generally understood the total national production plus imports minus exports. See **ANNEX 2.I, Table 2.1** for the national targets. It is important to mention that imports from outside the EU do not count against the national targets. In addition, the targets are only indicative not legally binding.

[4] The first Electricity Directive was adopted in 1996 (96/92/EC). In 2001, the EC proposed to amend the Directive and in 2003 a revised Directive was adopted (2003/54/EC). The new Directive entered into force on 1st of July 2004. Although a more detailed discussion on the differences between the two Directives will be provided in Chapter 3 on Energy markets, it suffice to say at this point that the old Directive already provided for more transparent arrangements within the national energy markets. For details on these requirements see also D. Barbu, "*The challenge of European energy transit in the context of internal energy Market*", pg.10-12 (*on file with the author)*. The new Directive however strengthens the language on few issues with relevance for RES development such as access to the grid for RES generators, fast track the authorisation procedures for small/distributed generation, enhanced transparency of energy supply information.

As policies operate within an economic context that tends to differ across Europe, few types of schemes seem to have emerged in recent years: direct price support scheme (or incentive feed-in tariff scheme), tradable green certificate scheme, under which demand can be created by mandatory quotas coupled with penalties, or by support to final users, competitive bidding scheme (with the electricity price as the main criterion), fiscal incentives : exceptional amortisation, tax exemptions or reductions.

Some of the support schemes are looking at the demand side while others at the supply side. Some are capacity oriented while others are price oriented. *Figure 2.1* below provides a qualitative overview of the types of policy and fiscal instruments observed to date in the EU-15.

**Figure 2.1 National support schemes in the EU-15 have different objectives**




*Source*: ECN (2003)[5]

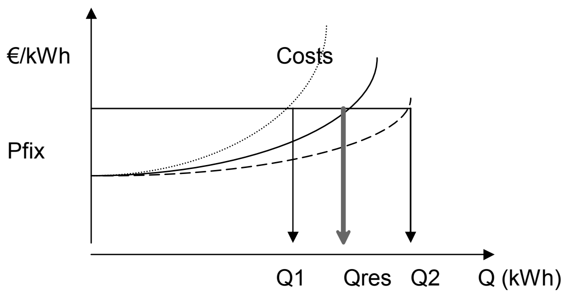
Investment support schemes were very popular in early days of renewable development as they are relatively easy to understand and administer. Investment support schemes could take various forms ranging from grants and soft loans (investment subsidies) to energy/VAT

5 K. Skytte et.al., "*Challenges for investment in renewable electricity in the European Union; Background report in the ADMIRE-REBUS project*", ECN-C-03-081, November 2003, www.ecn.nl

tax exemptions and/or reductions (fiscal measures). Two particular policy instruments, namely the feed-in-tariffs (FIT) and quota system accompanied by a scheme for trading green certificates (TGC) emerged as main support schemes while investment subsidies and fiscal benefits remain complementary to fine-tune the main policy.

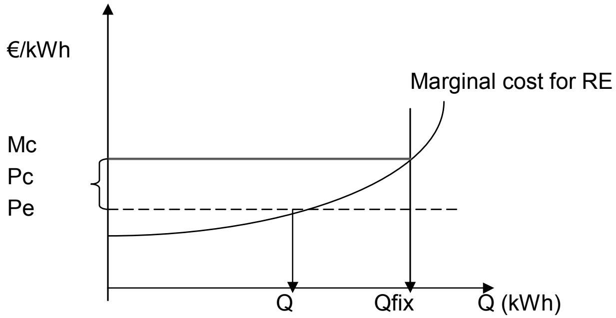
Since the two types of policies (FIT and TGC) generated a great deal of debate within the RES-E stakeholder community, below the basics of the two mechanisms are being briefly discussed. Although both types of instruments essentially target the same outcome - increased level of investments in RES capacity - their starting point is different. In the case of feed-in-tariffs, the price is set and the quantity of renewable energy produced is decided by the market (*Figure* 2.2 below). In the case of green certificates trading, the minimum quantity is set and the price is determined by the market (*Figure* 2.3)[6].

**Figure 2.2 The basics of the feed-in-tariff**




[6] The explanations provided are simplistic aiming to provide for the reader a basic understanding of the two mechanisms. For detailed discussions on the economics behind these policy instruments see R. Haas, "Promoting renewable electricity investments effectively", 2003, N.H. van der Linden et.al., "*Review of international experience with renewable energy obligation support mechanisms*", ECN-C-05-025, May 2005, www.ecn.nl , K.Vogstad, "*Designing market-oriented environmental policy instruments: the case of tradable certificates*", CML Leiden University, www.stud.ntnu.no/, K.Vogstad, I. S. Kristensen and O. Wolfgang, "*Tradable green certificates: the dynamics of coupled electricity markets*", CML Leiden University, www.stud.ntnu.no/ and RISO/EWEA, "*Evaluation of renewable support schemes; RE-Xpansion Final Report*", April 2005, http://www.ewea.org/06projects_events/proj_RE_Xpansion.htm.

**Figure 2.3 The basics of the green certificate trading**




Mc=marginal cost corresponding to the fixed quota; Pe=price of electricity; Pc=price of the green certificate with Pc=MC-Pe; up to the quantity Q, RES will be produced anyway as it is commercially viable;

Regarding the feed-in-tariff, there seem to be different ways in which this mechanism is applied across Europe. In some cases, the FIT represents the regulated, total guaranteed minimum price to be paid to the producer of green electricity. Sometimes, this total minimum price includes other subsidies or tax rebates. In other cases, the FIT takes the form of a premium on top of the market price for “grey electricity”[7]. The regulatory authority places an obligation on integrated companies to pay the green electricity producer the respective regulated tariff. A more detailed explanation on the basis for establishing FIT is provided in Sijm (2002).[8]

In a nutshell, establishing an adequate FIT able to deliver the set policy goals requires a thorough analysis of various issues including the followings: linking the level of the tariff to the cost of production as opposed to end-consumer prices may have different effects depending on the economy[9]; it is desired that the feed-in-tariff is time bound,

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[7] For the purpose of this section only, grey electricity means electricity produced from plants operating on conventional fuels.

[8] J.P.M Sijm, “*The performance of feed-in-tariffs to promote renewable electricity in European countries*”, pg. 6, www.ecn.nl.

[9] In Germany the first feed-in-tariff was linked to the end-consumer prices. As the consumer prices went down as a result of liberalisation, the level of support also went down. The FIT has been revised and now is based on production costs. For details see Ibid 8. Most of the new Member States have their FITs linked to the end consumer price but in short to medium term, the situation in these countries is likely to be exactly the opposite than it was the case in Germany. As subsidies are being phased out and new environmental regulations enforced, the end consumer prices are likely to rise. However, it also means that the support for RES could be more volatile. If the FIT level is based on

decreases over time and is negatively correlated with capacity size in order to ensure efficiency and innovation[10]; in case the FIT is targeted towards a narrow technology band, other support mechanisms may be necessary to allow for some degree of diversification in RES technologies provided that climatic and economic conditions in the country allow, to avoid distortions in competition among companies within the sector. Depending on the way they are calculated and applied, feed-in-tariffs seem to provide more certainty for the investors and deliver, at least in short to medium term, an increase in RES capacity[11]. However, they tend to fail in bringing down the cost of renewable generation and, in long term FIT may prove incompatible with liberalised energy markets.

In contrast, green certificate trading is sometimes perceived as being more attractive as it tends to avoid market distortions within the renewable market through price competition and, at least in theory, offers a greater potential for economic efficiency gains due to higher flexibility allowed for cost minimisation. Like in the case of FIT, there can be different design approaches to a TGC scheme. The main idea behind a tradable green certificate (TGC) is that it separates the market for physical electricity from the one for the "green value" of this electricity. Most commonly, when a TGC system is used, the demand is created via a mandatory quota[12] which is used in combination with a penalty system for non-compliance. Therefore, a green certificate may have two different functions: as an accounting mechanism to verify whether the quota has been reached and to facilitate trade in green electricity. Through a TGC system, suppliers have access to a wider pool of renewable technologies and, as a consequence, an opportunity to comply with national regulations in a cost-efficient way. The TGC system is more likely to deliver the desired outcome under certain conditions, including: the penalty level should be set high enough and should be enforceable; the scheme should be designed for an explicit time frame with short

production costs, the support for RES would probably become more comparable with the level in the EU-15 as most of the RES technology is imported so the production costs may be more comparable than end-user prices. The difficulty in seting the fee-in-tariff based on production cost lies in the limited ability of the regulator to obtain accurate information on those costs.

[10] See also C. Huber, "*Final Report of the project ElGreen*" .

[11] Across Europe, feed-in-tariffs seem to have been particularly instrumental in wind developments and to a much lesser extent PV (in Germany).

[12] There is an intimate relation between the price of grey electricity, the price of the green certificate and the quota. For a detailed discussion on this issue see also S.G Jensen, K.Skytte, "*Interactions between the power and green certificate markets"*

redemption periods in order to have the desired impact on the purchasing behaviour of companies who seek compliance; limited banking options to allow on one hand to hedge against price spikes of the TGC but on the other to ensure timely capacity deployment. The experience so far with TGC schemes is rather limited and signals are somehow mixed. As countries will gain knowledge in handling these schemes, further assessments will be necessary to draw clear conclusions. However, from the experience so far, it seems that on one hand the TGC scheme may offer a cost-effective way to meet RES targets and is likely to induce lower prices for renewable generation. On the other hand, if enforcement mechanisms are lax, TGC schemes may prove less effective in actually deploying new RES capacity within the desired period of time. In addition, being a mechanism where the price is set by the market but the minimum quantity is predetermined, chances are that disturbances in the price for the green certificate will occur. It is therefore common for countries who have implemented such a mechanism to introduce price caps (and floors) to protect the consumer (and the producer) in case of adverse price movements.

To conclude, although the Renewable Directive calls for the support schemes to achieve RES objectives in a cost-efficient way, designing such policies may prove challenging. To design instruments that deliver with some precision the expected outcome would require a good knowledge of the workings of various mechanisms and accurate information about production costs. As most of the European countries are still in the 'learning by doing' phase, changes in the main policy instruments are to be expected over time but transparent transitional arrangements should be made to allow for a smooth transition, predictable for investors. In addition, fiscal instruments could be used to fine-tune the policy[13].

As deployment of renewable energy technology is likely to have effects on other sectors of the economy (e.g. the electricity consumption-through price, land use, environmental protection, transport, etc) it seems

[13] Given the practical limitations of the quota systems (with an embedded trading scheme and penalties) the ultimate choice for a main policy instrument to support a faster deployment of renewable technologies, in the author's opinion, should take into account, at least in short to medium term, the existing situation on the ground (e.g. how much and what kind of green capacity already exists in the market) and the degree to which market players have the opportunity and the skills to use secondary markets for derivatives to hedge against various risks typical for a trading system (e.g. price volatility).

necessary to establish clear goals for the RES support schemes and take-to the extent possible-an integrated approach[14].

***Guarantees of origin***

Guarantees of origin (GOs) are an important tool in monitoring the generation of electricity from renewable energy and therefore deserve some discussion.
The Art.5.(3) of the Renewable Directive requires that a GO should specify the energy source from which the electricity was produced, including the dates and places of production, and in the case of hydroelectric installations, indicate the capacity and serve to enable producers of electricity from renewable energy sources to demonstrate that the electricity they sell is produced from renewable energy sources within the meaning of this Directive.

It is worth observing that the Directive requires neither to specify the amount of electricity produced nor the corresponding time frame. Both pieces of information though, may prove rather useful in accounting accurately the quantity of green electricity produced/traded in/among Member States and may facilitate monitoring the capacity development in long term.

GOs will have no intrinsic monetary value, but may prove useful in fostering trade in green electricity between Member States. By holding GOs, generators can demonstrate that their electricity has genuinely been produced from a renewable source. The GOs could also facilitate compliance with other national regulations (e.g renewable obligation –as long as the obligation is placed on generators, climate change, etc). However, there are some issues related to the use of the GOs that deserve attention. One challenge lies in the definition of renewable energy sources. Some countries for instance do not consider big hydro as a renewable energy source due to its potential environmental damage

[14] For instance, it may happen that the EU-wide emission trading scheme would help in achieving some of the renewables goals by stimulating the appetite for renewable demand. Also it is beyond the scope of this thesis, further analysis on the implications of current national allocation plans on the renewable demand may provide interesting and timely insights on how these types of policies could be better correlated in order to achieve simultaneously climate and renewable objective in the most effective way. For instance, a good discussion on how a TGC could deliver climate change benefits is provided in P.E. Morthorst, "*A green certificate market combined with a liberalised power market*". See also C.Huber and P.E. Morthorst, "*Linking promotion strategies for RES-E and CO2 reduction in a liberalised power market: is a simultaneous policy necessary?*"

although large hydro could be used against the 2010 target. In addition, at European level, the definition of waste it is still unclear[15]. Art. 5 (4) requires that the GOs are mutually recognised by the Member States. By recognising a Guarantee of Origin, the Member State recognises that a particular amount of electricity has been produced from a renewable source as defined in the Directive. This recognition does not provide for automatic compliance with national regulations[16]. Finally due to the possible multiple usages of GOs (e.g. support, reporting and monitor compliance with the RES-E target), the danger of multiple counting is significant. One way to go around this problem is to achieve a certain level of harmonisation across European countries, namely to avoid as much as possible that GOs are being used for reporting purposes in one country, to demonstrate compliance with the target in other and to support green electricity trading in another[17].

The definition of “generators” is provided in the Electricity Directive- to which the Renewable Directive refers to- as ‘a natural or legal person generating electricity’. So, a generator could be anyone from an individual person generating small-scale green electricity, a community based generation system or an on-site industrial generator to the more traditional integrated companies. Depending how Member States decide to apply the Renewable Directive (and the Electricity Directive especially with respect to the opening of their energy markets), different national arrangements may be put in place to implement legislation, appoint the appropriate body to issue the guarantees of origin and to prepare an adequate and reliable system including the preparation of documents and registries.

***The removal of administrative barriers***

The Directive requires that Member States put in place national mechanisms to reduce the regulatory and non-regulatory barriers to

[15] European standards allow only for organic waste to be considered as renewable. However some Member States include all municipal waste in the renewable category (e.g Spain, Italy, Lithuania).

[16] As a consequence, a certificate that proves the origin of electricity from big hydro may not be used to comply with national regulation (against a pre-defined quota) in a country where big hydro is not recognised as a renewable source. Same can happen with waste to energy sources-e.g UK. Spain also uses a definition for small and large-scale hydro power capacity that is different from the commonly adopted EU definition. In Spain all production capacity lower than 50MW is considered to be small-scale production capacity. Similar discussion is valid for waste generated electricity.

[17] For a comparative discussion on guarantees of origin in different EU-15 countries see M.A. Uyterlinde et.al, “*Guarantees of origin and multiple counting of electricity from renewable sources*”, ECN-C-04-098, September 2004, www.ecn.nl.

increase the electricity production from renewable energy sources, streamline and accelerate procedures at the appropriate administrative level, and ensure that the rules are objective, transparent and non discriminatory, and take full account of the particularities of the various renewable energy source technologies.

In order to remove administrative barriers, the Directive further highlights that there is a need for a good coordination among various institutions involved in the approval cycle for renewable generation. In particular, it seems important to coordinate between the authorities in charge with licensing procedures and those in charge with local planning for renewable energy if fast-tracking of renewables is envisaged.

***Guaranteed access to the grid***

Concerning the access to the grid of renewable energy generators, the Electricity Directive already paved the way for independent power producers (which are likely to contribute to a significant share in renewable electricity production). However, due to their inherent dependence on climatic conditions (therefore the variability of the electricity output) and the higher electricity price required to cover the production costs and ensure a reasonable profit, the connection of renewable generators to the grid remains an issue. From the financing perspective, the obligation to give priority to renewable generation to the extent possible provides a useful impetus by ensuring some certainty over the project revenue. Outstanding issues include connection costs and the maximum load an energy system could accept from renewable sources without endangering the quality of the electricity produced and the security of supply require further considerations.

In conclusion, the Renewable Directive opens up a timely opportunity for the Member States to rethink the way the future demand for electricity in their respective jurisdictions could be dealt with, ensuring in the same time a greater diversity in energy supply, a cleaner environment and in long term, sustainable development[18]. Because of different structures of the energy systems (some are largely based on hydro while others rely heavily on indigenous fuels or nuclear, etc), it is to be expected that

[18] However, the degree to which a renewable project contributes to sustainable development depends on the project design and how the economic cycle is ensured to secure a revenue stream that enables the community to pay the electricity in long-run and to afford adequate maintenance for the technology. This is particularly relevant for remote rural areas.

different domestic financial and administrative resources will be made available and maybe different objectives of the RES policy and national arrangements to fully implement the Renewable Directive will be established across European Union, at least in short to medium term.

### *2.2. Myths and facts about renewable technologies*

In the Art.2 of the RES-E Directive definitions are provided concerning the type of renewable energy sources (and consequently technologies) that are to be promoted and these include: solar, wind, tidal, hydropower, biomass, landfill gas, sewage treatment plants, gas and biogases. With respect to biomass, this source it is further defined as "*the biodegradable fraction of products, waste and residues from agriculture (including vegetal and animal substances), forestry and related industries, as well as the biodegradable fraction of industrial and municipal waste*." When it comes to waste, in the Directive's preamble, paragraph 8, it is mentioned that *"Where they use waste as an energy source, Member States must comply with current Community legislation on waste management. […] Support for renewable energy sources should be consistent with other Community objectives in particular respect for the waste treatment hierarchy*".

After more than twenty years of research and operation, the potential benefits brought about by renewable energy technologies should have created strong incentives for a large-scale deployment. For instance, their modular structure allows for a more flexible system that could better match supply with increasing demand and could contribute to enhance the security of supply and safeguard against high volatile international fossil fuel prices. From the environmental perspective, renewable technologies could support the world's efforts to combat climate change. For instance an off-grid solar system that replaces an average diesel unit will save about 1 kg CO2 for every kWh produced. CO2 savings for grid-connected systems, the actual carbon savings will, of course, depend on the local energy mix but a world average figure to date seems to be somewhere around 0.6 kg CO2 per kWh[19].

Despite their potential benefits, in particular to local communities and the environment, the market penetration for renewable technologies is still well behind what many may have expected. To date, only 18% of the

[19] The World Bank, "*Technical and Economic Assessment: Off Grid, Mini-Grid and Grid Electrification Technologies*", Summary Report, November 2005, www.worldbank.org

world's electricity production comes from renewables, mostly from hydro (*see Figure 2.4 below*).

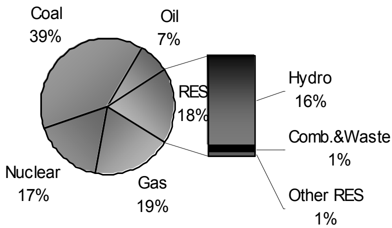


**Figure 2.4 World electricity production by source, 2001**

*Source*: GEO Year Book 2006[20]

To better understand the forces at work behind renewable technologies, below some of the outstanding issues concerning these technologies are briefly discussed.

***Generation cost***

Probably one of the main cause because of which renewable technologies did not achieve a higher market penetration rate is their perceived[21] high generation cost compared with conventional technologies. While this remains indeed true for most of these technologies, it is important to have a look at the facts behind this status quo.

Despite the relatively low market penetration, significant progress has been made in improving the economics of these technologies. If we are to take the PV systems for example, the electricity generation cost declined by an average of 5% per year over the last 20 years. The price for a turnkey PV system, grid-connected is now around €6000/$kW_p$ and

[20] United Nations Environment Programme (UNEP), Global Environmental Outlook 2006, DEWA 2006.

[21] While it is true that in appearance the generation cost of these technologies remains high, the comparison with conventional technologies still suffers from an incomplete analysis. For instance, comparisons with oil and gas fuelled power plants do not normally take into account the risk associated with the availability of these sources over the long term. Recent oil price increases at historic levels that already exceed the levels we have experienced in previous oil crises (even corrected for inflation), show that oil (and it is the author's opinion that gas will follow suit) resources may not be anymore easily available for a long time to come for reasons including political unrest in the Middle East region, lack of major oil fields discoveries to date, increased competition between major oil consumers such as EU, US, China, India, political interference in the natural resource industries in countries like Russia, Venezuela and Africa and the complexity surrounding new explorations (including lack of trained personnel, problems with new resources such as oil sands, etc). If all these were to be factored in, renewable technologies would gain some leverage against the more conventional technologies. This is the reason why the author prefers to use the term "perceived higher generation costs".

around €8000/ $kW_p$ for a stand-alone system[22]. Wind power is one of the clear winners among the renewable technologies and became a mainstream power technology. Two decades of technological progress led to the situation today where a single modern turbine at any given site produces about 180 times more electricity at less than a half the cost per kWh as it was the case twenty years ago[23].

Due to the natural cycle of a particular renewable source of energy (e.g. sun, wind, water, etc), the output from renewable sources is variable and thus the overall cost of these sources depends not only on the nature (and the availability) of the respective resource but also on the amount of back-up/storage equipment needed to meet the full demand (*see more discussion in the following section on Output variability)*[24]. While the performance of individual technologies has been studied to various degrees for different types of technologies, hybrid systems have been much less explored. This is, in the author's view, rather unfortunate for at least two reasons.

For one, the economics of hybrid systems could improve significantly thus leading to an overall lower generation cost within the system considered. For instance a solar PV-wind power system could take advantage of the complementary availability of solar and wind resources thus increasing the overall reliability of the system without having to resort to other back-up sources. This arrangement could be particularly interesting for small loads (100kW or less) in an off-grid or mini-grid configuration. The capacity factor of such system can be around 30% and proved already suitable in particular for islands mini-grids, remote facilities and buildings[25]. Another type of a hybrid system that has already been considered is the use of wind power in combination with hydro power with reservoir as a storage facility. Such a system could reduce significantly the need for peak-power generation thus bringing down the overall system costs. The performance of such a hybrid system will depend on the capacity of the hydropower system and its ability to cope with fluctuations in demand (e.g. when wind power is not available). Some alternatives to improve the performance of the hydropower plants

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[22] See *Supra Note* 19

[23] "*Europe's Energy Crisis; The No Fuel Solution*", EWEA Briefing, February 2006, www.ewea.org.

[24]http://www.erec-renewables.org/sources/geothermal.htm

[25] For more details see Chubu Electric Power Inc., Toyo Engineering Corporation, Princeton Energy Resource International, Energy Technologies Enterprises Corp, The energy and resources institute, "*Technical and economic assessment: off-grid, mini-grid and grid electrification technologies*", discussion paper, November 2005, www.worldbank.org.

might be available depending on the site characteristics and location (e.g. installing additional turbines to increase capacity and improve the ability of the plant to cope with higher swings in electricity demand, increase the storage capacity or implement a pumped storage system or a combination of the above)[26].

Secondly, if we are to tackle the new energy challenge, in particular in the context of liberalised markets, adverse movements in gas and oil markets and local communities that face global competition, distributed generation should, in the author's opinion, be part of the solution. In this respect the role of hybrid systems in mini-grid configurations becomes important and deserves a closer look. More detailed information on the technical indicators and system cost parameters of selected renewable technologies is provided in *Table* 2.2 in *Annex 2.II.*

***Output variability***

In case of higher market penetration of grid-connected renewable technologies, some electricity systems may need to improve their ability to manage the natural cycles of renewable energy. Natural cycles relate to a phenomenon that is common to most renewable sources, namely their output varies with natural conditions[27]. Each of the renewable source has its own natural cycle with a higher or lower impact on its energy output and consequently on the grid operation (in the case of grid-connected systems). While some of these sources have highly predictable and well understood natural cycles such as hydro, biomass, tidal and geothermal, others are less predictable having seasonal, diurnal and hourly variations and require further research and sophisticated weather forecasting techniques. Among the latter are wind, solar and wave sources. Wind power for instance, received significant attention in recent years because it has already achieved significant penetration rates in particular in Germany, Denmark and Spain. Wind power posed a new challenge for grid operators (and which is less important for other types of renewable sources), namely intra-day and intra-hourly output variations. Fortunately, few options are available to deal with this challenge. First, it is important to recognize the

[26] For details on the economic impact of introducing such a combination in Alberta's electricity system is provided in L.Dragulescu, P. Benitez and G. C. van Kooten, "*The economics of wind power with energy storage"*, working paper 2006-02, REPA, University of Victoria, January 2006, www.repa.econ.uvic.ca.

[27] For a more detailed discussion see International Energy Agency (IEA), "*Variability of wind power and other renewables; Management options and strategies*", IEA, 2005, www.iea.org.

geographical aggregation of wind parks within the electricity system. It is very unlikely that all wind mills in a system will stop operating in the same time. Some studies show for example that in the case of Germany and Denmark, the maximum hourly swing in output from distributed wind power rarely, if ever, exceeds 20% of installed capacity[28]. In Western Denmark, the maximum measured change in output per minute from some 2400 MW of wind power is usually around 6MW[29]. Secondly, the output variations from some renewables could be mitigated by having a good mix of various technologies (see also discussion in the previous section on hybrid systems). Some studies[30] suggest that by widening the renewable portfolio significant reductions in the need for backup reserve can be achieved. For example, at a rate of penetration of 10% for wind power, the backup reserve can be reduced from 90% (which may be the case if wind power was to be used alone) to less than 10% if a more balanced mix of technologies consisting of wind, solar PV and distributed CHP were to be used to satisfy the same demand[31].

In addition to widening the renewable portfolio and taking advantage of the geographical distribution of variable sources, other tools may be used to offset their variable output. Better weather forecasting tools, increased interconnection capacity to make better use of existing capacity and reserves, more distributed generation and shorter gate closure time will allow renewable generators to make better use of their generation thus reducing the need (and the costs) for balancing the supply. On the demand side, energy efficiency and demand response programmes could help to free-up capacity needed for backup and shave the peak-load which in turn would reduce the overall system costs[32].

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[28] See *Supra Note* 27

[29] See *Supra Note* 27

[30] G.Senden, "*Renewable Energy and Intermittency – Diversification and Optimisation*", presentation delivered during the workshop on *Intermittency in Renewable Energy*, 29 November 2002, London, www.eci.ox.ac.uk/lowercf/renewables/gsenden.pdf.

[31] See *Supra Note* 30

[32] For more detail on demand response programmes see for instance the International Energy Agency's demand side program (IEA-DSM). Under its DSM program, the IEA has established Task XIII to evaluate demand response resources (DRR) from around the world and develop recommendations for best practices on how to integrate DRR into regular market activities. Details on the program and useful publications are available at http://www.demandresponseresources.com/Home/tabid/1/Default.aspx.

***Energy payback time, the energy return factor and environmental benefits of renewable technologies***

The benefits of renewable technologies have not always been a clear-cut issue. To investigate the benefits of renewable technologies - in terms of how much more energy they produce over their life-time than it is consumed for their manufacturing, operation and decommissioning and how much CO2 can be avoided - usually three indicators are calculated: the energy payback time, the energy return factor and the potential for CO2 mitigation. For the purpose of this discussion the following definitions are considered:

*Energy Pay Back Time (EPBT)* is the ratio of the total energy input during the system lifecycle (e.g. manufacturing, operation and decommissioning) and the yearly energy generation during system operation, both expressed either in primary energy ($MJ/kW_p$) or in final electrical energy ($kWh/kW_p$).

*Energy Return Factor (ERF)* is the ratio of the total energy generation during the system operation and the total energy input during the system lifetime. In other words, the energy return factor represents how many times over the system generates energy compared with the energy consumed during manufacturing, operation and maintenance, installation and dismantling.

*Potential for CO2 mitigation* is the quantity of greenhouse emissions that can be avoided by installing a renewable technology. This is calculated by multiplying the energy output of the system during its lifetime by the average CO2 content of the local electricity mix. It is obvious that this indicator will only make sense after the system would have already paid back the input energy.

Given these definitions, the findings from a recent IEA study concerning PV systems are summarized in *Table 2.3* [33].

[33] International Energy Agency (IEA), "*Compared assessment of selected environmental indicators of photovoltaic electricity in OECD cities*", Photovoltaic Power Systems Programme, report IEA-PVPS-T10-01:2006, http://www.epia.org/documents/NL_0606_002.pdf

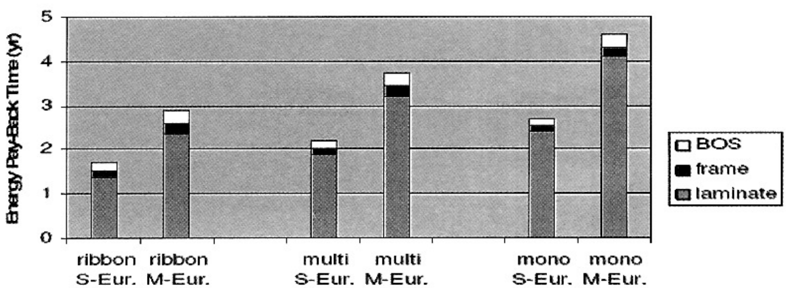
**Table 2.3 The EPBT, ERF and the potential for CO2 mitigation for PV systems**

| PV technology | Roof-top mounted PV | | PV facade | |
|---|---|---|---|---|
| | Min. value | Max. value | Min. value | Max. value |
| EPBT (Min and Max values in years) | 1,6 | 3,3 | 2,7 | 4,7 |
| ERF (Min.and Max.values are unit values) | 8 | 17,9 | 5,4 | 10 |
| Potential for CO2 mitigation (Min. and Max. values in tCO2/kWp) | 0,1 | 40 | 0,0 | 23,5 |

*Source:* IEA (2006)

From the *Table 2.3* above we can see that while the overall performance of the PV systems depends significantly on the location and the type of technology, they remain a viable technology that could bring about important benefits both in terms of energy supply and GHG emissions avoidance. Similar findings are presented in *Figure 2.5* below. The calculations have been done using a life cycle assessment (LCA).

**Figure 2.5 Energy Pay-Back Time (EPBT) for different PV modules**




*Source*: Newsletter di ISES Italia – Sezione dell'International Solar Energy Society (2006)[34]

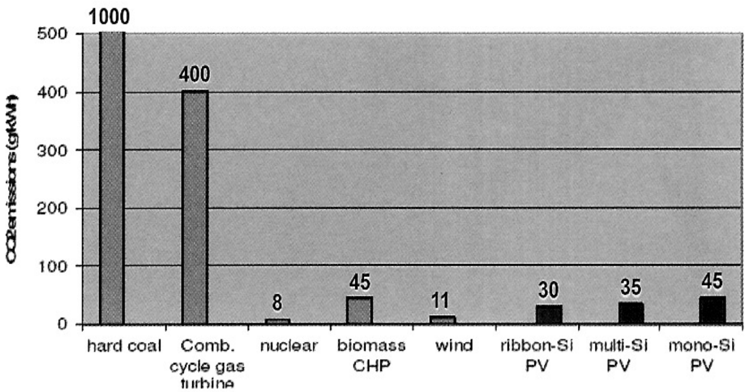
*Note*: S-Eur = South Europe; M-Eur = Central Europe; the energy efficiency for the three types of modules considered (*amorphous silicon, poli and mono cristaline*) is 11.5%, 13.2% and 14% respectively; BOS = balance of system

[34] Newsletter di ISES Italia – Sezione dell'International Solar Energy Society, Anno XIII – no. 6, Giugno 2006, pg.5

For wind power, the indicators look even more promising. For instance a Danish 600kW wind turbine is likely to recover all the energy spent in its manufacturing, operation and maintenance and decommissioning within three months of its operation[35]. During its 20 year life cycle, the same 600kW turbine would have produced at least eighty times more energy than its energy input (in other words ERF is 80). When it comes to climate change, a 500kW wind turbine operating at 30% load factor and producing some 1.3 MWh/year could avoid as much as 351MtCO2/year[36].

*Figure* 2.6 below shows a brief comparison between different types of electricity generation technologies in terms of $CO_2$ emissions per kWh using LCA.

**Figure 2.6 $CO_2$ emissions for different electricity generation technologies (*measured in g/kWh*)**




*Source*: Newsletter di ISES Italia – Sezione dell'International Solar Energy Society (2006)

[35] The calculations are made for a turbine manufactured in 1995. They include all components of a wind turbine including foundation and grid reinforcement costs. For decommissioning, it was assumed that all parts are destroyed with the exception of the transformer and the parts that are economically recyclable (such as the blades as scrap metal). If the foundation was to be used for a new turbine, the energy balance is likely to improve. The scrapping process also seems to have a positive energy balance. For details see Danish Wind Industry Association, "*The energy balance of modern wind turbines*", Note No.16, December 1997, www.windpower.org

[36] United States Energy Association, http://www.usea.org/Climatechange/chapter8/8.8.html

From *Figure 2.6*, it appears that wind, solar PV and biomass CHP could bring about significant $CO_2$ emissions reductions.

Taking into account the discussions above, it is becoming evident that the challenges associated with renewable technologies are not insurmountable and the risks can sometimes be overstated. It is also very important to recognize that the cost of renewable technologies and/or of the electricity they generate is determined both by factors that are specific to the industry (e.g. the characteristics and the natural cycle of a particular resource) and by external market conditions. The cost of generation from renewable technologies depends also on developments in other sectors of the economy. Rising prices in the commodity markets such as steel, silicon, land, etc (including rights for subsurface mineral exploitation) and/or the labour markets (for instance due to rising demand in drilling expertise for oil and gas industries or construction works), could significantly increase the cost of generation from these technologies. For example, a doubling of the steel price for a geothermal project could trigger a 10-20% increase in overall project cost, depending on the type of the project and its size[37] thus leading to an overall increase in the electricity (heat) price generated. In the solar PV market for instance, despite an unprecedented annual growth in 2005 - the market reached 1460 MW world wide, up 34% compared with 2004 with the strongest growth taking place in Germany (53%) - its development is significantly affected by the tight supply of silicon. Despite a rise of 12% in silicon feedstock capacity, the tight supply caused long-term poly-silicon contract prices to increase by 25%[38], development which might affect the cost of solar cells production.

Different development strategies for an energy system should be considered as solutions are already available to bring down the overall generation cost. Also, risks have to be adequately identified and shared among the market participants. Understanding the real risks associated with each of the renewable technologies would help to better structure the projects, ultimately bringing down the overall cost of the energy produced with these technologies. Some studies suggest for example that in the case of geothermal projects, the cost of borrowing for an

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[37] Cedric Nathanael Hance, "*Factors affecting costs of geothermal power development*", Geothermal Energy Association, August 2005, www.geo-energy.org/publication .

[38] http://solarbuzz.com/Marketbuzz2006-intro.htm, searched on August 8th 2006. The impact of tight silicon supply on the solar PV industry has been identified also by the European Photovoltaic Industry Association (EPIA). For details see www.epia.org .

Independent Power Producer (IPP) compared with that for a municipal utility can be as much as 89.4% higher. Assuming similar costs for operation and maintenance (O&M), the levelized cost[39] of power produced by an IPP can be at least 44% more expensive than the power generated by a municipal utility[40]. The difference in costs can be explained by the type of financing each of the two types of developers usually have access to. While the municipal utility may have access to cheaper debt financing, the IPP is often required by financial institutions to have a higher share of equity which tends to have higher financial costs associated with it. Consequently, one way to bring down the cost of generation from renewable technologies is to identify adequate innovative financing schemes that involve a mix among public authorities, private companies and the general public. To what extent such arrangements are possible in Central and Eastern Europe, depends to a great extent on the economic environment in these countries and whether bottlenecks at local level are being dealt with in a timely manner (*for a more extensive discussion on challenges at local level in NMS, see Chapter four: Investment context for RES-E in the new Member States*).

The cost of technology itself has decreased over time due to innovation and chances are that the trend will continue in the future, maybe at a faster pace if research and development activities related to renewable technologies are adequately supported and niche small and medium sized companies (SMEs) are encouraged. One example of a recent initiative is the joint venture that was formed early in 2005 between the German company Q-Cells AG and the American company Evergreen Solar Inc. The new company, called EverQ, intends to use a new technology, called String Ribbon, in the solar cell manufacturing. The advantage of this new technology is that it uses 30% less silicon. In November 2005, the largest independent manufacturer of silicon and polycrystalline wafers, the Norwegian firm ASA (REC), joined EverQ. The new company is now owned 64% by Evergreen, 21% by Q-Cells and 15% by REC. The joint venture has already become an important economic engine in the German town Thalheim. To date, 260 workers have been employed and the number is likely to increase to about 300 once the plant achieves its planned capacity of 30 MW. The venture

[39] The levelized cost of power is calculated as the project's annual cash flow divided by the annual amount of energy produced. For details on this methodology see IEA, Guidelines for economic analysis of renewable energy technology applications, OECD/IEA, Paris, 1991.
[40] See *Supra Note* 37, pg. 37

received a 27.5 million Euro grant from the German Government[41]. A more detailed discussion on a possible solution to encourage such initiatives in NMS using Structural Funds for risk capital financing is provided in *Chapter four: Investment context for RES-E in the new Member States*.

Given all of the above, it seems therefore crucial that RES development is being considered not in isolation but as an integral part of an energy system and within a specific economic context.

### 2.3. Developing renewable energy: lessons learnt from EU-15

The deployment of renewable energy sources in Western Europe started approximately 30 years ago, first as a reaction to the oil crises and later as a means to tackle security of supply issues and increasing environmental and unemployment concerns. The variety in size, climatic condition, level of economic development, stage in liberalising the energy markets and culture among the EU-15 led to the emergence of different support schemes for renewable energy sources.

At a glance, it seems that most of the EU-15 countries have chosen as a main policy instrument a FIT or a TGC with investment support mechanisms and tax rebates as complementary instruments. Ireland is the only country from the EU-15 that still uses a tendering system as a main instrument. Most of the countries seem to have differentiated support for different types of RES-E technologies, maybe as a result of a strategic planning concerning the development of renewable energy sources[42]. Finland, Italy, Luxembourg, Greece and Portugal however, exhibit a less diverse assortment of RES-E policies. In the case of Luxembourg, the reason is that the CCGT[43]-based energy system already delivers environmental benefits at lower cost that renewable energy would and as a consequence there is no sense of urgency in implementing RES-E policies in this country. In the case of Italy, Greece

[41] http://www.renewableenergyaccess.com/rea/news/story?id=45213, searched on 8th of August, 2006 and www.epia.org searched on 25th June 2006.
[42] For instance Germany, Denmark and Spain contribute to 84% of total wind production in the EU-15, Finland, Denmark and the UK are front runners concerning biomass, Germany accounts for 70% of the PV installed capacity in the EU-15 followed by Spain, Austria and Luxembourg.
[43] Combined Cycle Gas Turbine

and Portugal on the other hand, the approach towards renewable energy might be restraint by economic factors[44].

On 26 May 2004, the European Commission issued a communication to the Council and the European Parliament on the status of renewable energy in the European Union[45]. The communication is based on reports received from the Member States at the end of October 2003. The main findings presented in this communication reveal that: policies and measures currently in place in the EU-15 will probably achieve a share of electricity produced from renewable energy only 18-19% in 2010 and only 10% if we include the heating sector. In other words, in the absence of further action, the target of 22% for electricity and 12% in total for 2010 will be missed by the EU-15; the main risk in achieving the target is the significant imbalance between the level of commitments among Member States; the main culprit seems the sluggish growth of RES in heating and cooling[46]; as far as the electricity production is concerned, biomass is used less than expected[47]; within the EU-15, 3 clusters of countries seem to have emerged given the probability to achieve the RES target with current policies in place: unsurprisingly, Denmark, Germany, Spain and Finland are the front runners followed by the Netherlands, UK, Sweden, Belgium, Italy and France who only recently started to accelerate the pace of RES development (and therefore at this time the impact of recent policies was difficult to assess) and should policies be properly enforced, they might meet the RES target and Greece and Portugal who lag behind with a slim probability to meet their target; complex licensing procedures, poor integration of renewable energy sources into regional and local planning and opaque grid-connection procedures coupled with lack of appropriate financing seem

[44] In Italy is the public debt is 105% of GDP. In addition, Italy is on the way to breach the Maastricht criteria on public deficit as well. As a consequence, government spending may need to be revisited and eventually constrained. Portugal experiences similar problems. See "*Commission warns Italy as budget dispute goes to court*", on www.euractiv.com (searched on 29.04.2004).

[45] COM(2004) 366 final from 26 May 2004, www.europa.eu.int It is worth mentioning that the paper presents information from all members, including the New Member States. However the impact assessment is mainly based on reports received from EU-15 as it was recognised that for the New Member States it may be too early. More substantial information is expected from the New Member States in the next reporting round which is due in 2006.

[46] RES utilisation from heating and cooling is at the moment of writing included in the Directives on energy utilisation in buildings and on combined heat and power. A future Directive to strengthen the requirements to use RES in heating and cooling is envisaged.

[47] C.Duvigneau in his presentation at the Conference on "*Restructuring the energy sector in transition countries*" (Leipzig 2004), also highlighted that some of the renewables are not on track in meeting the 2010 target. Apart from biomass he also mentions solar PV.

to be among the most common reasons for the current situation[48]; concerning the implementation of a system to issue a Guarantee of Origin, only five countries out of 15 seem to have finalised the process; all the other are in various stages of implementation (*see Table 2.4 in the Annex* 2.III).

### *2.4. Promoting renewable energy sources in the new Member States*

The development of renewable energy sources in the new Member States takes place (and will continue to take place at least in the short to medium term) in a changing environment shaped by the need for further adjustments of national economies to fully integrate in the EU internal market. Regarding the energy sector, the ongoing reforms triggered a series of questions including: How to proceed with the energy market liberalisation given the lack of experience with decentralised energy planning? How fast energy price adjustments can be made in order to allow on one hand a functional energy market to develop but on the other hand to come up with energy tariffs that could be socially acceptable (e.g. the question of indigenous fuels or nuclear power, etc)? What is the real status of available capacity reserves and how big a scope exists for RES-E in this context?[49]

Answers to these questions become highly relevant to any attempt to estimate the pace and the scale of future deployment of RES-E capacity in the new Member States. There are little doubts about the reasons why the new Member States need to pursue ambitious goals to promote renewable energy. However, in attempting to achieve these goals, NMS may find themselves treading water.

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[48] In France for instance, obtaining construction permits especially for wind and small hydro, seems to be very challenging and time consuming for the project developers. In contrast, the change in the urbanism law in Germany back in 1997 proved extremely helpful for investors ("*Understanding Investment Risk in the European Renewable Electricity Market*" – minutes from the ADMIRE-REBUS workshop, Paris 17$^{th}$ June, 2002). For a good discussion on various RES-E support schemes in EU-15, see also R.Haas et.al."*How to promote renewable energy systems successfully and effectively*", Green-X Final Report.

[49] Although it is known that central planning resulted in overestimated generation capacity, part of this capacity it is rather obsolete. As a consequence investments in new capacity might be needed to comply with various regulations concerning the EU internal energy market. *See more in Chapter 3 on energy markets*.

### 2.4.1. The driving forces for RES development in the new Member States

As mentioned earlier in this paper, the latest initiatives within the EU-15 to develop a policy framework to address specifically energy efficiency and renewable energy sources stem from ambitious environmental goals, clear commitments to mitigate climate change, and the desire to take stock of possible efficiency gains provided by market-based solutions. In the NMS, the process is likely to be driven by somewhat different factors including: opportunities to reduce unemployment, energy security (both in terms of resources and distribution), significant changes in agricultural policies[50] and the need to modernise and upgrade obsolete production capacities[51].

Without a doubt, the accession process was instrumental in changing the political, social and economical landscape in the new Member States and therefore a brief discussion on the **Accession Treaty** is provided below.

The Treaty of Accession[52] consists of two main parts. The first part (the Treaty) lays down the framework for cooperation between the present Member States and the candidate countries regarding the accession to the European Union. The second part (the Act) describes in detail the conditions of accession for the candidate countries and adjustments to the Treaties based on which the European Union is founded.

The Treaty consists of only 3 Articles, basically recognising the eligibility of the 10 candidate countries to become full Members of the European Union. The Act specifies all issues negotiated by the present Member States and the 10 candidate countries. The Act is divided in 5 parts (part one – Principles, part two – Adjustments to the Treaties, part three – Permanent provisions, part four – Temporary provisions, part five –

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[50] e.g. in Hungary there will be significant changes in crops, and therefore opportunities might arise for the increased use of biomass.

[51] REC and D.Barbu, Final Report, Renewable energy and energy efficiency partnership (REEEP)-Central and Eastern European regional meeting, Hungary, July 3-4, 2003, pg. 7

[52] The Treaty can be found on http://europa.eu.int/comm/enlargement/negotiations/treaty_of_accession_2003/index.htm . For a detailed discussion see M.Ivanica, "*An Overview of the Treaty of Accession of Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia to the European Union*", June 2003.

Provisions relating to the implementation of this Act) and includes a series of Annexes, Protocols, Declarations and the Final Act.

While the Treaty as a whole is significant to the extent that it clearly defines the rights and the obligations of the NMS as integral part of the EU, The Act (especially the Annex II, the Final Act and the Protocols) is particularly relevant to the RES-E development in the NMS and therefore some of its provisions are being briefly discussed below.

***Annex II – Energy***

The Annex II on Energy[53] is divided in two parts, part A containing general provisions and part B containing specific provisions concerning energy labelling. As far as the RES-E development is concerned, part A of the Annex is the most relevant. In paragraph 8.a) the specific targets for RES-E to achieve the objectives set by the Renewables Directive are defined. It is noteworthy to mention that Czech Republic clearly specified that the compliance with the RES-E Directive is directly influenced by the climatic conditions in the country. Consequently, in the absence of favourable climatic conditions, the overproduction of water resources in Czech Republic (e.g. big and small hydro) is “ruled out”[54].

***The Protocols***

There are in total 10 Protocols concluded with individual NMS on matters that would require sustained efforts beyond the accession date or address security or other issues relevant for the respective State. Among the protocols, two are of importance for the RES-E discussion as they refer to the closure of nuclear power plants in Lithuania and Slovakia.[55]

The Protocol no.4 on the Ignalina nuclear power plant in Lithuania stipulates that the Unit 1 should be closed before 2005 and the Unit 2 by 31 December 2009. During 2004-2006 the Community will provide financial assistance to compensate for the plant closure. The financial support will cover environmental issues, enhancing energy supply, increase energy efficiency and provide support for the employees. The financial assistance will be managed by the EBRD. In case of disruptions

[53] See the Accession Treaty, AA2003/ACT/Annex II available at www.europa.eu.int.
[54] Ibid 53, paragraph 8.d)
[55] More discussion on nuclear power developments in the new Member States is provided in Chapter 3 on energy markets.

of energy supply in Lithuania, the safeguard clause can be applied until 31 December 2012[56] interesting to note is that Ignalina currently produces 40% of the total electricity demand and a significant part is exported to the neighbouring Baltic countries.

In a similar fashion, the Protocol no. 9 on Bohunice V1 nuclear power plant in Slovakia provides for the closure of the Unit 1 by December 2006 and Unit 2 by December 2008. During the period 2004-2006, the Community will provide financial assistance to cover the decommissioning costs. The financial assistance will also be managed by the EBRD.

### *The Final Act*

Final Act consists of 44 declarations divided in two main categories: declarations adopted by the plenipotentiaries and other declarations. Below in *Table 2.5* selected declarations with potential relevance to the RES development are presented:

**Table 2.5 Selected declarations annexed to the Accession Treaty with relevance to RES development**

| Text of the declaration | Impact with relevance for RES. |
|---|---|
| **Joint declaration by the Czech Republic and the Republic of Austria concerning their bilateral agreement regarding the Temelin Nuclear Power Plant** *The Czech Republic and Austria may continue to fulfil their obligations taken on the 29th November 2001 in the "Conclusions of the Melk Process and Follow-up"*[57]. | Competition with nuclear |

[56] The Safeguard clause is stipulated by the Article 37 : "*If, until the end of a period of up to three year s after accession, difficulties arise which are serious and liable to persist in any sector of the economy or which could bring about serious deterioration in the economic situation of a given area, a new Member State may apply for authorisation to take protective measures in order to rectify the situation and adjust the sector concerned to the economy of the common market*." Act of Accession, Treaty of Accession, AA 2003 final, Brussels, 3 April 2003 (OR. En)

[57] The Melk Protocol and the Agreements on Follow-Up made in Brussels contained the following measures concerning the Temelín Nuclear Power Plant: An Info-Hotline, an Early Warning System, the Energy Partnership between the two countries carried out by the Austrian Energy Agency in cooperation with the Czech Energy Agency, Safety Issues, the Environmental Impact Assessment, the commercial operation of the Temelín NPP, free movement of goods and publicity in the media, the European Union enlargement process.

| | |
|---|---|
| **Declaration on shale oil, the internal electricity market and common rules for the internal market in electricity: Estonia**<br>*Estonia will be closely monitored to fulfil its commitments regarding the preparation to the internal energy market. Estonia will have to accelerate the market opening in the electricity and gas sectors. Estonia reserves its position regarding future legislative developments in this area. The oil shale sector requires particular efforts until the end of 2012 as well as the possibility to open the Estonian electricity market for non-household customers until the same date. The Commission will closely monitor the development of the electricity production and the changed in the electricity market in Estonia and neighbouring countries. Any member state may from 2009 request the Commission to assess the development of the electricity markets in the Baltic Sea area. After the analysis, the Commission will report to the Council with appropriate recommendations.* | Oil shale is cheap and accounts for approx. 90% of the total electricity generation. Due to social reasons, in short to medium term the RES development will be weighted against the use of cheap indigenous fuel. |
| **Declarations by the Republic of Malta**[58]<br>*With regard to Gozo, Malta states that "before the end of each Community budgetary period entailing a redefinition of the Community regional policy, Malta may request that the Commission report to the Council on the economic and social situation of Gozo, and in particular, on the disparities in the social and economic development levels between Gozo and Malta"14. The Commission will propose measures to reduce the disparities between Gozo and Malta. If Malta will not be eligible any longer for certain measures of the regional policy. The Commission should address whether the situation in Gozo requests further help from the regional policy.* | Funds from rural development may be allocated in Gozo for RES development (e.g. biomass); |
| **Declarations by the Republic of Slovenia** (partial)<br>*Slovenia agrees with the whole territory to be considered as one single region at NUTS 2 level for the period up to the end of 2006.* | Energy planning |

[58] Declarations of Malta refer to: neutrality, the Island of Gozo, maintenance of VAT zero-rating for foodstaffs and pharmaceutical products. We have retained here only the one concerning the island of Gozo as the island is eligible for future RES development projects that might benefit from rural assistance unlike Malta.

| **Declarations by the Commission of the European Communities** (partial) | Possible implications for biomass development (Poland) |
| --- | --- |
| *The Commission will apply the internal market and justice and home affairs safeguard clause after will hear the views and positions of the member states that will be directly affected by the application of the two safeguard clauses.*<br>*The general economic safeguard clause covers agriculture as well. It can be used when in certain agricultural sectors problems arise, that can induce the deterioration of the economic situation in a given area. Because of specific problems in Poland, "the measures taken by the Commission to prevent market disturbances under the general economic safeguard clause may include systems of monitoring of trade flows between Poland and other member states".* | |
| *The declaration to the conclusions of the accession negotiations with Latvia includes technical specifications to the treatment of abandoned land.* | Potential impact on off-shore wind power, biomass |

Finally, complying with various requirements of the Treaty of Accession entails considerable efforts to be made to align legislative measures and current practices virtually in all sectors of national economies of the new Member States. Due to past legacies, switching to new economic (particularly energy, agriculture and transport) and social systems (notably by strengthening public participation in decision making and project development) may prove nonetheless difficult at times. As a result, some NMS may choose a different pace in implementing certain requirements based on social, political or economic reasoning on short to medium term. On the other hand, the Treaty of Accession provides a framework to work within towards a higher level of integration thus ensuring a more effective implementation of future policies across European Union[59] on long term.

[59] For the impact of harmonisation of policy frameworks across EU, see also J.C. Jansen and M.Uyterlinde, *"A fragmented market on the way to harmonisation? EU policy –making on renewable energy promotion"*;

### 2.4.2. Renewable energy policies in the new Member States

As it has been presented earlier in the chapter, the EU-15 countries have already in place a wide range of policies and instruments renewable energy sources. In the NMS, the situation is somehow different. Most of these economies are emerging from a centrally planed economy and respectively a centrally planed energy system. Consequently, the priorities and the arrangements within national borders concerning the development and the integration of renewable energy sources are likely to differ from those currently in place in the EU -15, at least in short to medium term.

In the NMS, the share of renewable energy sources out of gross electricity consumption has been lower than in the EU-15. In the year 2000, the electricity production from renewable energy sources ranged from 0.2% in Estonia to 31.2% in Slovenia as compared to an average of about 14.7 % in the EU[60]. According to the EC, in acceding countries (now NMS) no strategic approach has been observed in recent years with respect to the development of renewable energy sources. The existing policy framework, although in line with general requirements of the Renewables Directive, mirrors this lack of strategic approach (*see Table.2.6, Annex 2.IV for a qualitative overview of existing policies and instruments to promote renewable energy sources in NMS*)[61]. All NMS countries have in place targets[62] and in some cases support mechanisms but existing instruments lack clear objectives and, in some cases, the level of support proves to be inadequate. Consequently, the renewable potential in these countries remained largely untapped[63].

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[60] European Commission report on "*Key structural challenges in the acceding countries: the integration of the acceding countries into the Community`s economic policy co-ordination process*", pg.33

[61] The author would like to draw the attention on the fact that some countries may have already changed their policy from the time the table was elaborated like for instance Czech Republic. At the time of writing this paper details on the new policy were not available and therefore the table has not been updated accordingly. Other countries such as Poland refined their policy within the time frame this paper was written. In the modelling exercise presented in Chapter 5, the new penalty system for Poland was considered.

[62] See *Supra Note* 3 for targets in the new Member States.

[63] Estimating RES-E potentials in the NMS is a rather challenging task and various potentials have been calculated by various institutions. One of the most comprehensive study on RES-E potentials in transition countries is the Black&Veatch, "Strategic assessment of the Potential for Renewable Energy in EBRD Countries of operation; Stage 1", Final Report, 22 April 2003, www.ebrd.org. However, in the modelling exercise undertaken for the purpose of this paper, the author used estimations of potentials as they have been used in the ADMIRE-REBUS model. The method employed to make

In the new Member States there are few developments that appear to work as disincentives for the promotion of renewable energy sources.

One of the issues is the current relatively low levels of electricity prices. As the NMS are making significant efforts to keep up with EU-15 in terms of market development, subsidies in the energy sector are being phased out. In addition, NMS falter over the question of the future use of indigenous fuels[64] and nuclear capacity as there is a continuous pressure on national governments to keep the energy bill at acceptable levels and unemployment down especially in those regions where the exploitation of the indigenous fuels represents the main income source[65].

Another issue is the need and high potential for energy efficiency[66]. Although energy efficiency and renewable energy should be considered as complementary rather than substitutes in the context of liberalised energy markets[67] (*as one of the case studies in this paper shows, energy efficiency could actually help European countries in achieving the RES-E target in a cost-effective and sustainable way; for details see discussion in Chapter five*), in most of the NMS, the high potential for energy efficiency is perceived as a disincentive to promote renewable energy sources. The main arguments at hand are the availability of seeming low cost options and the extensive know-how already existing in the region[68].

Lack of appropriate financial resources is yet another factor that hampers the development of renewable energy sources. In some of the NMS, the cost of finance may be higher than in the EU-15 due to higher investment

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these estimations and the values used in the modelling exercise are explained in detail in Chapter 5 in this paper.

[64] This is particularly relevant for Estonia, Poland and Czech Republic. *See also discussion on Chapter 3 on energy markets.*

[65] Social pressure triggered by fears of competition is not unheard of within EU-15 either. Social pressure escalated in France as a reaction to the Government`s plan to change the status of the two energy monopolists: EdF and GdF. (BBC news, June 17 2004)

[66] *See more details in Chapter 3 on energy markets.*

[67] For instance energy efficiency corroborated with an increased use of renewable energy could cost-effectively reduce natural gas prices and volatility. See also R. Neal Elliot, A. M. Shipley, S. Nadel and E. Brown," *Natural Gas Price Effects of energy efficiency and renewable energy practices and policies"*. More discussion on the interaction between the gas prices, energy efficiency and RES will be provided in *Chapter 3 on Energy markets*.

[68] Although it may sound trivial, the existence of know-how does play an important role. In all NMS there is already a well-developed strategy concerning energy efficiency and also well established networks of expertise at local level (e.g. OPET, Energy Cities, Energy Regulators Network, etc). For renewable projects this will have to be built almost from scratch. Consequently, these activities will require dedicated funding and human resources.

uncertainty prompted by current market conditions (e.g higher transaction costs, lack of experience in the financial sector to deal with energy efficiency and renewable projects, etc)[69]. In addition, CEE countries are revisiting their monetary and fiscal policies. This may have some repercussions on short to medium term on the cost of finance and the public budgets and, consequently, on the amounts the CEE governments may be able to spend to match private financing for renewable energy projects.

While the apparent hurdles are rather well known and used more often than not to justify the lack of initiative in promoting renewable energy sources, the motives why NMS may need to take a more proactive attitude in this respect are sometimes overlooked.

For instance, the seeming high potential for energy efficiency may very well prove a double-edged sword as the "low hanging fruit" opportunities possibly will soon be exhausted. Before long, some NMS may face hard decisions to make in order to comply with various future requirements concerning the EU internal energy market while ensuring in the same time that the increasing energy demand is met.

Mitigating climate change provides yet another opening for investments in new RES-E capacity. By ratifying the Kyoto Protocol, all new Members commit themselves to unswervingly combat climate change, commitment that will require long-term sustainable energy planning strategies. In addition, the NMS will participate in the EU emissions trading scheme[70] which, together with the Linking Directive[71] provides a new impetus for RES development. On one hand, carbon financing (through JI) is likely to

[69] Although in reality, emerging markets may not be more risky than the EU-15 if modern risk management tools are applied. More discussion will be provided in Chapter 4 on Investments but further ideas could be found in Marc H. Goedhart and Peter Haden, "*Emerging markets aren`t as risky as you think*", on www.mckinseyquaterly.com.

[70] The EU trading scheme is designed to operate independently from the Kyoto Protocol. The EU ETS came into force in 2005. For details see Directive 2003/87/EC of the European Parliament and the European Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending the Council Directive 96/61/EC , OJL 275 from 25.10.2003. On the linkage between renewable policies and the emission trading scheme see also discussion in Chapter 3 on energy markets.

[71] The Linking Directive clarifies the rules to link the EU emissions trading scheme with other Kyoto Mechanisms such as joint implementation (JI) and clean development mechanism (CDM). For details see Directive 2004/101/EC of the European Parliament and the European Council of 27 October 2004 amending Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms, OJL 338/18 from 13.11.2004.

enhance the project internal rate of return thus increasing its attractiveness to investors[72] and most probably will contribute to broader sustainable development. On the other hand, the implementation of the upcoming EU emission trading scheme is expected to raise the electricity price, thus providing further opportunities for RES technologies[73].

Further compliance with the revised Electricity Directive would also help in streamlining the efforts to promote RES in NMS. For instance Article 3 (6) on public service obligations and customer protection stipulates that "*Member States shall ensure that electricity suppliers specify in or with the bills and in promotional materials made available to the final customers.*

*a. the contribution of each energy source to the overall fuel mix of the supplier over the purchasing year;*

*b. at least the reference to existing reference sources, such as web-pages, in terms of at least emissions of CO2 and the radioactive waste resulted from the electricity production by the overall fuel mix of the supplier over the preceding year is publicly available"*

These requirements for disclosure of information most likely will help in raising public awareness and future monitoring process of the compliance with RES policies. Furthermore, Article 6 on *Authorisation procedure for new capacity* calls for the Member States to "*ensure that the authorisation procedures for small and/or distributed generation take into account their limited size and potential impact*". Compliance with this requirement will most likely favour fast tracking of a significant number of renewable projects thus reducing their transaction costs and project lead times. *Table 2.7* provides a quick qualitative overview of the situation in the new Member States concerning the compliance with various requirements of the Renewable Directive and the revised Electricity Directive mentioned above*:*

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[72] For a more detailed discussion on the impact of carbon financing on RES projects see Chapter 5. See also D.Barbu, "*Clean Development Mechanism and renewable energy: a possible win-win solution for developing countries*", presentation delivered during the Forum for Higher Education, Bonn, June 2004, http://www.zef.de/renewables.htm.

[73] Although the impact of the EU emission trading scheme on the electricity price is yet to be seen, some experts estimate an increase up to 40% in the electricity price. For recent discussions on this topic see Point Carbon, "Lack of clarity in ETS means short-termism", on www.pointcarbon.com (searched on 17.06.2004) and E.de Leyva, p.A. Lekander, "*Climate change for Europe`s utilities*" on www.mckenseyquaterly.com. Depending on the future gas prices, RES technologies could benefit from such an increase.

**Table 2.7 A qualitative overview of the status quo concerning national arrangements related to RES development in new Member States**

| **Countries/ RES Directive requirements** | **Cy** | **Cz** | **Ee** | **Hu** | **Lv** | **Lt** | **Mt** | **Pl** | **Sk** | **Si** |
|---|---|---|---|---|---|---|---|---|---|---|
| Targets | ☺ | ☺ | ☺ | ☺ | ☺ | ☺ | ☺ | ☺ | ☺ | ☺ |
| Support schemes | ☹ | ☺ | 😐 | 😐 | ☺ | 😐 | ☹ | 😐 | ☹ | ☺ |
| Access to the grid | n.a | ☺[74] | n.a[75] | 😐[76] | n.a | ☺ | ☹ | n.a[77] | ☺[78] | n.a.[79] |
| Streamline administrative procedures | ☹ | ☹ | ☹ | ☹ | ☹ | ☹ | ☹ | ☹ | ☹ | ☹ |
| Establishment of a national system for issuance GOs | n.a | n.a | n.a | n.a | n.a | n.a | n.a | n.a | n.a | ☺ |
| Power information disclosure | ☹ | ☹ | ☹ | ☹ | ☹ | ☹ | ☹ | ☹ | ☹ | ☹ |

## *2.5. Establishing an adequate RES-E framework in the NMS: a complex issue*

As NMS are advancing in their preparations to implement the Renewable Directive, it is becoming evident that these countries could provide a meaningful contribution for future European commitments to increase the share of renewable energy sources in the fuel mix.

[74] Distribution system operators are obliged by law to transport RES electricity. In addition, the RES independent power producer is responsible for the costs of extending and/or strengthening the grid for new connections. For details see World Wide Fund (WWF), "*The Eastern Promise*", pg.11.
[75] The RES independent power producer is responsible for the costs of extending and/or strengthening the grid for new connections.
[76] In Hungary the Electricity Act requires the transmission system operators to give access to the grid to RES >0.1 MW and if technical requirements of the grid operator are met.
[77] The RES independent power producer is responsible for the costs of extending and/or strengthening the grid for new connections.
[78] Ibid 74.
[79] The RES independent power producer is responsible for the costs of extending and/or strengthening the grid for new connections.

Like in the EU-15, in most of the countries, targets and some policy instruments are already in place thus providing a good basis to start with. However, countries like Cyprus, Malta or Slovakia will need to step-up efforts to catch up with the rest of the countries in defining their policies. As we have learnt already from the experience of the EU-15, policies are usually more effective when they have an unambiguous goal, appropriate enforcement mechanisms and an explicit time frame. In this respect, most of the NMS will have to further refine their support schemes, in particular Estonia and Hungary. Unlike the EU-15, the new Member States are still in the process of reforming their energy markets. Some of the incumbent integrated companies and transmission system operators are yet to be privatised. As a consequence, much remains to be done to ensure not only market pricing for the electricity produced but also fair access to the grid for independent RES power producers.

In addition, the establishment of an adequate informational system that allows to effectively issue the guarantees of origin for electricity produced from RES-E and for informed decisions at the level of the final consumer coupled with enhanced capabilities for local energy planning are few prerequisites for a wise utilisation of renewable energy sources equally in the new Member States and the EU-15. Like their Western counterparts, the NMS will also have to streamline administrative procedures if transaction costs and project lead times are to be diminished. Unlike the EU-15 however, the new Member States have limited experience with local energy planning (*see discussion in Chapter four)* and it may have that appropriate institutional and human resources base will have to be put in place if any large scale deployment of RES-E technologies is envisaged in the region.

To end with, during the last decade significant efforts (including financial) have been made to bring the new Member States closer to the level of development of the EU-15 to avoid big distortions in national economies across the European Union in the accession aftermath. While the benefits of the accession process are incontestable (e.g significant improvements in establishing adequate legal frameworks and ensuring functional markets, etc), the related costs are maybe yet to be revealed. Therefore, renewable objectives may only be achieved in the NMS if integrated into wider development strategies to allow for the effective use of scarce financial and human resources and for national economies to attain a business cycle more suitable to national circumstances.

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## ANNEX 2. I Table 2.1

National indicative RES-E targets 2010 for Member States

| | RES-E % in 1997 | RES-E % 2010 |
|---|---|---|
| Austria | 70 | 78 |
| Belgium | 1.1 | 6 |
| Denmark | 8.7 | 29 |
| Finland | 24.7 | 31,5 |
| France | 15 | 21 |
| Germany | 4.5 | 12,5 |
| Greece | 8.6 | 20.1 |
| Ireland | 3.6 | 13,2 |
| Italy | 16 | 25 |
| Luxembourg | 2.1 | 5.7 |
| Netherlands | 3.5 | 9 |
| Portugal | 38.5 | 39 |
| Spain | 19.9 | 29.4 |
| Sweden | 49.1 | 60 |
| UK | 1.7 | 10 |
| Cyprus | 0.05 | 6.0 |
| Czech Republic | 3.8 | 8.0 |
| Estonia | 0.2 | 5.1 |
| Hungary | 0.7 | 3.6 |
| Latvia | 42.4 | 49.3 |
| Lithuania | 3.3 | 7.0 |
| Malta | 0.0 | 5.0 |
| Poland | 1.6 | 7.5 |
| Slovakia | 17.9 | 31.0 |
| Slovenia | 29.9 | 33.6 |
| EU 25 | 12.9 | 21.0 |

*Source*: EC COM(2004) 366 final

## ANNEX 2.II

**Table 2.2 System performance and cost parameters for various renewable technologies**

| **Technology** | **Resource description** | **System description** | **System performance parameters** | **System cost parameters** |
|---|---|---|---|---|
| Biomass | Fuel/Feedstock type, species<br><br>Moisture content (%), wet basis<br><br>Heating value (kJ/dry kg) | Energy conversion equipment<br><br>Reference technology<br><br>Rated power output (kW)<br><br>Thermal power output (GJ/hour)<br><br>Feedrate (dry kg/hour)<br><br>Expected system lifetime (yr) | **Annual input energy**<br><br>Annual feedstock requirement in (GJ/yr or t/year)<br>Aux.energy (kWh/yr or GJ/yr<br>Load factor (%)<br>Energy conversion efficiency to convert biomass into energy (%)<br><br>**Annual energy prod**.<br><br>Energy forms produced in GJ/yr, kWh/yr, l/yr<br>Annual by-product (kg/yr or l/yr)<br>Capacity factor – 8760 hours/yr<br>Reference system efficiency – the type of energy | Feedstock prep./handling<br>Mobile equipment<br>Energy conversion equipment<br>Building/Structure<br>Pollution Control<br>Site preparation<br>Land<br>Equipment installation<br>Indirect capital costs: design and engineering<br>**Total investment costs**<br>**Equipment replacements**<br>Maintenance<br>Labour<br>Chemicals and other materials<br>**Annual O&M costs** |

| | | | | |
|---|---|---|---|---|
| | | | conversion and fuel used instead of biomass (%) | |
| Geothermal | For electricity production moderate to high temp. res. Is required >150ºC; depths <3km; reservoir vol.>5ckm<br><br>Brine chemistry (ppm) | **Depth of well**<br>Production well (m)<br>Injection well (m)<br>Total flow (kg/h)<br><br>**Plant design and turbine parameters**<br>Temperature (ºC)<br>Pressure (bar)<br><br>**Fluid losses** (%)<br>**Rated system power output** (MW)<br><br>**Expected lifetime** (yr) | Energy flow from fluid (GJ/yr)<br>Installed capacity (M $W_e$)<br>Reinjection rate (%/yr)<br>Capacity factor (%)<br><br>**Input energy**<br>Internal el.use (M $W_e$)<br>Electric consumed by the field (M $W_e$)<br><br>**Annual energy production**<br>MWh/yr<br><br>Load factor (%) | Exploration<br>Exploration well<br>Environmental survey<br>Land<br>Well<br>Building<br>Site preparation<br>Power plant<br>Field equipment<br>Site-specific<br>Indirect costs<br>**Total investment costs**<br>**Equipment replacements**<br>Maintenance<br>Miscellaneous operating<br>Labour<br>Additional well costs<br>Management after start-up<br>Water costs<br>**Annual O&M costs** |
| Photovoltaics | Maximum intensity of solar energy at sea level is 1kW/$m^2$<br>Amount of | A typical size for a solar PV module is around 1 $m^2$ and can produce | Rated module efficiency at nominal peak conditions (%)<br><br>Temperature | PV module<br>Area-related BOS<br>Land cost<br>Site preparation<br>Module installation |

| | | | | |
|---|---|---|---|---|
| | solar energy falling on 1$m^2$ ranges between 800-2600 kWh/yr<br>Annual total global radiation (kWh/ $m^2$/yr)<br>Annual total direct beam insolation (kWh/ $m^2$/yr) | between 30 and 120 peak Watt ($W_p$). Depending on application, the balance-of-system (BOS) may include: inverter, power conditioner, current and voltage regulators, storage batteries, power controls, etc)<br><br>Module area ($m^2$)<br>Nominal installed peak power ($kW_p$) – the power output of a photovoltaic module at noon, with clear sky and 25ºC, 1 atm.<br>Rated output power ($kW_{out}$)<br>Total area ( $m^2$ or $km^2$) | correction factor (%)<br><br>BOS efficiency (%)<br><br>System efficiency (%)<br><br>Load factor (%)<br><br>Annual energy production (kWh/yr)<br><br>Required input energy (kWh/year)<br><br>Capacity factor 8760 h/yr | DC Subsystem<br>Power conditioning<br>AC Subsystem<br>Indirect capital costs<br>**Total investment costs**<br><br>**Equipment replacements**<br><br>**Annual O&M costs** |

| | | | | |
|---|---|---|---|---|
| | | Expected lifetime (yr) | | |
| Small hydropower | Usually <10MW but some countries include power plants of <20MW in the SH category.<br><br>Net head (m)<br>Turbine design flow ($m^3$/sec) | Annual mean flow rate ($m^3$/sec)<br><br>Restricted flow rate ($m^3$/sec)<br><br>Spilway design flow ($m^3$/sec)<br><br>Fish passage facilities (yes/no)<br><br>Expected lifetime (yr) | System efficiency (%)<br><br>Rated output power($kW_{out}$)<br><br>Required input energy (kWh/yr)<br><br>Load factor (%)<br><br>Annual energy production (kWh/yr) | Turbine, generator and powerhouse equipment<br>Land<br>Civil works<br>Building, aux. structures<br>Power-related BOS<br>Indirect costs: undistributed construction costs, engineering and project management, administration, etc.<br>**Total investment costs**<br><br>**Equipment replacements**<br><br>**Annual O&M costs** |
| Wind | Average wind speed (m/sec) at the hub's height | Rated system power output ($kW_{out}$)<br><br>Hub height (m)<br><br>Rotor diameter | Wind turbine power curve<br>Expected theoretical production (kWh/yr)<br>Array losses (%)<br>Other losses (%)<br>Required input energy (kWh/yr) | Wind turbine<br>BOS equipment<br>Land<br>Foundation<br>Installation<br>Grid connection<br>Indirect costs<br>Back-up system<br>**Total investment** |

| | | | | |
|---|---|---|---|---|
| | | Swept area ($m^2$)<br><br>Total land area ($km^2$)<br><br>Expected lifetime | Load factor (%)<br>Annual energy production (kWh/yr)<br>Capacity factor | **costs**<br><br>**Equipment replacements**<br><br>**Annual O&M costs** |

*Source*: Data extracted from IEA – Guidelines for the economic analysis of renewable energy technology applications, 1991

## ANNEX 2.III

**Table 2.4 The status of implementation of a system to issue a Guarantee of Origin in the EU-15**

| Country | Legislation | Issuing body | Ready to „GO“ |
|---|---|---|---|
| Austria | implemented | DSO implemented | implemented |
| Belgium, BR | Under preparation | Others Under preparation | Under preparation |
| Belgium, Fl | implemented | Regulator implemented | Under preparation |
| Belgium W | implemented | Regulator implemented | implemented |
| Denmark | implemented | TSO implemented | Under preparation |
| Finland | implemented | TSO implemented | implemented |
| France | Not implemented | Others Under preparation | Under preparation |
| Germany | implemented | Auditors Under preparation | Under preparation |
| Greece | Not implemented | DSO and TSO | Not implemented |
| Ireland | Under preparation | Regulator Under preparation | Under preparation |
| Italy | implemented | TSO Under preparation | Under preparation |
| Luxembourg | implemented | Regulator implemented | implemented |
| Portugal | Under preparation | TSO Under preparation | Not implemented |
| Spain | Under preparation | Regulator Under preparation | Under preparation |
| Sweden | implemented | TSO implemented | implemented |
| The Netherlands | implemented | TSO implemented | Under preparation |
| UK | implemented | Regulator implemented | Under preparation |

*Source*: COM (2004) 366 final

| | |
|---|---|
| DSO | Distribution system operator |
| TSO | Transmission system operator |

## ANNEX 2.IV

**Table 2.6 Qualitative overview of national policies to support renewable energy sources in the new Member States**

| Country | Type of support | Renewable sources supported | Relevant national circumstances |
|---|---|---|---|
| Czech Republic[80] | Feed-in-tariffs annually adjusted<br><br>Exemption from property tax for 5 years<br><br>Exemption from income and property tax for 5 years<br><br>Reduced import duty<br><br>Reduced VAT (5% instead of 22%)<br><br>Reduced VAT (5%) for the end consumer<br><br>Exemption from excise duty | • wind onshore, geothermal, biomass and biogas, small-hydro, PV<br>• conversion of building heating from solid fuels to RES<br>• investments in RES<br>• RES technology<br>• Small plants (hydro, wind, all solar and biomass)<br>• Biofuels and heat from RES<br>• Biodiesel | One perceived barrier in the development of RES at any significant pace at least for another decade is perceived to be the trend in the Czech energy policy towards nuclear power. Due to a premature sale of locally manufactured wind technology, previous wind projects failed and led to a slow down of the wind development in the country.<br><br>Existing overcapacity is perceived as a barrier[81]to faster deployment of RES |
| Cyprus | Financial incentives in the form of gov. grants (30-40% | • Wind, solar thermal, PV, biomass, landfill and sewage | Cyprus is almost totally dependent on oil imports for its energy supply accounting for |

[80] At the time of writing, a New Renewable Energy Act is under preparation and scheduled to enter into force by the end of June 2004.
[81] *See Chapter 3 on energy markets for detailed discussion on overcapacity.*

| Country | Type of support | Renewable sources supported | Relevant national circumstances |
|---|---|---|---|
| | of investments);<br>Fixed price paid by EAC[82] | waste<br>• RES | 91% of the primary energy supply. The burden of cost of energy imports on the economy of Cyprus is considerable. |
| | A premium paid by EAC through a levy on electricity consumption<br><br>Feed-in-tariff | • selected technologies<br>• wind, biomass, landfill and sewage, PV | The energy infrastructure in Cyprus may constitute an impediment in developing RES as it is designed for the use of fossil fuels. |
| Estonia | Feed-in-tariff<br>Investment support (soft loans)<br>Fiscal incentives (reduced VAT) | • all RES<br>• all RES<br>• wind | Competition with oil shale which covers almost 90% of the PES. |
| Hungary | Feed-in-tariff<br>Investment support | • All RES (indefinite time frame); wind on-shore<br>• All RES | Hungary is significantly dependent on energy imports (aprox.70%) |
| Latvia | Regulations fixing the total capacity for installation and specific volumes for next year are annually published.<br><br>Feed-in-tariff | • Wind<br>• Wind on-shore, biomass, hydro, geothermal | The energy imports account for approx. 70%, partly because of the high volatility of the hydro.<br>The plan to build an undersea cable from Finland to import cheap energy may jeopardize RES development.<br>Latvia imports electricity from Lithuania.<br>However, taking into |

[82] Electricity Authority of Cyprus

| Country | Type of support | Renewable sources supported | Relevant national circumstances |
|---|---|---|---|
| | | | consideration the planned closure of the Ignalina power plant in Lithuania, Latvia will be left most probably with more expensive options for its imports[83]. In addition, gas supply from Russia may pose some risks in the future.[84] |
| Lithuania | Feed-in-tariff | • Hydro, wind, biomass, biofuel | Lithuania relies significantly on its nuclear power plant Ignalina both to cover most of its domestic electricity demand but also to export to the other two Baltic countries with which Lithuania shares the energy system, namely Latvia and Estonia. The Ignalina power plant is scheduled to be decommissioned gradually in 2005 and the second reactor in 2009. This will leave Lithuania with more expensive options for electricity supply and possibly loss in export capacity but should |

[83] See *Supra Note 2*

[84] In February 2004, Latvian Minister for foreign affairs, Sandra Kalniete, apprehended the Commissioner for European External Affairs Chris Patten on the restrictions on oil transit through Latvian port Ventspils. She further suggested that energy supplies in the Baltic States could be" under threat as a result". For more details see *Enlargement Weekly* , 18 February 2004.

| Country | Type of support | Renewable sources supported | Relevant national circumstances |
|---|---|---|---|
| | | | provide in the same time a good opportunity to promote cleaner energy sources.<br>At the moment of writing some delays in elaborating secondary legislation to support the implementation of policies has been observed especially concerning biofuels. |
| Malta | VAT reduction (5%) | • Solar applications | Total dependence on oil and fossil fuel imports. |
| Poland | Green power purchase obligation with penalties<br>Feed-in-tariff<br>Investment subsidies | • All RES<br>• Wind on-shore<br><br>• All RES | |
| Slovakia | Fiscal incentives (exemption from income tax) | • SHPP, waste, geothermal and CHP | Imports from neighbouring Czech Republic and Poland account for 85% of the Slovak energy supply.<br>Development of small hydro seems to be on the way. The biomass capacity development is limited to rural areas where gas supply is not possible.<br>The tax incentives however, are not sufficiently used as they are perceived to be too restrictive.<br>In the future other fiscal |

| Country | Type of support | Renewable sources supported | Relevant national circumstances |
|---|---|---|---|
| | | | incentives are envisaged such as VAT[85] reduction or tax relieves. |
| Slovenia | Feed-in-tariff<br><br>Co2 tax for fossil fuels indirectly<br><br><br><br>TGC | • Hydro, biomass, wind, geothermal, PV<br><br><br><br><br><br>• wind, solar, geothermal biomass and hydro energy | The existing hydro capacity is obsolete. In addition, Slovenia had to share half of the nuclear power plant production with Croatia which leaves the country with little capacity reserve[86]. Complicated procedures for acquiring the administrative permissions.<br><br>In February the Holding Slovenske Elektrarne (HSE), a Slovenian holding of hydro and steam power plants, initiated RECS Slovenia. The Slovenian Energy Agency - the official Issuing Body - will start issuing certificates this month guaranteeing that electricity was generated from renewable energy sources.[87] |

*Sources:* COM(2004) 366 final, Reiche (2003)[88], WWF (2004)[89], other

[85] The proposed reduction is from 14% to 10%.
[86] See *Supra Note* 2
[87] www.greenprices.com , searched on 14 May 2004
[88] D.Reiche, „Handbook of renewable energies in the European Union II", 2003
[89] WWF, „*The Eastern Promise: Progress report on the EU Renewable Electricity Directive in Accession Countries*", 2004