MARKET STIMULATION OF RENEWABLE ELECTRICITY IN THE EU

WHAT DEGREE OF HARMONISATION OF SUPPORT MECHANISMS IS REQUIRED?

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This report is based on discussions within the Task Force jointly organised by CEPS and the Energy research Centre of the Netherlands (ECN), aimed at exploring the optimum degree of harmonisation of support schemes to stimulate the market for renewable energy in the EU. Participants in this CEPS Task Force included senior executives from a broad range of industry –including energy production and supply companies, energy-intensive industries and service companies – and representatives from business associations and non-governmental environmental organisations. A full list of members and invited guests and speakers appears in Annex B. The members of the Task Force engaged in extensive debates in the course of several meetings from January 2005 to August 2005 and submitted comments on earlier drafts of this report. Its contents present the general tone and direction of the discussion, but its recommendations do not necessarily reflect a full common position agreed among all members of the Task Force, nor do they necessarily represent the views of the institutions to which the members belong.

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Introduction

Over the last two decades, renewable energy sources (RES) have attracted heightened interest for a number of different reasons. RES promise strategic improvements in the security of supply, reduce the long-term price volatility to which the EU is subjected as a price-taker for fossil fuels and could offer an enhanced competitive edge for the EU RES technology industry. Renewables reduce air pollution and greenhouse gas (GHG) emissions. They also facilitate improvement in the economic and social prospects of rural and isolated regions in industrialised countries and provide better access for meeting basic energy needs in developing countries. The cumulative effect of all these benefits makes a robust case for renewables support. The EU aims at having renewable sources provide the power for 21% of the electricity generated in its 25 member states by 2010. This target has been formulated in the EU Renewables Directive (2001/77/EC), which sets out differentiated targets for each member state and framework conditions for market support for renewable generation. The Renewables Directive stipulates that member states have to provide better access for renewable energy generators to electricity transmission and distribution networks, as well as streamline and expedite authorisation procedures.

This report analyses the state of play of EU renewables policy and reviews the support mechanisms to achieve the 2010 target. It develops a medium- to long-term strategy and provides a blueprint for a viable support framework for beyond 2010 (in chapter 6).

Key Messages

1. Harmonisation of divergent national support schemes among EU member states is a policy directly related to the forthcoming increase in volumes of renewable electricity (RES-E) in the EU. A greater percentage of RES-E – coupled with different member-state stimulation policies – could result in distortions in Europe's renewable electricity markets, essentially raising barriers to trade and affecting competition. On the other hand, policy harmonisation is expected to increase the stability of the electricity grid and allow for economies of scale through the creation of liquid and efficient markets. Although difficult to implement at present – mainly owing to the fact that in many member states RES-E policies have only recently been initiated – in the medium term harmonisation is an essential component of the drive towards completion of the internal electricity market. It will have to be based on either feed-in tariffs (FIT) or feed-in premiums (FIP) as a next step, or a renewables portfolio standard (RPS), or a hybrid system of RPS/FIP or RPS/FIT.
2. In the short run, coordination of total support levels per MWh for each RES-E technology is warranted, with due allowance for differences in renewable resources. The compilation of comprehensive standardised data on support levels by technology for each member state is a prerequisite to that effect. These have to be compiled by the member states, based on criteria (to be issued by the European Commission) for generating the information needed for the coordination of RES-E support. 'Support' not only encompasses direct subsidies but also the price consequences of quota systems. It is possible that quota systems will lead to higher electricity prices, by either direct higher production costs or by paying fines for not reaching the quota.

3. Targets can give investment signals for specific periods and thus enhance regulatory stability and consistency. Future RES-E targets (i.e. beyond 2010) should be set in such a manner that they are reasonably ambitious without undermining competitiveness. The setting of long-term targets is also needed to provide more transparency to stakeholders on market framework conditions during (most of) the expected lifetime of RES-E projects coming on-stream in the next few years. On the one hand, targets should be higher than the RES-E volume to be realised in their absence. On the other, targets should not be overly ambitious, i.e. they should not result in excessive additional costs that impact the competitiveness of electricity-intensive economic activities and may lead to carbon leakage. Prudent analysis should precede the setting of RES-E targets, which reconcile in a balanced way the three pillars of energy policy and the Lisbon Agenda: i) to realise energy prices in the internal market that are competitive in a global perspective; ii) to enhance long-term energy security; and iii) to mitigate the environmental impact, including climate change, of energy production and use. Another approach to long-term RES-E targets as a means of strengthening European industry could be the support of the competitive 'edge' of RES-E technologies in the global market. The focus would be on reducing unit production costs, thus investing more in R&D for generation, transmission and distribution, promoting innovation, efficacy and efficiency in a cost-effective manner.

4. The Renewables Directive envisages a role for renewable energy guarantees-of-origin (RE-GOs) to facilitate trade in renewable electricity and to increase transparency for the consumer's choice. To be able to achieve these objectives, it is imperative to implement harmonised (fully compatible), reliable and accurate RE-GO systems covering renewable electricity on a comprehensive basis. To that effect, cross-border externalities related to trade in renewable electricity guarantees and consumer protection are compelling arguments. Furthermore, such RE-GO systems are indispensable for the facilitation of a range of other commercial and official applications, not the least of which is reliable and accurate generation-attribute disclosure. The introduction of harmonised, dependable and accurate RE-GO systems is a key stepping stone towards a comprehensive guarantee-of-origin system. This, in turn, will help to prevent a duplication of effort in electricity certification for other policy purposes, such as (reliable) generation attribute disclosure and certification of electricity from efficient heat and power plants. Clear guidance by the European Commission is warranted to define the details of harmonised RE-GO systems.

5. A number of network improvements will be necessary in order to facilitate the greater uptake of RES-E in the European grid. These actions need to have an ongoing character. Grid extension planning in parallel with decisions to construct new capacity will be necessary all along the process. Continuous coordination and sharing of information among regulators and transmission system operators (TSOs) are also essential. A number of technical issues such as harmonisation of member-state grid access codes and standards for network equipment must be considered to improve RES-E market penetration in a cost-effective manner. After an initial period, and contingent upon improvements in renewable electricity competitiveness *vis-à-vis* conventional fuels, priority dispatch for RES-E could be re-examined.

Recommendations

1. Member states should be encouraged to implement adjustments to their respective schemes for RES-E promotion based on the forthcoming review of 'best practice' for each of the different main approaches by the European Commission. Moreover, the bottom-up cross-border joining of similar national support systems would be a measure for the integration and reduction of (transaction) costs.

2. Market support frameworks that include periodic monitoring and appraisal features will ensure the eventual phasing-out of regulatory market support for currently supported RES-E technologies. Accordingly, associated additional costs for electricity end-users should be phased out as well. Reasonable, normative benchmark figures should be set for the future evolution of unit electricity costs and market penetration of supported RES-E technologies in close coordination with the stakeholder associations concerned. Performance with respect to establishing benchmarks in future milestone years should have transparent, pre-set consequences for subsequent regulatory support levels. The phasing-out of market support is only possible if originally high-cost RES-E can eventually compete with the marginal production costs of the alternative conventional production.
3. The Commission should further clarify the nature of RES-E targets and set these out in an unambiguous way without compromising the integrity of RE-GOs. The targets should be clearly interpreted as *either* production targets *or* as consumption targets as a percentage of gross consumption. If, as recommended, the Commission opts for the production-target interpretation, member states should be allowed to merge their respective targets along with having the responsibility of jointly meeting the aggregate target. In the case of an unjustified failure to meet the aggregate target, each member state under the 'target bubble' should be held responsible for (under)compliance with respect to its own national target. The production-target interpretation is fully compatible with the cross-border trade of RE-GOs. If the Commission alternatively opts for consumption targets, compliance should be based exclusively on the underlying renewable energy of eligible RE-GOs redeemed during a target year (automatically including RE-GOs imported from other member states). In so doing, the integrity of the RE-GOs market is preserved, the deadweight administrative costs of obtaining desired target attributes from exporting member states are avoided and the consistency principle (implying that the information on a certain phenomenon from various official sources is consistent– e.g. national renewable-electricity consumption) is respected.
4. Authorisation procedures in the member states should be streamlined and expedited. This includes making licensing and complaint procedures more efficient and establishing one-stop authorisation agencies to facilitate RES-E project developers. The public's engagement should be promoted and developed in such a manner that adds value, credibility and expediency to an open consultation process. Decisions regarding authorisation of RES-E project applications should be reached within pre-defined timeframes and justified in accordance with transparent criteria. In the authorisation procedures, there should be a clear assignment of competences among central, regional and municipal authorities.
5. More detailed – in particular trans-boundary – studies should be conducted on the network effects of grid integration and requirements for network reinforcement to accommodate the integration of planned volumes of RES-E. Accordingly, appropriate forward planning of network expansion and reinforcement will have to be pursued. A certain, limited amount of public funding could be allocated to the integration of renewable electricity into networks, with special attention paid to research, development and demonstration (RD&D) on the storage of generated capacity and forecasting (for wind energy in particular). Harmonisation of member-state grid access codes and standards for network and renewable power-plant equipment are short-term actions that will improve cost-efficiency through economies of scale and coordination across borders. Special attention should also be given to grid connection charges – possibly including locational price signals, which could steer RES-E investor decisions into more network-optimal directions (it should be noted that some countries do not have these signals).
6. The two policy instruments – the Emissions Trading Scheme (ETS) and support for RES-E production – pursue different objectives. One aims at increasing the share of renewables

(i.e. supply) in view of multiple sustainable development objectives, while the other aims at reducing GHG emissions (i.e. supply and demand measures) solely in view of meeting climate change objectives. There is, however, an important interaction between the two instruments and their two aims. The amount of emissions from the covered installation will correspond exactly to the amount of allowances allocated plus the amount of certified emission reductions and emission reduction units allowed into the ETS market through the Linking Directive (2004/101/EC). This means that additional RES-E production no longer has a CO_2 effect as the cap for the power sector remains unchanged, irrespective of the level of renewable power production targets. If, however, a member state cannot expect any CO_2 benefits from its renewables policy, this could eventually weaken the political support for such policy if the implementation burden among member states is perceived as unequal.

7. Renewable electricity stimulation may interact significantly with other Community environmental policies. For example, in Austria and Italy – where hydro power is the most important source available for the generation of renewable electricity – implementation of the Water Framework Directive (2000/60/EC) is limiting the use of available hydro power potential considerably. This raises the issue of coherence and better coordination among Community initiatives.

8. The international dimension of RES policy should also be explored through the integration of non-EU countries (such as those in the EEA, EU candidates and European Neighbourhood Policy countries) in the EU renewables policy framework. Any such country applying to join this framework would have to transpose the Renewables Directive into its national legislation in close association with the European Commission. This would entail *inter alia* the adoption of credible RES targets. Consequently, these countries should be allowed to transfer RE-GOs to EU member states, which could generate additional revenue and facilitate arrangements for financing new RES-E projects in these countries. Potential benefits for the EU relate to the enhanced security of energy supply and the spread of sustainable development in neighbouring countries.

Chapter 1
Introduction

The last decade has seen heightened interest in renewable energy sources (RES) for a number of different reasons. RES promise strategic improvements in the security of supply as the EU will increasingly have to source fossil fuels in geopolitically unstable countries, but they are likely to pose challenges for short-term security of supply or systems security. Other benefits associated with renewables are an enhanced competitive edge for the EU in the dawning renewable electricity (RES-E) technology industry and a reduction in the long-term price-volatility risk that the EU has as a price-taker for fossil fuels. Renewable energies mitigate regional and local pollution, as well as greenhouse gas (GHG) emissions. Long-term climate change policy will rely on zero carbon technologies or carbon capture and storage or both. Finally, renewables also provide improvements in the economic and social prospects for rural and isolated regions in industrialised countries and more opportunities to meet basic energy needs in developing countries. Although individually each benefit on its own would not necessarily be sufficient to make a persuasive argument in support of renewables, their cumulative effect makes a robust one. This case becomes even stronger if one adds the EU's international obligations on sustainable development (as discussed in the Johannesburg World Summit on Sustainable Development in 2002 and the Bonn Action Plan in 2004), the Kyoto Protocol (and the yet to be established post-2012 regime when the Protocol expires in 2012) and the International Action Plan on renewables.

As a result, the EU aims at having renewable sources provide 21% of the electricity generated in its 25 member states by 2010. This target has been formulated in the EU Renewables Directive (2001/77/EC), which has set differentiated targets for each member state and framework conditions for market support for renewable generation. In addition, the Renewables Directive stipulates that member states have to provide better access for renewable energy generators to electricity distribution networks, including the streamlining and expediting of authorisation procedures.

Under the Renewables Directive, member states are free to choose their preferred support mechanism and will be allowed to continue to do so for a transition period of at least seven years after a new EU-wide regulatory framework is adopted. A proposal for such a framework may be forthcoming, but it is not expected in the context of the forthcoming 2005 European Commission evaluation report.

Although this 'decentralised' approach towards renewables support appears to be justified as long as volumes are limited – hence there are few cross-border effects (e.g. on grids) and a minimal impact on the internal energy market – there are concerns that national solutions may create trade barriers, distort competition in the internal market and forego efficiency gains from, for example, economies of scale. Further (largely unrelated) concerns are the existing barriers to renewables, which may inhibit further penetration. These include administrative and grid barriers but also subsidies to competing fuels. A first step must be to create a level playing field for renewables. As volumes rise, questions are increasingly raised about the costs and who should bear them, leading to more voices calling for cost-effectiveness. Finally, a successful EU renewables policy will ultimately need to be embedded in and consistent with other EU policies governing the internal energy market, competitiveness, the environment, technology, security of supply, agriculture and social structures. Since a substantial number of the public benefits pursued by policies supporting renewables are national or local (e.g. pollution reduction and security of supply), national peculiarities should be respected and duly taken into account when addressing potential issues related to trade barriers and the distortion of competition.

This report analyses the state of play of the EU's renewables policy. It further attempts to develop a longer-term strategy against the background of the EU Treaty and other EU policy goals for achieving the short-term objectives of the 2010 target, and to also provide a viable framework for beyond 2010 and meeting potentially more challenging objectives.

Following this brief introduction, the main report is structured in five chapters. Chapter 2 assesses the potential benefits of renewable energy and how they can be met in the most cost-effective way. Chapter 3 surveys RES-E market support mechanisms in terms of their efficiency and efficacy in meeting set targets. Chapter 4 covers the issues of disclosure and verification of electricity from renewable sources and guarantees of origin for renewable electricity (RE-GOs). Chapter 5 identifies the principal barriers to renewables and briefly sketches their impact. Chapter 6 returns to the initial question of what degree of coordination or harmonisation would be needed to achieve the key objectives in a cost-effective way that is consistent with the EU Treaty and other EU policies. Accordingly, chapter 6 identifies a series of consecutive steps towards a long-term strategy for an effective and efficient EU renewables policy. The main findings of the report are also contained in the preceding Executive Summary, including key messages and recommendations.

The report has two annexes. Annex A outlines the relative support given by EU legislation to co-generation of heat and power (CHP) and distributed generation and their relation to RES-E. Annex B provides a list of members of the Task Force and invited guests and speakers.

Chapter 2
The EU's Renewable Electricity Policy:
Objectives and Instruments

2.1 Introduction

The case for stimulating the market deployment of renewable energy in general and renewables-based electricity in particular is broadly embraced. Member states have introduced a variety of distinct instruments to support the market uptake of renewable electricity. This chapter introduces four main support mechanisms and reviews stakeholder positions regarding the promotion of renewables.

Section 2.2 presents the key arguments underscoring the case for policy support to promote the market uptake of renewable electricity. Recent developments in EU legislation affecting market stimulation of renewable electricity are outlined in section 2.3. Section 2.4 introduces the four main support mechanisms. An analysis of stakeholder positions on the design of market support for renewable electricity is provided in section 2.5.

2.2 The potential merits of electricity from renewable sources

Briefly stated, enhancing the role of renewables in the EU electricity mix in a certain target year (e.g. 2020) with respect to a certain base year (e.g. 1997, the base year of the Renewables Directive, 2001/77/EC) has the following benefits:

- *Improved security of energy supply*. In meeting their rising needs for the depletable resources of natural gas and oil, the world's largest economies (the EU, the US, China, Japan and India) will increasingly have to source supply in geopolitical regions that are highly unstable. The problem is compounded for both these economies and other fossil-fuel importers in that they are bound to meet their requirements in fierce competition with one another. Increasing the share of renewables in the EU electricity mix will help to reduce the dependence on imported fossil fuels from volatile geopolitical regions. On the other hand, renewable energy sources (RES) alone cannot fully secure energy supply – especially if we consider the present and future share of non-baseload renewables such as wind power and solar PV in electricity generation.[1] Hence, careful planning is required so that the increased share of non-baseload renewables, which provides indigenous energy and reduces import dependence, will not negatively affect the operation of the electricity system.
- *Improved long-term electricity price and price volatility.* The problem of security of supply is reflected in the fossil-fuel price risk, notably for natural gas and oil. As distinct from generating portfolios in which gas-based electricity generation is assuming an increasingly dominant role, portfolios with a substantially rising share of renewable electricity (RES-E) will see their long-term portfolio price risk fall. Increasing the share of renewables in the EU electricity mix in a cost-effective way will help in the long run to reduce:
  - the (average EU) portfolio (electricity) price at the same year-to-year portfolio (price) risk; or
  - the portfolio risk at the same portfolio price; or
  - the portfolio price *and* year-to-year portfolio price risk.

[1] Wind power capacity is poised to increase by 7.4% per year by 2010, a 265% rise *vis-à-vis* 2003 capacity (for wind power and solar PV potentials); see CEER (2004), pp. 36-37.

In other words, it will help move the EU's electricity mix closer to the efficient frontier of electricity mixes (Awerbuch & Berger, 2003). Enhancing the role of RES-E is therefore consistent with the Lisbon Agenda in making the EU economy more competitive and resilient, provided this is done in a cost-effective way.

It should be noted that the natural volatility of wind power supply together with a rising share of wind power may lead to higher *day-to-day* volatility in electricity prices. A recent DENA study (2005) indicated that an increase in the share of wind power in electricity supply results in a lower capacity credit for wind power capacity. DENA puts the capacity credit of German wind power in 2003 at a mere 6-8% with a 4.2% energy penetration rate (14.5 GW of wind power installed) and even projects it to fall to 5-6% with an estimated 13.5% penetration rate (36 GW of wind power installed by 2015).

- *Enhanced competitive edge for the EU in the dawning RES-E technology industries*. The high impact of local pollutants as well as the emissions of greenhouse gases (GHG) will challenge government authorities in the EU and elsewhere to impose increasingly strict pollutant emissions constraints. As a result of accounting for environmental externalities and supply constraints regarding natural gas, a long-term trend towards improved competitiveness of lower-cost RES-E appears in the offing. Consequently, a sustained growth in the demand for related RES-E technology equipment is anticipated. But with large hydro being a major exception, RES-E is by and large not yet fully commercially mature in the centralised electricity markets. This is partly owing to the fact that the external costs of electricity generation are not yet accounted for. Hence, under current technology and market conditions, RES-E will not take off to a substantial extent without significant government intervention in that direction. Therefore, a strong long-term policy commitment in the EU to stimulate the production and market uptake of renewable electricity will stimulate European RES-E technology providers to consolidate and even strengthen their first-mover competitive edge in the global market. Learning-curve analyses suggest that learning rates for renewables such as wind power and solar PV are on the order of 10-20%. This would imply that their costs go down by 10-20% for each doubling of cumulative market deployment. Typically, for non-renewable generating technologies these rates are much lower.

- *Mitigation of GHG emissions by the EU power sector.* The diplomacy of the EU has assumed a pioneering role in enabling the Kyoto Protocol to enter into force and the EU has a strong interest in establishing a global post-2012 regime when the Protocol expires. Increasing the share of renewables in the EU electricity mix will help the EU to strengthen the credibility of its aspired model role in achieving a more sustainable world. For example, the European Wind Energy Association (EWEA) expects wind energy alone to meet 30% of the EU's total GHG reduction obligation by 2010 (EWEA, 2003). Yet, except for some regions that are well-endowed with low-cost renewable resources, renewables-based power generation remains a rather expensive GHG reduction option in the short and medium term.

- *Mitigation of regional and local pollutant emissions.* Increasing the share of electricity from renewable sources in the electricity mix, notably from non-biomass ones, at the expense of electricity from fossil fuels will reduce regional and local pollutant emissions. To date, in the EU non-market-based emission control regulation prevails, as far as SO_2, NO_x and other local pollutants are concerned. The adverse impact of local pollutants (e.g. on public health and biodiversity) raises serious concerns among EU policy-makers. Renewable electricity, especially if it is not based on biomass, has low impact characteristics. Therefore, tightening future emissions control and introducing more market-based control instruments will favourably affect the prospective economics of electricity from renewable sources.

- *Improved economic and social prospects for rural and isolated regions*. Electricity supply in rural and isolated regions might be improved cost-effectively by on-grid and distributed generation options based on renewables. These options imply deployment of more local labour, including labour in the supplying industry. Obviously, the best solutions are very site-specific, precluding more detailed general statements. Furthermore, the case for a sector-specific policy at the EU or national level – such as renewables-based electricity stimulation – to promote 'social coherence' seems a rather weak one. Improvement of regions with a weak economy can be much better achieved by way of integrated regional policies (Jansen, 2003b). Nonetheless, within the framework of such 'structural policies' investment in renewables-based electricity generation facilities can play a certain role.
- *Improved opportunities to meet the basic energy needs of the rural poor in the developing world.* More or less the same considerations apply to this point as the previous one.

The benefits listed above are not (or only partially) captured by the net value added fetched by operators in the value chain of renewables-based electricity. Moreover, generators and suppliers of electricity from sources other than renewables – notably fossil fuels and nuclear energy – have enjoyed and are still enjoying net positive public-sector interventions.[2] These take the form of targeted research, development and demonstration (RD&D) programmes with public support, direct production or financing subsidies (or both), or (partial) waivers for compensation tax payment of damages caused to the environment. To the extent that this situation prevails, there is a clear case for public intervention in support of RD&D and market deployment of renewables-based electricity.[3]

Renewables stimulation should be pursued as a separate policy and not be linked to climate change policy. In fact, *if* RES-E stimulation was considered merely as a component of climate change policy then the implementation of the EU Emissions Trading Scheme would obviate the need for specific RES-E market stimulation schemes altogether (Sijm, 2005). The broad range of merits associated with RES-E justifies measured, dedicated public support for RES-E penetration in the electricity market (also see chapter 6).

Several eminent international forums have embraced renewables stimulation as a high priority policy. For example, the 2002 Johannesburg World Summit on Sustainable Development linked deployment of renewable energy to the supply access of the poor for meeting their basic energy needs, which resulted in the Johannesburg Renewable Energy Coalition.[4] During the 2004 World Renewable Energy Conference in Bonn, the Bonn Action Plan was adopted with an impressive list of actions to which governments and international bodies committed themselves. The European Union was urged during this conference by renewable energy organisations and some member states to set a renewable energy target of 20% in 2020, which – if adopted – would translate into quite an ambitious renewable electricity target of about 40%. The European Council of 22 and 23 March 2005 concluded that a 15-30% CO_2 reduction by the developed countries in 2020 (as compared with 1990) in the framework of a post-2012 United Nations-based arrangement should be considered, which could further enhance the role of renewables.

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[2] A paucity of unbiased information exists on this issue. According to the EEA, more than 80% of recent energy subsidies paid in the EU went to fossil fuels and nuclear power (EEA, 2004). On the other hand, subject to confirmation, the most recent information indicates that this share is decreasing.

[3] The reduction of net support for generation and use of electricity from other sources should also be part of the level-playing-field equation. The EREC position paper (Kjaer & Schäfer, 2005) exposes public interventions in favour of electricity from sources other than renewables and provides further references.

[4] For more information, see the europa website (http://forum.europa.eu.int/Public/irc/env/ctf/library).

Moreover, the UK government put the promotion of renewable energy sources prominently on the agenda during the G-8 conference in Gleneagles this past summer and indeed the G-8 adopted a (non-committal) resolution in favour of the world-wide promotion of renewables.

2.3 Current EU legislation

2.3.1 Recent legislation on support for RES-E [5]

The internal electricity market

Overall competitiveness is being promoted through liberalisation of the EU electricity and gas markets as well as by separation of energy production, transportation and distribution activities. For fostering competitiveness of the EU economy and concomitant income and value-added creation, the promotion of one internal market at the Community level is considered essential. Cross-border trade on level-playing-field terms would foster competition. The Electricity Market Directive (2003/54/EC) establishes common rules for the generation, transmission, distribution and supply of electricity within the internal market in electricity.

RES-E support

In 2001 the EU adopted its Directive on the promotion of electricity produced from renewable sources (European Council, 2001). The Renewables Directive (2001/77/EC) sets out to create a framework that will facilitate, in the medium term, a significant increase in renewables-based electricity within the EU. It constitutes an important milestone in shaping the regulatory framework for RES-E generation in the EU. The main support features of the Renewables Directive are outlined below.

The Renewables Directive sets targets for the share of RES-E in total electricity consumption at EU and member-state levels. The overall share of renewable energy sources in total primary energy supply in the EU-15 is to reach 12% in 2010, with a renewable energy share in electricity consumption of 22% in that same year. The latter objective is broken down into differentiated percentages for each member state. For the 10 countries that entered the Community in May 2004, similar RES-E targets have been negotiated and published in the Accession Treaty. Given reference projections for total electricity demand, the implied target for the EU-25 by 2010 is 21%.

The Renewables Directive defines the targets as consumption targets, i.e. “national indicative targets for future consumption [as] a percentage of gross electricity consumption of electricity produced from renewable energy sources in terms of a percentage of electricity consumption” (European Commission, 2001, Art 3.2). The Annex, however, refers to “national indicative targets for the contribution of electricity produced from renewable energy sources to gross electricity consumption”. Hence, the denominator (gross electricity consumption) is clear, whereas the nominator could be interpreted as either production or consumption of RES-E.[6]

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[5] In conjunction with RES-E legislation, a short account on legislation governing co-generation of heat and power (CHP) can be found in Annex A.

[6] The third note to the table in this Annex states that “The percentage contributions...are based on the national production of RES-E divided by the gross national electricity consumption. In the case of internal trade of RES-E (with recognised certification or origin registered) the calculation of these percentages will influence 2010 figures by Member State but not the Community total”. This statement does not help to provide full market transparency on the role of renewable electricity (generation attribute) trade in target compliance. Nor does the Commission’s Communication (COM(2004) 366 final) offer transparency to the market by stating that, “A Member State can only include a contribution from

The Renewables Directive provides a broad definition of renewable energy. It includes hydropower (large and small), biomass (solids, biofuels, landfill gas, sewage-treatment plant gas and biogas) wind, solar (PV, heat and thermal electric), geothermal and marine energy (wave and tidal). General waste incineration has been excluded but the biodegradable fraction of waste has been included as renewable energy. Furthermore, large hydropower (generated by facilities in excess of 10 MW) has also been included. It appears, however, to have been tacitly agreed that large hydro will count for meeting set targets but will not be eligible for support measures.[7] This would be the case in spite of the absence of an explicit statement to that effect in the approved Directive.

Governments are allowed to continue their own support schemes for a transitional period of 'at least' seven years after a possible Commission proposal towards a harmonised Community framework is accepted. In principle, the Commission may propose a harmonised Community framework, but it is unlikely to do so in the evaluation report of member-state RES-E support systems, due in fall 2005.[8]

Furthermore, the Directive states that better access is to be provided to electricity distribution networks, including streamlining and expediting authorisation procedures at the administrative level. Where appropriate, member states may require transmission and distribution system operators to bear (fully or in part) the RES-E connection and grid reinforcement costs. When dispatching authorisations, transmission system operators should give priority to RES-E plants "to the extent possible".

2.3.2 State aid for environmental protection

In 2001 the European Commission adopted an amended set of Community guidelines for assessing whether aid administered by member states for environmental protection is compatible with the internal market (European Commission, 2001). These guidelines will cease to be applicable on 31 December 2007. The guiding principle in assessing aid for renewable energy, contained in the Community *Guidelines on State Aid for Environmental Protection*, is that the beneficial effects of such measures on the environment must outweigh the distorting effects on competition (European Commission, 2001, point 5).

Explicit reference is made to the possibility of state aid for promoting the use of renewable sources of energy and combined heat and power production by way of tax exemptions or reductions (European Commission, 2001, point 24). "Where it can be shown to be necessary" investment grants of the eligible costs[9] in support of renewable energy up to 100% are possible (European Commission, 2001, point 32). Operating aid may be justified *to cover the difference between the cost of producing energy sources and the market price for energy* (European Commission, 2001, point 56). In assessing such costs for, say, producing RES-E, this should be

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import from another Member State if the exporting state has accepted explicitly, and stated on a guarantee of origin, that it will not use the specified amount of renewable electricity to meet its own target and thereby also accepted that this electricity can be counted towards the importing Member State's target" (European Commission, 2004, p. 18).

[7] The Community *Guidelines on State Aid for Environmental Protection* (European Commission, 2001) does not include large hydro or the biodegradable part of waste incineration under its definition of renewable energy (ibid., point 6). This would suggest that these categories would not be eligible for state aid under conditions specified by these guidelines.

[8] This report should also contain recommendations on best practices on administrative procedures on feed-in authorisation and other grid access issues (see the last paragraph of this section).

[9] That is, the extra investment costs necessary to meet environmental objectives.

done after the deduction of any investment support (i.e. the support equivalent per unit of RES-E). Furthermore, state aid based on avoided external costs is not allowed to exceed €0.05/kWh.

These forms of aid should result in an overall increase of renewable energy sources and not in shifts from one renewable energy technology to another or from one member state with less favourable renewable energy incentives to another with greater state aid.

The Commission should be notified of this aid by the member state concerned and re-notified every 10 years. It is then up to the discretion of the Commission to determine on a case-by-case basis whether or not the support measures concerned are in breach of any Community legislation and reach an approval/rejection decision accordingly.

A famous judgment by the European Court of Justice concerns the compatibility of the German feed-in tariffs (FIT) system with the EU's internal market regulations (ECJ, 2001). The court judgment negates the purview of Art. 87(1)[10] of the EC Treaty stating that any aid granted by a member state distorting (or threatening to distort) competition by favouring certain undertakings, in so far as it affects trade between member states, is incompatible with the internal market. The Court argued that FIT schemes were not to involve any direct or indirect transfer of state resources to undertakings (generating RES-E in the jurisdiction concerned) and not to constitute state aid within the meaning of Art. 87(1) of the Treaty.

2.4 Market support: Scope

Government support for RES-E may take three major forms:

(i) Government policy may provide RD&D support for selected fledgling RES-E technologies. Governments may wish to do so to facilitate technological maturity, cost reduction and dissemination of information on the selected commercially immature technologies.

(ii) Governments may equally wish to support market uptake of specific RES-E technologies. Currently four major types of direct market support for RES-E generating technologies in EU countries can be distinguished. These are These are feed-in tariffs or feed-in premiums systems (FIT or FIP), renewables portfolio standards (RPS), investment subsidies and tendering systems.

(iii) Notably, in the liberalising electricity market framework, governments may wish to empower consumers to be able to steer the market. Given adequate electricity-generation disclosure mechanisms being in place, consumers may do so by revealing preferences among electricity mixes with distinct shares of RES-E through the price mechanism.

The remainder of this chapter addresses market support policies, while the next chapter focuses on electricity generation disclosure. (RD&D is beyond the scope of this Task Force.) Hereafter, four major categories of RES-E market support instruments are set out, which will also be assessed in the evaluation report on RES-E support by the Commission due in October 2005. It should be stressed, however, that there are more categories of RES-E market support (e.g. reduction/exemption of indirect energy tax on RES-E consumption), while in most member states several market support instruments are used at the same time.

2.4.1 Feed-in tariffs and premiums

Feed-in tariffs are preferential, technology-specific tariffs mandated by the regulator and guaranteed for a specified period up to 20 years. Feed-in premiums are technology-specific premiums (bonuses) on top of the plain electricity proceeds, mandated by the regulator and

[10] This was formerly Art. 92(1).

guaranteed for a specified period. Feed-in tariffs/premiums are granted to operators of eligible domestic RES-E plants for the electricity they feed into the grid of the member state concerned. Generators of eligible RES-E produced in another member state are excluded from benefiting from RES-E support by any member state with a FIT/FIP support system, even if they can prove the export of their production to the latter country.[11] The tariff/premium, fixed per generator, may be periodically revised for new vintages of RES-E plants, in order to account for the decrease in production costs ('stepped' tariffs/premiums). This could be done, for example, by projecting recorded cost-reductions by way of 'learning curves'. FIT/FIP systems have a track record of some two decades and are well established in the EU. In Denmark, Germany and more recently Spain, the respective feed-in tariffs/premiums have enabled an astounding growth of RES-E generation, especially wind power. To date, most member states are applying a FIT and/or FIP system, including Germany, France, Spain, Greece, Portugal and the Netherlands.

2.4.2 The renewables portfolio standard

An RPS is a requirement for consumers or their retail suppliers (or alternatively, electricity generators)[12] to source a minimum percentage of their electricity portfolio from eligible renewable-based electricity.[13] The RPS system is a recent support mechanism,[14] which has been introduced in, among other areas, Australia, Japan and in at least 18 American states. EU member states applying this support mechanism include the UK, Italy, Sweden and Belgium. So far, the RPS schemes in the EU are national schemes. Sweden and Norway have announced that in 2007 they will start operating one clustered RPS scheme. To add flexibility to parties with an RPS obligation, a parallel system of tradable RES-E certificates (TRECs – also referred to as 'tradable green certificates') is usually introduced. These certificates can be traded separately from the underlying electricity in a certificate market. TRECs serve as proof of eligible RES-E. Ultimately, affected parties will have to surrender the required number of TRECs to the competent authority to verify compliance with the RPS regulation or face penalties for non-compliance. Upon submission for compliance the competent authority will then redeem (retire from circulation) the surrendered certificates.[15] Depending on the regulations in place, another reason for TRECs to be removed from the market is expiration (when the ultimate day of validity has passed).

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[11] This protectionist feature may be relaxed if and when member states with FIT or alternatively, FIP systems decide to harmonise and cluster their respective support mechanisms and merge their eligible support region.

[12] Most countries opting for RPS have chosen a midstream/downstream variant with the RPS compliance obligation assigned to electricity consumers or their suppliers (electricity distribution companies). So far, only Italy has opted for an upstream RPS system, imposing the RPS obligation on power generators or importers.

[13] Alternative terms such as 'quota obligation mechanism' are used as well. The term 'renewables portfolio standard' describes most precisely that a certain minimum share of the electricity portfolio of affected parties has to originate from (eligible) renewables-based electricity (see Espey, 2001, p. 560).

[14] The RPS mechanism was conceptualised in the US and Europe in the late 1990s. The first precursor of an RPS system in Europe, a voluntary one agreed upon by electricity suppliers, was conceived (van der Tak, 1998) and introduced (in 2000) in the Netherlands, but relinquished in 2001, resulting in a sequel of shifts in Dutch RES-E support policy. Worldwide, the first well-functioning RPS was introduced in Texas in 2000 (Sloan, 2005), while in Europe the first functional RPS dates from 2002.

[15] Subject to the prevailing regulations, TRECs may also be redeemed for other purposes. A case in point is Texas, where voluntary green-power programmes have to surrender TRECs (there referred to as 'RECs') for verification of their product offerings.

2.4.3 Investment subsidies and fiscal incentives

The granting of some form of investment subsidy is a support policy with a long implementation history. Compared with most conventional generation technologies, RES-E technologies tend to be characterised by high up-front investment costs per unit of electricity output. In order to lower the financing barrier of commercially immature RES-E technologies, investment subsidy instruments may be applied. Investment subsidies can be outright subsidy transfers or fiscal investment facilities (e.g. tax credits and accelerated depreciation). Moreover, the provision of finance on soft terms (e.g. at a subsidised interest rate) can be conceived as another type of indirect investment subsidy. By lowering the typically high upfront cost hurdle, investment subsidies can be especially important for those RES-E technologies that still have to bridge a wide cost-gap to commercial maturity. Investment subsidy instruments are being applied by many member states for these technologies in particular, such as solar PV. Often some form(s) of investment subsidy is applied as supplementary RES-E support in conjunction with either FIT/FIP or RPS as the main RES-E support scheme.

2.4.4 RES-E tendering systems

Under a RES-E tendering system, the government awards power purchase contracts by way of tender for a certain aggregate volume of eligible RES-E. The tenders can relate to RES-E in general or be technology-specific. Project developers who submit the lowest kWh asking price are offered a long-term power purchase agreement (PPA) until the tendered RES-E volume has been filled. The PPA price could be on a reversed-auction (price as bid) basis or on the basis of a uniform price, i.e. the highest asking price among those of the successful bidders. The additional costs of RES-E tenders are usually passed through to the power consumers. To date, Ireland and France (for 12+ MW RES-E projects) are the only member countries applying this support mechanism. Recently, the UK has shifted from a tender-based system (known as ‘NFFO’ – non-fossil fuel obligation) to an RPS system, while Ireland has announced that it is shifting to a FIT system.

2.4.5 Coordination of support levels

EU-wide harmonisation of support systems does not seem a realistic prospect in the very near future. Yet the co-existence of quite divergent support mechanisms across member states begs the question of whether – and if so, to what extent – these systems generate distortions in Europe’s renewable electricity markets. To monitor this situation, reliable information on support levels in terms of €/MWh per renewable generation technology for each member state is urgently needed. A method for reliably gathering this information is outlined in section 4.4.2.

2.5 Stakeholder analysis

Market support regulations are a crucial business-environment factor for the various stakeholder groups in the RES-E value chain. These regulations largely determine the extent to which each of them can capitalise on ‘regulatory rents’. They have features that can be beneficial for the whole RES-E value chain, but they also include some zero-sum game features with both winners and losers. Hereafter the business interests and preferences of the major RES-E stakeholder groups in the EU member states are described.

Government authorities tend to be a rather diverse group of entities, both among and within member states. The security of energy supply and (the mitigation of) climate change are often invoked as the main issues to justify national RES-E policy-making. In drafting RES-E support schemes special attention is typically paid to achieving the national indicative RES-E target for

2010. Yet other key motives at least as important for many member-state government authorities seem to be the creation of 'national champions', national competitive advantages and in-country employment, especially in regions that are economically weak. In practice (as distinct from official speeches), many if not all member-state governments seem to give precedence to these national considerations over and above the Lisbon Agenda to create a genuinely single European market and to improve the EU's competitiveness. Condoned by the European Court of Justice,[16] so far virtually no member state is prepared to grant access to RES-E generators from other member states to the RES-E support system under its jurisdiction. The choice of main support mechanism is mainly a matter of the prevailing national political culture. National governments pursuing industrial policies with a strong belief in the merits of central guidance tend to favour a FIT/FIP scheme as the main RES-E support instrument. Conversely, governments with a stronger belief in market forces tend to favour an RPS scheme (the UK and Sweden) or a tendering scheme (Ireland). In some instances, the choice in favour of a FIT or FIP system may also have been triggered by politically convenient reparation of previous, flawed support schemes (e.g. the fiscal RES-E demand stimulation in the Netherlands) or by the small size of the national markets concerned (as in Luxembourg), or the perceived complexity of RPS schemes (as in Denmark). The differential effects of the distinct support mechanisms on national innovation and technological diversity in the national economy are major concerns to the member states. Other major design concerns are various effects on end-user electricity prices and the size of over-stimulation (the free-rider phenomenon).

RES-E equipment producers have a great interest in RES-E market support policies that are designed to i) speed up market demand for their product by way of attractive regulatory rents in the value chain of national RES-E generators and ii) create 'national champions'. Demand for their products can be stimulated by regulation that establishes stable framework conditions for RES-E generators with prospects of certain, high positive cash flows over most, if not all of the design life of the RES-E plants concerned. Moreover, regulations that substantially reduce the up-front investment requirements for RES-E generators will be appreciated. RES-E equipment producers operating in member state(s) may also solicit national champion policies, which can involve a mix of elements. These may include some of the following: tailor-made R&D support; national testing, service centres for certification and quality assurance; launch orders for new prototypes by local utilities or through direct procurement (tendering or regional support programmes); export support, by way of 'development aid' and authorisation procedures favouring local job creation, etc.

RES-E generators and project developers also have a keen interest in RES-E market support policies that will establish stable framework conditions with a high regulatory rent. Such regulation would entail high recurrent net cash flows over as many years of the RES-E plant life as politically feasible and reduction of their up-front investment requirements by way of investment subsidy instruments. Moreover, they favour measures to straighten out and speed up sticky authorisation procedures and priority – or at least level-playing-field – access to the grid at shallow grid-integration tariffs. Shallow tariffs, as opposed to deep tariffs, reflect only the cost of the connection to the nearest grid transmission line and do not include the cost of grid reinforcement.

Conventional electricity generators have to weigh the impact of RES-E support regulation on their own bottom lines and those of their competitors, the market response of their competitors and the public image of their environmental performance. The latter is regarded as an important indicator of corporate social responsibility – an aspect of general business performance that has lately been given more attention by the industry. Increasing RES-E plants in the generating portfolio of incumbent major power producers may improve their public image and mitigate

[16] See European Court of Justice (2001).

their fossil fuel price risk. This risk per unit of fossil fuel is widely perceived to increase over time. Therefore, incumbent generators typically have no overriding objections to support policies that will lead to a gradual, predictable penetration of RES-E. On the other hand, they tend not to favour open-ended RES-E support schemes. Strong and abrupt stimulation of RES-E with priority grid access may upset the planned deployment of existing baseload capacity plants, and consequently, negatively affect the short-term bottom line of generators with large generating baseload assets. This effect is underscored by the fact that the short-term marginal costs of intermittent renewables are usually quite low. Contingent on weather conditions, they can put downward pressure on electricity prices.

Transmission and distribution system operators (TSOs/DSOs) will have to accommodate the high technical and administrative requirements of partly intermittent RES-E generators. Strong and abrupt stimulation of RES-E with priority grid access may upset the planning of this stakeholder group to an even greater degree. The result may be congested transmission and distribution lines, an adverse impact on system harmonics and overburdened administrative departments. In this regard, an important planning consideration is that high-voltage grid extensions have relatively long gestation periods (typically 5-10 years). This stakeholder group also tends to have the fewest problems with support policies that will lead to a predictable penetration of RES-E. Moreover, the incidence of grid integration costs is a key concern for these stakeholders. TSOs/DSOs typically favour deep grid connection tariffs, i.e. the pass-through of the lion's share, if not all, of the additional costs attributed to RES-E grid integration to RES-E generators.

Incumbent large electricity suppliers have similar considerations as their generator counterparts. Those incumbent suppliers that still benefit in their supply area from the absence of complete unbundling of transmission and distribution infrastructure ownership may resist the erosion of their market power by distributed generators, including renewable ones. Yet their environmental performance image may become a consideration of increasing importance. The population in north-western Europe is particularly noted for having relatively strong concerns for environmental issues. Prospective news coverage in the media of environmental impact as well as reliable electricity-origin labelling may elevate environmental interest. Again, this stakeholder group tends to favour support policies that will lead to a predictable penetration of RES-E, with a fair spread of the associated additional costs. For example, a major concern is that those competitors that are over-represented in national areas or in other member states that are poorly endowed with renewable energy resources should assume their fair share of the additional RES-E costs.

Electricity users possibly constitute an even more diverse group. Thus we elaborate the position of two subgroups more specifically. *Electricity-intensive industries* are very sensitive to any policy that may push up – at least in the short term – the cost of electricity and will have a 'natural' aversion against open-ended support schemes such as FIT/FIP systems. Moreover, in a similar vein to the previous stakeholder group, within-sector competitive distortions are a major concern. *Small power consumers* comprise a myriad of very different and, on average, less-informed agents. As long as political parties or consumer/small business associations do not specifically canvass on one-issue themes such as 'stop the squander of our money on windmills' or 'stop climate change', small power consumers will not be able to significantly influence the outcome of the RES-E support policy debate.

Environmental NGOs articulate a high degree of environmental effectiveness and are inclined to promote policies that will accelerate market penetration of RES-E. Regard for environmental effectiveness – as opposed to cost-efficiency – is a consideration of profound importance to this stakeholder group and their constituency.

Chapter 3

The EU's Renewable Electricity Policy:

An Assessment of Market Support Mechanisms

3.1 Introduction

This chapter presents a preliminary assessment of four principal support mechanisms towards greater market penetration of renewable electricity. It builds upon the analysis in the previous chapter of the merits and objectives of renewable energy source (RES) promotion policy, the main instruments used to shape this policy and stakeholder positions. The criteria used for the assessment in this chapter are set out in section 3.2. Subsequently, given the absence in Europe of well-designed support systems with regard to, notably, renewables portfolio standards (RPS), we define four notional models optimised for pan-EU application (section 3.3) and then proceed to an analysis of their suitability (section 3.4). Finally, some conclusions are put forward (section 3.5).

3.2 Assessment criteria

Based on the stakeholder analysis presented in section 2.5, the following criteria are applied to the assessment of support mechanisms:

1. *Stimulation of RES-E generation.* Is a support mechanism effective? Certain stakeholder groups (the RES-E sector and environmental NGOs) have a basic interest in fast market deployment. Governments that are behind schedule in their bid to achieve their respective indicative target may also seek fast growth.
2. *Certainty of target achievement.* To what extent can a support mechanism control the RES-E volume or share? Member-state governments are supposed to achieve their respective indicative targets. To the extent that RES-E expansion entails substantial additional costs for electricity supply, member states may wish to avoid target-overshoot situations. Also, incumbent power suppliers, transmission and distribution system operators (TSOs/DSOs) and producers with a largely non-RES-E electricity mix may favour a predictable increase of RES-E generation. Many power consumers having to bear the brunt of high-cost RES-E may also dislike target overshoots.
3. *Regulatory certainty after the introduction of support mechanisms.* What are the risks of stop-go instability or the outright repeal of a support mechanism? For developing investor confidence in the RES-E sector, stable and long-term regulatory framework conditions are essential.
4. *Level of end-user electricity prices.* To what extent does a support mechanism negatively affect the competitiveness/affordability of end-user electricity prices? Market support interventions will on average lead, at least in the short and medium term, to higher electricity bills. In this respect, it is a zero-sum game between support beneficiaries and power consumers. Given the wider societal impact, the public sector might wish to avoid excessive levels of aggregate additional costs for RES-E support.
5. *Occurrence of over-stimulation.* To what extent does the implementation of a support mechanism result in serious over-stimulation of RES-E (free-riding, low-cost, eligible RES-E generators cashing in on unusual profits, subsequent to the implementation of the support mechanism)? Again, this is a zero-sum game. Generally, government officials may wish to limit the free-rider phenomenon associated with market support.

6. *Impact on technology cost-reduction and innovation.* How does a support mechanism affect the capacity, entrepreneurial diligence and risk-taking behaviour of RES-E sector agents in pursuing cost-saving measures and cost-reducing innovation? To government authorities, stimulating cost-reducing innovation is a major priority. Given the RES-E support regulation in place, to agents in the RES-E sector cost-reduction in their own company matters as well. Yet these agents may be tempted to rally against regulation that pushes the regulatory rent in their sector in a downward direction.
7. *Technology diversity.* How does a support mechanism affect deployment of fledgling RES-E technology (with a wide cost gap) in relation to technology that has come closer to market maturity (with a relatively small cost gap)? To the public sector, technology diversity has a strategic value to enhance long-term energy security. Hence, facilitating market development of promising high-cost RES-E as such might make sense to civil servants. To high-cost RES-E operators and their technology equipment providers, technology-specific support is crucial for their survival. With the possible exception of direct beneficiaries and environmental NGOs, however, most other stakeholders might be inclined to favour limiting the outlays of market support for high-cost RES-E technologies.
8. *Suitability for EU-wide application.* How effectively can a support mechanism limited to one member state be applied to all 25? Does the scheme involve many institutions or rules that make it a bureaucratic burden if implemented on a large scale?

Some aspects of great concern to certain stakeholders are not considered explicitly. The *impact on employment creation* of a certain kind of RES-E expansion depends notably on the RES-E technology mix, on the labour intensity of the RES-E supply chain, its cost-efficiency (criterion 4) and on the system boundary conditions (member-state or EU level). A high (low) score on criterion 4 would work out to be positive (negative) for the macroeconomic employment impact. Typically, the application of RES-E technology on a life-cycle basis is more labour-intensive, especially when considered at the EU level. On the other hand, the higher the cost gap of RES-E technology compared with other generating technologies, the more important the negative, indirect employment impact is relative to the positive direct employment effects. As electricity-consuming sectors have to incur the additional RES-E costs, a high cost gap of RES-E might well negatively affect macro-level employment levels. Hence, *a priori* the macroeconomic employment impact of RES-E is ambiguous. Although partially based on highly contestable assumptions,[1] Commission-sponsored research suggests that on balance, a substantial, positive, short-term employment impact can be anticipated from RES-E deployment (ECOTEC, 2003).

Generally, contingent on the RES-E mix, the *environmental impact of RES-E technology* is much lower than other generating technologies. Broadly, this holds for greenhouse gas (GHG) emissions as well as local and regional airborne pollution. Yet the efficiency of energy conversion on a life-cycle basis may markedly reduce the positive score of RES-E on its environmental performance. For instance, the 'energy pay-back time' of a solar PV system is several years. Likewise, the energy requirement for the growth of biomass feedstock, transport and processing can be a high proportion of the resulting biomass fuel. Moreover, on local and regional airborne and affluent pollution, the score for biomass-based RES-E technology compared with fossil-fuel based generation is mixed. Given a broadly lower impact per kWh of RES-E, compared with the impact per kWh of other generating technologies, the score of a mechanism on *environmental effectiveness* will be in line with its score on stimulation of RES-E generation (criterion 1)

[1] See Jansen (2003b), p. 32.

In conclusion, other factors remaining the same (including aggregate electricity demand), the most effective support mechanisms for RES-E will have the highest impact on net employment creation and the environment. Yet a crucial ‘other factor’ for the employment effect is the extent of the cost gap between RES-E and electricity from conventional sources. If the scores of a mechanism on overall effectiveness are good and on cost-efficiency are poor, the employment impact is indeterminate in both size and nature. On environmental performance, the RES-E mix is a significant aspect. Generally stated, technologies such as wind power and geothermal tend to be more environmentally benign than biomass-based RES-E technologies. It should be added that deployment of a non-baseload renewable such as wind power – as distinct from, for example, a geothermal source – would need additional balancing power. To the extent that these additional power requirements are generated from fossil fuels, this limits the environmental benefits of wind power and other non-baseload renewable sources.

3.3 Description of notional pan-EU RES-E support models

For each of the four market support mechanisms previously introduced in section 2.2, many implementation variants exist. With regard to investment subsidy mechanisms, feed-in tariffs and feed-in premiums (FIT/FIP) and RES-E tendering mechanisms, a history of policy experimentation exists that goes back several decades. Conversely, renewables portfolio standard (RPS) mechanisms have been introduced quite recently. The RPS systems running in Europe are not state-of-the-art. The latter are fraught with weak design elements partly falling into the category “teething problems” (van der Linden et al., 2005). Given this current situation, an analysis of the experience gained so far in Europe with support mechanisms is prone to give rather poor and even outright false indications for any pan-EU coordination of renewable electricity support policies.

Therefore, for each mechanism we set out some essential design elements of *a notional* optimised variant for pan-EU application and make an assessment of the expected scores – based on a mix of literature study and logical reasoning – for the criteria outlined above. This type of analysis can give far better clues for appropriate EU-wide policy coordination, as evidenced by the preparations for launching the most daunting EU-wide environmental policy instrument to date, the EU CO_2 Emissions Trading Scheme (ETS). The EU ETS was even designed prior to significant CO_2 trading experience. As a point of embarkation, four ‘pure’ models are depicted for assessment. Based on assessment results we venture to describe the contours of two ‘ideal’ hybrid RES-E support schemes. Realising that any such model is still far from implementation, we consider it nevertheless a useful mental exercise for future policy directions.

3.3.1 Generic support model features

In order to provide certainty to investors in RES-E plants, the support schemes are defined for a 20-year *moving* period, hence in 2005 for the period 2006-25, in 2006 for the period 2007-26, etc. Prior to programme implementation of any of the support models, the model-specific parameter values for the next 10 years will be fixed, while determining indicative values for programme years 11 to 20. In the first programme year, indicative values for the next horizon year (programme year 21) will be determined and so forth. Every 5 years, starting with programme year 5, a major programme evaluation will be undertaken during which parameter values for the next 6 to 10 programme years will be fixed. For example, in programme year 5 parameter values for programme years 11 to 15 will be fixed. This way, in the post-evaluation period of a major evaluation year, fixed parameter values are known for the evaluation year itself and for the next 10 calendar years, while indicative parameter values are known for the following 10 calendar years.

3.3.2 A feed-in tariffs and/or premiums model

Points of departure for the notional pan-European FIT model are the anticipated kWh cost of the distinct RES-E technologies, the anticipated baseload electricity price over the next 20 years and the budgeted RES-E subsidy fund, broken down by distinct technology. In each major evaluation year, technology-specific feed-in tariffs will be fixed for the next 10 years[2] (stepped FIT), while indicative tariffs will be determined for prospective years 11-20.[3] Eligible RES-E investors will be granted a long-term (say 15 years) power purchase agreement based on the technology-specific FIT in the applicable vintage year. The additional costs of the scheme will be paid by European suppliers in proportion to their sales volume and will be passed through to the European power consumers by way of a premium on the kWh end-user price. Electricity-intensive industries will receive a premium discount in due consideration of the electricity costs of global (non-EU) competitors. The design of the alternative notional feed-in premiums model runs along similar lines.

3.3.3 An RPS model

This scheme will focus on renewable generating technologies that are not yet commercially viable without policy support but have a relatively modest cost gap among all the non-commercial renewable generating technologies. Targets will be set at the EU level, while compliance will be relegated to a competent authority in each member state. Prior to the first programme year, RES-E technology-specific volume targets will be set for the next 20 years. Targets for the first 10 programme years will be mandatory, while those for years 11 to 20 will be indicative. In each major evaluation year, targets for the next 6 to 10 years will be fixed. Fairly ambitious but realistic targets[4] will be set, based on technology-specific cost performance, cost-reduction performance and production potentials. In order to avoid shortening the economic life of RES-E plants (which would increase the additional RES-E costs), no age limits are put on RPS eligibility.[5] Penalty payments for non-compliance will either be transferred to a renewables research, development and demonstration (RD&D) fund or to the general government budget, based on subsidiarity. In order to provide more certainty to potential investors, the competent authority implementing the scheme will guarantee a minimum tradable RES-E certificate (TREC) price well below the expected long-term marginal generation cost.[6] The flexibility of the RPS scheme can be enhanced by the introduction of

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[2] With the effect of the second major programme evaluation year, the rates for years 6-10 onwards will be fixed, with rates for years 1-5 having been fixed in the previous programme evaluation year.

[3] For technologies such as wind power and solar PV, region-specific FIT schemes can also be considered in a few (e.g. three or four) EU zones based on resource endowments. This may well reduce the free-rider phenomenon and provide more regional equity in the stimulation of economic activities related to these technologies.

[4] An ambitious RPS target is one that will be under-achieved in its absence. Conversely, a non-ambitious target will be achieved anyway.

[5] In some RPS systems eligibility is constrained to a limited period, e.g. 10 years in Italy, which tends to increase certificate prices and hence the additional RPS system costs for electricity users. It seems that legislation in Norway and Sweden is being introduced or prepared specifying technology-specific limitations to the eligibility duration of RES-E plants for the envisaged joint RPS. This would be a set-back in comparison with the current situation in Sweden. Provided that eligibility durations will last at least 15 years, this design flaw, if introduced at all, will have an additional-cost-raising impact, albeit limited.

certain well-constrained banking and borrowing options. This approach is particularly warranted by unpredictable weather conditions (wind, solar PV, hydro and biomass feedstock) and to mitigate gaming opportunities in TREC markets.

3.3.4 An investment subsidy model

As with the FIT (FIP) model, the starting points for this scheme are the anticipated kWh cost of the distinct RES-E technologies, the expected baseload electricity price over the next 20 programme years and the budgeted RES-E subsidy fund, broken down by technology. Hence, in order to contain the subsidy amount the support scheme will be capped. Available technology-specific funds will set an upper limit for the eligible technology-specific volume. Estimations will be based on projected technology-specific learning curves. Based on these projections, during each major evaluation year, the technology-specific subsidy amount per watt of rated capacity will be fixed. The technology shares in the RES-E investment fund will be adjusted based on *ex post* cost-reduction performance over the past five years compared with the related projections. Technologies showing higher (lower) cost-reductions than expected will receive a higher (lower) portion. Yearly RES-E fund inflows will be paid by European suppliers in proportion to their sales volume and will be borne by the end users through a RES-E surcharge on the bill. The surcharge will be per kWh with a discount for energy-intensive industries.

3.3.5 A RES-E tendering model

In this scheme, a RES-E fund will be organised in a similar vein as the previous model. Periodic technology-specific tenders will be held for RES-E projects with a long-term (say 15-year) power purchase agreement, based on unitary pricing and the highest successful bid price. A high penalty will be enforced on those failing to honour their bids within a given pre-set period without valid *force majeure* reasons. Penalty payments will be transferred to the RES-E fund.

3.3.6 Treatment of high-cost technology

High-cost renewable generating technologies need dedicated policy support within 'reasonable' additional cost limits. The FIT (FIP) investment subsidy and tendering models can handle high-cost renewable generating technologies, such as solar PV, fairly easily in contrast with the RPS model. As for the latter, one approach would be to opt for a hybrid system. In this approach the 'generic' RPS would be applied to high-cost technologies as well, while the cost gap with first-tier eligible generating technologies would be bridged by alternative instruments such as investment subsidies or FIP with due regard to limiting the additional costs. Alternatively, dedicated RPS schemes could be implemented for specific technology tiers (Verbruggen, 2004; Jansen, 2003b) with technology-specific TRECs. The clustering of technologies may take place if the number of generators is limited or some generators obtain too much market power in the absence of technology clustering. Only technologies with broadly similar cost gaps will be clustered. Technology clusters with a high cost gap will initially be allotted much lower targets than those with a low cost gap. Depending on realisations with respect to the cost-reduction revealed during the major evaluations, targets for high-cost technology clusters will be adjusted by a high or a low percentage per year. Renewables portfolio standards will be enforced by penalties well above expected marginal generation costs per technology tier.

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[6] This feature will in fact render the proposed RPS a hybrid RPS-FIP variant: the minimum TREC price can be considered to denote a backstop feed-in premium. The maximum TREC price acts as a cap on the additional cost per unit of RES-E. In conjunction with the target, the maximum TREC price also fixes the maximum total additional costs.

3.4 Assessment of the distinct market support models

The support models outlined in the previous sub-section have been assessed by their respective scores on the criteria previously set out in section 3.2. This was done under the assumption that for all models equally effective complementary policies on permit authorisation procedures and grid access would prevail. The results can be summarised as below.

With the exception of technology diversity, *the performance of the investment subsidy model and tendering model are shown to be poor to mediocre as the main market-stimulation mechanism on all scores*. Therefore, it is proposed that these models be rejected as major market-stimulation tools. In contrast, both the FIT (FIP) and RPS schemes show strong and weak points. Let us focus on these two alternatives as the main market-stimulation instrument.

Given attractively set premium tariffs, the strongest points of the FIT (FIP) model are its perceived simplicity and effectiveness in stimulating RES-E as well as its positive impact on technology diversity, including technologies that are still far from market maturity. Its weakest points are the uncertainties regarding target achievement, potential over-stimulation of eligible generators and the much stronger upward impact of these uncertainties upon end-user electricity prices for captive consumers. Over-stimulation results from typical FIT (FIP) rate-setting procedures affected by asymmetric information and the political economy of negotiations with special interest groups. Moreover, the supply curves for technology-specific renewable electricity are much steeper than for aggregate renewable electricity. Hence, even if the regulator were to avail of perfect information and holds his own without government interference against a well-organised lobby of special interest groups, the free-rider phenomenon would still be substantial. Further, given the assurance of demand at pre-set prices (premiums) in the FIT (FIP) system, the incentives for risk-taking by renewable generators to introduce cost-reducing technology and measures are limited. With reference to criterion 8, an EU-wide FIT (FIP) system can contain two equalisation mechanisms carried out by the grid operators: one for the paid subsidies and one for the physical volumes fed into the grid. The expansion of this mechanism across the EU would involve high transaction costs and extensive electricity transport operations.

The strongest points of the RPS model are the likelihood of target achievement, stimulation of cost-reducing innovation and regulatory certainty. Market-based incentives such as RPS in the absence of dominant market players do stimulate risk-taking to introduce cost-reducing innovation.[7] In addition, in a large market such as the EU, the supply curve of renewable electricity is rather flat, making for a relatively modest occurrence of the free-rider phenomenon. Once a well-designed RPS system is in place with long-term target-setting, it can provide relatively strong regulatory certainty. This relates to its innate capacity to assure target compliance under a strong compliance enforcement regime and its comparatively good degree of cost-effectiveness. A FIT (FIP) system can also be relatively stable but the inherent political risk associated with a FIT (FIP) system is larger, notably if and when the overall FIT system costs are mounting. With reference to criterion 8, a possible EU-wide TREC scheme involving many traders and one issuing and clearing body is regarded as a means of low transaction costs. Only certificates have to cross borders. As distinct from the FIT scheme, the price equalisation process would take place automatically and volume transactions would not be needed because of equal quotas for suppliers and the separation of the power and certificates markets.

A generic RPS model notably stimulates renewable technology with a modest cost gap. More technology diversity can be promoted through technology banding. Yet in this respect the FIT

[7] A wealth of literature exists attesting to the positive relationship between the extent of market competition (engendered for example by well-designed market-based instruments) and cost-reducing innovation.

system scores better. Alternatives to a generic RPS model are complementary investment subsidies or fiscal incentives. A hybrid RPS/FIP or RPS/FIT model could also be envisaged. In fact, the US case with RPS programmes in 18 states and a federal PTC (production tax credit) of some $18/MWh for some qualifying renewable technologies works out as a hybrid RPS/FIP in the RPS states concerned.

3.5 Conclusions

Judging from both the experience gained over several decades and theoretical considerations, neither the investment-subsidy model nor the tendering model seem to perform well as a main support mechanism for renewable electricity. As for FIT (and FIP) or RPS systems, no clear candidate as the major market-stimulation model for eventual harmonisation has presented itself in Europe so far. FIT schemes have been applied in Denmark, Germany and Spain with a remarkably positive impact on the deployment of wind power technology, if with a rather high subsidy per kWh. RPS systems have a rather short history so far in Europe with many teething problems regarding sub-optimal design features. Some of these sub-optimal features are currently being addressed. In some American states such as Texas and California, and to some extent in Sweden as well, experience to date with RPS is promising.[8] At present, in the latter cases additional costs per kWh of RES-E support are lower than under any successful FIT system to date. Therefore, it is premature to reject RPS as a main support mechanism to stimulate renewable electricity.[9] Furthermore, from 2007 nationally-restricted member-state support schemes will be at odds with the mandated full opening of the EU electricity market taking effect at that time.

Improvement of current FIT (FIP) and RPS schemes towards best practice is highly desirable. Moreover, bottom-up clustering of either FIT (FIP) or RPS market stimulation models should be encouraged. Development towards a harmonised RPS/FIP or RPS/FIT system is fully consistent with the unfolding internal electricity market. A total withering away of market stimulation of renewable electricity is not envisaged in the foreseeable future.

It is essential that stable framework conditions be offered to investors in renewables-based generation plants. Stop-go stimulation policies for deployment of renewable technologies that are not yet commercially mature can deter potential investors and destabilise fledgling renewable energy industries. Long-term renewable electricity targets are recommended with a periodic updating procedure and an ambition level that reflects a judicious balance between the concerns of electricity users and renewable energy industries.

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[8] Some of the success of the US RPS examples are owing to an accompanying fiscal measure, the federal production tax credit (PTC). Likewise, the deployment success of some European FIT systems have been amplified by accompanying fiscal measures, such as investment subsidies, accelerated depreciation and subsidised interest programmes.

[9] A recent spate of publications suggest explicitly or implicitly that a FIT system would be more cost-effective on a generic basis than RPS by merely comparing the German FIT system to the UK RPS scheme. There is an inherent risk, however, of being misled by general conclusions drawn from comparing national systems, as such comparisons do not account for specific weaknesses in the system design.

Chapter 4

Empowering EU Consumers to Drive the Market for Renewable Electricity

4.1 Introduction

This chapter considers electricity generation attribute disclosure and verification in the EU, focusing on renewable electricity. Information on renewable electricity is or can be used for a range of applications. It is enshrined especially in existing EU legislation that electricity consumers have a right to know the fuel mix of the electricity delivered to them for reasons of transparency and consumer choice.

This chapter sets out the merits of electricity generation attribute disclosure and verification (section 4.2) and summarises existing EU legislation (section 4.3). The main EU-wide legal requirements concerning renewable electricity encompass the mandate to member states to have a system in place to issue renewable energy guarantees-of-origin (RE-GOs) at the request of renewable electricity generators. Section 4.5 provides a preliminary analysis of stakeholder positions on this issue, while section 4.6 reviews the implementation of RE-GO schemes in the member states so far. Section 4.7 compares this with the current achievements in implementing disclosure and authentication requirements, as prompted by existing EU legislation. Special attention is given to the current lack of transparency for consumers as a result of the ongoing potential for multiple counting problems and inconsistent statistics on the renewable electricity performance of the member states. Section 4.8 presents recommendations to improve the transparency, accuracy and reliability of renewable electricity information in the member states.

4.2 Reliable electricity generation information: Merits and pre-conditions

Obviously, transparent, easily accessible, accurate and reliable electricity-generation information is essential for *consumer protection*. It not only enables consumers to make more informed choices, it may also improve *market efficiency* as it may stimulate competition with new entrants in the market offering ‘green electricity products’. Finally yet importantly, consumers willing to pay a premium price for offerings with an over-representation of renewable electricity over electricity from non-renewable sources can drive the electricity market towards *enhanced environmental sustainability*.

Along with liberalisation of the electricity sector, governments may wish to improve consumer protection and enable consumers to influence the generation fuel mix.

Given the failure of the power market to spontaneously provide transparent, accurate and reliable electricity-generation information, governments may resort to introducing and enforcing effective legislation to that effect. For example, electricity suppliers could be required to further disclose product information to consumers of their as yet not well-understood products.

The capacity of consumers to stimulate – by their deliberate, voluntary choices – the generation of renewable electricity crucially depends on the legislation in place for electricity generation attribute disclosure and verification. Introduction and enforcement of appropriate legislation will permit the realisation of potential demand from *voluntary markets* for additional renewable electricity. This will be supplementary to demand from *compliance markets*. In the latter, affected parties have certain obligations to generate, supply or consume renewable electricity through regulatory market support systems such as feed-in tariffs (FIT) and renewables portfolio standards (RPS).

This necessitates the existence of consumer choice among a range of electricity products, differentiated in a clear way by price, contract conditions, reliability of service and (especially) electricity generation attributes such as the fuel mix. Moreover, a reliable verification system for electricity product offerings is warranted for reasons of consumer protection and the effective functioning of the electricity market.

Current efforts by the EU member states to stimulate the market uptake of renewable electricity are centred on the implementation of market support instruments. The two most important instruments are FIT (FIP) and RPS programmes, typically complemented with investment subsidies or fiscal incentives (or both). With some exemptions, the member states have so far neglected to facilitate the emergence of voluntary markets as a driver of demand for renewable electricity *on an additional basis* in favour of 'compliance markets' (the uptake of eligible renewable electricity mandated by FIT or RPS regulation). Experience in the US suggests, however, that in areas with reasonable access to credible green power offerings at least 1 to 2% of residential consumers are disposed to buying renewable electricity for roughly a \$5 to \$40/MWh premium (Bird & Swezey, 2004). Corporations would tend to go for the lower values in this range. In Europe, especially in the presumably more environmentally concerned northwest, the potential for voluntary markets may be greater. This should be determined by well-designed market research.

Policy-makers wishing to boost renewable electricity can ill afford to ignore the *additional* potential of voluntary markets. Yet, before consumers may wish to drive the electricity market, consumers need to be able to trust that they really receive what is implied by their electricity provider. Consumers subscribing to a certain green power product should be able to ascertain that his of her choice will really matter in order for green power to penetrate into the market.

4.3 Current EU legislation

4.3.1 Disclosure and verification of electricity from renewable sources

In accordance with the Renewables Directive (2001/77/EC), "to facilitate trade in electricity produced from renewable energy sources and to increase transparency for the consumer's choice between electricity produced from non-renewable and electricity from renewable energy sources, the guarantee of origin of such electricity is necessary" (recital 10, European Council, 2001). An allusion to another application of an origin guarantee for electricity from renewable sources is made in the Directive. It regards the accounting for the percentage contribution of renewable electricity sources (RES-E) in 1997 and the target year 2010. The Directive states that "In the case of internal trade of RES-E (with recognised certification or origin registered) the calculation of these percentages will influence 2010 figures by member state but not the Community total" (Annex, third note to table).

Member states are to have introduced a renewable energy guarantees-of-origin (RE-GOs) scheme by 27 October 2003 at the latest. They are to ensure that a RE-GO is issued *in response to a request* (Art. 5(1)). RE-GOs should confirm that the origin of electricity generated in their respective territories from renewable energy sources, including that from 10 MW+ hydro power plants, can be guaranteed throughout the EU according to objective, transparent and non-discriminatory criteria. The information requirements to be included in a guarantee of origin are limited, however. A RE-GO shall (Art. 5(3)):

> (i) specify the energy source from which the electricity was produced, specifying the dates and places of production, and in the case of hydroelectric installations, indicate the capacity; [and]
>
> (ii) 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 (European Council, 2001).

RE-GOs are to be mutually recognised by the member states "exclusively"[1] as proof of the aforementioned elements (Art. 5(4)). Further, appropriate mechanisms are to be put in place to ensure that RE-GOs are both *accurate and reliable*.

4.3.2 Disclosure and verification of electricity from co-generation of heat and power plants

To increase transparency for the consumer's choice between electricity from co-generation and electricity produced on the basis of other techniques,[2] the CHP Directive (2004/8/EC) mandates the member states to introduce a scheme of guarantees of origin of CHP electricity (CHP-GOs). These shall be issued at the request of CHP generators (Art. 5(1)). Appropriate mechanisms are to be put in place to ensure that the CHP-GOs are both accurate and reliable (Art. 5(2)). Further, according to Art. 5(5), a CHP-GO shall specify:

- the lower calorific value of the fuel source from which the electricity was produced, the use of the heat generated together with the electricity and finally the dates and place of production;
- the quantity of electricity from high efficiency cogeneration in accordance with Annex II that the guarantee represents; and
- the primary energy savings calculated in accordance with Annex III based on harmonised efficiency reference values established by the Commission (European Council, 2004a).

Member states may include additional information on the guarantee of origin. CHP-GOs should be mutually recognised by the member states, exclusively as proof of the aforementioned elements (Art. 5(6)). On the tradability of CHP-GOs the CHP Directive is rather vague. No specification is given on any form of linkage of CHP-GOs with RE-GOs (Directive 2001/77/EC) or with the verification of electricity origin disclosure (Directive 2003/54/EC).

4.3.3 Generic electricity origin disclosure

The Electricity Market Directive (2003/54/EC, Art. 3(6)) mandates that,

> Member States shall ensure that electricity suppliers specify in or with the bills and in promotional materials made available to final customers:
>
> (a) the contribution of each energy source to the overall fuel mix of the supplier over the preceding year; [and]
>
> (b) at least the reference to existing reference sources, such as web-pages, where information on the environmental impact, in terms of at least emissions of CO_2 and the radioactive waste resulting from the electricity produced by overall fuel mix of the supplier over the preceding year is publicly available.

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[1] In principle, the word "exclusively" can be interpreted as 'only' or as 'on an exclusive basis'. Presumably the legislator refers to the former connotation.

[2] See Directive 2004/8/EC, recital 12 (European Council, 2004).

> With respect to electricity obtained through an electricity exchange or imported from an undertaking situated outside the Community, aggregate figures provided by the exchange or the undertaking in question over the preceding year may be used.
>
> Member States shall take the necessary steps to ensure that the information provided by suppliers to their customers pursuant to this Article is reliable" (European Council, 2003).

4.4 Scope of applications for RE-GOs

The scope for useful applications for guarantees of origin with renewable electricity as the underlying source for commercial and official purposes is rather broad. The following (potential) applications can be distinguished (Uyterlinde et al., 2004, chapter 2):

Applications for commercial purposes

- proof of a certain quantity of qualifying renewable electricity to substantiate claims for market support – eligibility for feed-in tariffs, for example, which could be made contingent on the surrender of commensurate RE-GOs;
- evidence for affected parties in member states with an RPS scheme to substantiate claims regarding compliance with the scheme's standard; and
- proof of a claim to the attributes of a certain quantity of renewable electricity by way of public disclosures, reports and statements. Examples include the disclosure of the electricity supplier/product fuel mix and the associated environmental profile, disclosure of the fuel mix of electricity consumption in annual corporate social responsibility reports and 'green' commercial messages.

Applications for public policy purposes

The aggregation of generation attribute information enabled by comprehensive RE-GO accounting systems can facilitate the monitoring of system-wide trends. Useful applications for policy-makers include:

- generating reliable and accurate statistics for monitoring the production and use of renewable electricity in the EU;
- providing information on aggregate market support levels per renewable technology in the EU member states in €/MWh to facilitate coordination of the different support frameworks. This requires dedicated standard attributes for this purpose and detailed instructions on how to express a support measure in €/MWh; and
- ensuring accurate, reliable and consistent proof of target compliance by a member state.

Several of these potentially quite useful applications are not yet implemented in most EU countries. Some of the uses are not even explicitly endorsed in current EU legislation, albeit none is explicitly excluded either.

4.5 Stakeholder positions

Because of the apparent complexity of the issues, so far many stakeholders have refrained from communicating their respective positions on electricity generation attribute disclosure and verification. Nonetheless, in this section we attempt to sketch how the interests of distinct stakeholder groups will presumably be affected. We focus on the verification of renewable-electricity claims through renewable-electricity accounting systems.

Government authorities have to weigh the perceived benefits of introducing a reliable (renewable) electricity generation attribute information system against its perceived implementation burden. It appears in order for the European Commission to provide more objective information on this issue. *Some rather pervasive misunderstandings are*:

i) The costs of a reliable RE-GO accounting system on the basis of a central electronic tracking platform would have a significant adverse impact on the cost of electricity. If the costs were allocated on a pro rata basis to electricity consumption and system demand is 10 to 500 TWh/year, the cost per kWh will be in the range of €0.001 to €0.030 ct/kWh. Hence, in most member states the costs of a reliable RE-GO accounting system will be below 0.1% of the electricity bill.

ii) In a member state with a FIT scheme, a reliable RE-GO accounting system would have no use. Yet the previous section shows that such a system has several valuable applications. In fact, implementation of a *reliable* RE-GO system is indispensable for implementing the Renewables and Electricity Market Directives (2001/77/EC and 2003/54/EC). These Directives mandate the member states to ensure that in their jurisdiction both the RE-GO system and the electricity mix disclosures of electricity suppliers are accurate and reliable. This holds irrespective of the renewable electricity support mechanisms in place.

The renewable-electricity business sector (comprising generators, project developers and technology providers) still has to position itself on the subject matter. So far, the sector is most concerned with rallying for market support mechanisms that create the highest and most certain regulatory rent for the renewable-electricity value chains. Nevertheless, reliable electricity generation attribute disclosure and verification through RE-GO trade is essential for stimulating the market broadening of renewable electricity in the EU and for harnessing the potential of additional demand for renewable electricity from voluntary markets. The message that reliable RE-GO accounting systems are very compatible with FIT schemes still needs to get across to many representatives in this stakeholder group.

Incumbent generators will tend to weigh their position on the impact of reliable electricity disclosure on their competitiveness relative to their main competitors. Generators with a relatively large share of 'green' generating facilities may see their position as improved against those with an over-representation of nuclear and fossil-fuel generating facilities. In contrast, the latter may favour continuation of the current rather opaque situation regarding *reliable* disclosure of generation attribute information.

Transmission and distribution system operators (TSOs/DSOs) may feel an initial reluctance towards implementation of a reliable disclosure and verification system. This might be compared to reluctance to implement a new business information system in a company. Once the fairly complex introduction phase has been completed, however, these stakeholders may particularly find that a reliable verification system will greatly facilitate a number of their public tasks. Specific advantages relate to their possible role in the transfer of market stimulation subsidies, assignment of the residual mix to suppliers and in operating a central registry and electronic platform for transacting RE-GOs.

For *incumbent suppliers*, more or less the same applies as with the incumbent generators. To some extent there is a difference in that they are closest to the end users. If on the part of consumers there is significant potential demand for more environmentally benign electricity, efficient client-oriented suppliers may try to acquire a competitive edge by offering a selection of green electricity products.

Electricity users will generally appreciate being offered a number of real options regarding electricity products as well as suppliers. Price-sensitive consumers may care less about green electricity products, while those who are environmentally concerned may favour certain green premium products and green suppliers. Typically, commercial users wishing to develop a green profile among their target clients may be prepared to pay a relatively modest premium, while a relatively small proportion of households may be prepared to pay a relatively large premium. As in other economic domains, end users will trade off quality against price with a range of different price-quality preferences. What is essential for consumers to enable them to make informed choices is that the information disclosed is relatively simple and trustworthy. This feature and the minimisation of dishonest information disclosure can only be enforced by rather strict regulation on disclosure standards and verification.

Environmental NGOs will generally favour credible implementation of the transparency aspect for the principle of consumer choice. These stakeholders will especially favour enhanced access for consumers to reliable green options (for example, see Greenpeace International, 2005).

4.6 Variations in the implementation of RE-GO accounting schemes

The Renewables Directive (2001/77/EC) leaves much scope for the member states regarding the implementation details of their respective RE-GO schemes. As a result, the schemes vary a lot in design across member states. A design classification of the national RE-GO systems that are currently in place is below (adapted from Vrolijk et al., 2004).

- *Minimum implementation.* In the minimum compliance implementation model the information content of the RE-GOs and their regulatory structure is limited to the basic requirements stipulated in the Renewables Directive. Such a regulatory structure can be set up at minimal cost and in a relatively short time. But the potential benefits from this level of implementation will also be very limited.
- *Advanced implementation.* Some key features of national RE-GO systems that can be classified as advanced are: i) automatic issuance of RE-GOs when eligible renewable electricity is being generated and ii) introduction of a central registry to monitor the issue and transfer of RE-GOs. A central electronic register will greatly enhance the potential uses of RE-GOs. Introduction of a redemption system and information attributes on the nature and preferably also the level of direct support granted to the commercialisation of the underlying renewable electricity is essential to reduce the potential of multiple counting. Yet it should be noted that so far not many member states have done so. Some advanced implementations of RE-GO systems have introduced mutual interfaces for the cross-border transfer of RE-GOs. The initial set-up costs of the advanced implementation model are higher than those in the minimum compliance scenario. But the operating costs for issuance and transfer activities as well as the quantitative scope for multiple counting are less.
- *Partial policy integration.* RE-GO systems in the partial policy integration model are used for some commercial or official applications (see previous section), though not yet in a fully integrated way. Moreover, redemption procedures and at least qualitative information attributes on market support for the underlying renewable electricity have been included in these RE-GO systems. As a result, both the benefits and reliability (i.e. reduction of the multiple counting potential) of RE-GO systems in this class have been improved.
- *Full policy integration.* Under this scenario, RE-GO systems in the partial policy integration model are used for some commercial or official applications in a fully integrated way. Moreover, the systems under this model have moved towards a certain degree of mutual harmonisation. This greatly facilitates cross-border RE-GO trade among the member states concerned. As a result, both the benefits and reliability (i.e. minimisation of the multiple counting potential) of RE-GO systems under this model are highest compared with those in the other three classes.

The current situation regarding implementation of RE-GOs in the EU-15 member states is shown in Table 4.1. The table reveals that a lot of policy effort is still warranted to capture the full benefits of the RE-GO systems in the EU for a variety of policy purposes. Such purposes notably include *reliable* generation attribute disclosure of renewable electricity and cross-border trade in RE-GOs, for instance to improve the accessibility and affordability of (reliable) green electricity products for European consumers.

Table 4.1 Implementation status of RE-GO systems in the EU-15: Situation in October 2004

Not implemented	**Minimum compliance**	**Advanced implementation**	**Partial policy integration**	**Full policy integration**
France	Germany	Belgium (Brussels)	Austria	None
Greece	Ireland	Denmark	Belgium (Flanders)	
Portugal		Finland	Belgium (Wallonia)	
Spain		Italy	Netherlands	
		Luxembourg		
		Sweden		
		UK		

Source: Adapted from Vrolijk et al. (2004).

4.7 Disclosure and authentication

As set out above, several EU directives require member states to promote transparency for the consumer's choice in EU electricity markets. Retail suppliers should provide end users reliable and accurate information on the company fuel mix and its associated environmental profile for the previous year. Given the transparency objective stated in EU legislation, this also tacitly holds for green electricity offerings and green electricity quality labels issued by several environmental NGOs for voluntary markets, etc.

Yet current practices in most EU member states are still far from ensuring that such information by retail sellers in their jurisdiction is indeed reliable and accurate. For this to happen, the member states will ultimately have to enforce the following conditions (as per Sedano, 2002):

- fairly strict standards for company and product disclosure labels that are well understood by the average customer and facilitate comparisons between suppliers and products. Moreover, requiring broadly standardised, transparent information makes consumer-deception abuses more difficult; and
- a reliable and credible system of substantiation by a comprehensive accounting system of electricity generation attributes preferably covering all generation sources.

The member-state RE-GO systems have to be fully compatible to enable cross-border transactions. This requires, for example, full harmonisation of technology nomenclature and other attributes to be embedded in the GOs, rules for retirement, expiration period and other accounting system operation rules. For this purpose a voluntary scheme, the European Energy Certificates System (EECS), can be a point of departure. The EECS has been developed by RECS[3] and has been adopted by six EU member states. The New England power pool

[3] For further information about EECS, see the RECS website (retrievable from http://www.recs.org).

generation information system (NEPOOL GIS) introduced in six states in the US sets a good example for addressing the practical implementation issues of an advanced, robust, harmonised multi-state certificate system.[4]

The most serious problem impeding the voluntary market from taking off is the occurrence of *multiple counting*. This problem, which needs to be addressed by policy-makers, happens either inadvertently or results from outright fraud when:

- incompatible commercial claims are made more than once over the same quantity of renewable electricity production (using more than one kind of ‘proof’ or using one proof, say a RE-GO, more than once); or
- the electricity underlying commercial claims has not been produced at all.

Companies directly involved may claim generation attributes that they do not own or may use certain generation attributes they do own more than once. Another related potential problem is *inconsistent statistics on a member state’s renewable electricity performance in a target year*. Let us give one example for each problem without going into further details.

Legislation introduces a FIT scheme in order to make eligible renewable generators competitive with their counterparts using non-renewable energy sources. At the same time, however, it allows the sale of RE-GOs by generators benefiting from a FIT scheme. These RE-GOs are typically used by electricity suppliers for green product disclosure. As a result of this situation, the buyers of green power products get the wrong impression that their choices have a positive impact on *additional* renewable electricity production commensurate with their uptake. If the legislator were to require beneficiaries of competitive-making FIT support to surrender their RE-GOs, this *multiple counting* case could be resolved. The system operator may add them to the residual mix that consists of, for instance, the electricity used for system balancing and system losses as well as unspecified imports. Subsequently, the system operator may assign the residual mix for disclosure to all electricity providers in all their offerings under the legislator’s jurisdiction on a pro rata basis. Green electricity products should hence be ‘greener’, i.e. contain more renewable electricity than the residual mix. Allowing FIT scheme beneficiaries to transfer their RE-GOs not only is at odds with transparency as it does not meet environmental additionality, it inhibits green consumers to steer the power market towards a more sustainable direction. A major (but by no means the only) example of this multiple counting problem is in the EU’s largest market to date for green power products, the Netherlands.

Inconsistent statistics on a member state’s renewable electricity performance can stem from the export of RE-GOs issued in a target year, say 2010. It is likely that in the case of cross-border RE-GO trade, most exporting member states do not wish to relinquish their right to count the underlying renewable electricity for their target compliance. EU legislation would only allow counting renewable electricity of imported RE-GOs towards the target of the importing member state if the exporting member state has provided an approval earmark (see chapter 2, footnote 6). Consumers in the importing country of RE-GOs without such a target attribute may be under the impression that total disclosed consumption of renewable electricity gives a good indication of their country’s renewable electricity performance.

Improving the consistency of information on the deployment of renewable electricity is to invariably base renewable-electricity target compliance by member states on renewable electricity *production*. Member states would still be allowed to pool their targets, but each state would remain accountable for achieving its target should the joint target of the regional ‘bubble’ not be met (Jansen, 2005a). If target achievements (the nominator of target percentage) are

[4] For further information, see the websites (retrievable from http://www.iso-ne.com/committees/generator_information_systems and http://www.nepoolgis.com).

based on production, member states may prove this either by means of national RES-E production statistics or, alternatively, by statistics on the aggregate issuance of RE-GOs upon national renewable generation during the target year. With advanced RE-GO systems in place, the latter option is the most reliable and thus preferred. If target achievement is also based on national renewable-electricity consumption, then from the perspective of reliability and transparency for consumer choice, member states *should* prove target achievement, based on RE-GOs redeemed to cover renewable electricity consumption during the target year. From the same viewpoint, such RE-GOs would then automatically include those imported from other states. In keeping with current realities, it is recommended that the European Commission unequivocally specifies that target achievement be measured by national renewable-electricity production.

4.8 Conclusions

Important first steps have been taken in EU legislation to foster transparency for consumer choice. Yet quite a few steps still need to be taken towards the genuine empowerment of electricity consumers to drive the EU power market in a more sustainable direction. The following 'best practices' are recommended for the design of robust, credible and accurate RE-GO accounting systems, which can facilitate all the distinct market-support systems in place:

- One competent organisation per member state under close public scrutiny and at arm's length from electricity generators and suppliers should be made responsible for operating the RE-GO system, maintaining one central registry that can interlink with those of other member states.
- A RE-GO should be automatically issued as the *unique* proof of a certain MWh of renewable electricity generation for whatever purpose, with comprehensive coverage of renewable electricity.
- The attributes carried by a RE-GO should be able to facilitate all useful commercial and public policy purposes. RE-GOs should be compatible across member states to facilitate cross-border trade.
- Member states with competitive-making FIT systems should effectively forbid FIT-eligible renewable generators from transacting RE-GOs with underlying FIT-supported electricity. This would preferably be done by requiring the redemption of RE-GOs for obtaining FIT support, with the accounting system operator assigning these RE-GOs to electricity suppliers on a pro rata basis. Legislation in some member states with a FIT system in place, allowing FIT-eligible renewable generators to transact RE-GOs (e.g. in the Netherlands), is incompatible with the objective of transparency for consumer choice as stipulated in the Renewables, Electricity and CHP Directives.
- Member states with an RPS should use their RE-GO system instead of a parallel TRECs scheme for compliance verification. Legislation in some member states with an RPS scheme in place, which defines the TRECs as purely financial instruments (e.g. Sweden and the UK), is also incompatible with the objective of transparency for consumer choice.
- For substantiating the veracity of green electricity products, corresponding RE-GOs should be mandated for redemption. No generation attributes of underlying renewable electricity should be allowed as disclosure proofs if competition-inducing market support has been received, for example through FIT or RPS systems, unless the particular RE-GOs have been assigned by the RE-GO system operator.

RES-E target compliance by member states should be based on production targets. Member states should be allowed to pool their production targets, with each individual member state remaining accountable for achieving the joint target of the 'bubble' region. This procedure – as opposed to cross-border transactions in RE-GOs with(out) an approval 'earmark' of the exporting member state – would ensure consistency of information on renewable electricity statistics while not hampering cross-border trade in RE-GOs.

In the background of liberalising power markets, European legislators need to give due attention to consumer protection and empowerment.

Chapter 5
Obstacles to a Greater Presence of Renewable Energy Sources
Grid Integration and Administrative Barriers

This chapter investigates barriers to the increased penetration of renewable electricity (RES-E) in the EU. The main stumbling blocks are the grid integration of renewable energy sources (RES) in the electricity system and administrative matters related to the authorisation of RES-E projects. The management of these two issues is decisive if renewable energy sources are to increase their share in electricity generation. This is for two main reasons. First, as a result of the fact that the grid was not created with the expectation of such a high RES-E percentage, a higher RES-E capacity has to be supplemented by technical and operational modifications along with infrastructure improvements. Second, to meet RES-E penetration targets it is necessary to create a process that will facilitate the increased presence of RES-E generation units in a timely and simple manner.

The Renewables Directive (2001/77/EC) sets the indicative target of having renewable sources provide the power for 21% of the electricity generated in the EU-25 by 2010. The accomplishment of this target will require a very strong presence of RES-E, which has ranged from 12.9% in 1997 to 15.2% in 2001 and is currently around 13%.[1] Given that almost all hydro capacity is already exploited, the main source able to cover the remaining capacity requirements and to do so in a cost-effective manner is wind energy.[2] In this context, our discussion about the grid integration of RES-E will mostly be concerned with the integration of wind energy into the network.[3]

5.1 Grid integration of renewable energy sources in the electricity system

It is acknowledged in the literature[4] that growth in wind capacity is not matched by investment in the long-term development of the network, either in planning or in committed long-term R&D. Yet in order to sustain reliable power-system operation in the future with significant amounts of renewable energy, as well as conventional energy, a new philosophy in the design and the operation of the system is needed. The grid not only needs to be extended and reinforced to better absorb and conduct the renewable energy generation with its specific characteristics – new approaches in the operation of the conventional generators and the transmission and distribution networks are necessary. Moreover, the completion of the internal energy market creates opportunities for increased cross-border trade in electricity. Integration of member-state markets will result in the Europeanisation of issues that used to apply only at the member-state level, such as load management, interconnector investments and cross-border trade.

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[1] This approximation is made according to the values presented in the *Green-X Project Final Report* (University of Technology, 2004).

[2] See also the IEA (2004) *World Energy Outlook* study, concerning both the reference and the alternative policy scenarios.

[3] Biomass is also expected to acquire an increasing share in the next five years, yet its integration does not really constitute a grid issue.

[4] See for example Sustainable Development Commission (2005), Justus (2005), Union for the Coordination of Transmission of Electricity (UCTE) (2005) and ETSO (2005).

The grid integration of an increasing share of wind energy will *amplify* a number of technical and operational challenges to the network. The intermittency of wind power and the geographical concentration of wind farms (with an increasing share of those that are offshore and often located in remote areas) are known features, which will multiply in scale and scope in the forthcoming 5-10 years. The effective management of issues arising from the greater share of RES in the EU energy mix and in direct relation to the grid integration of renewables is crucial so as not to impede the projected future penetration of wind power.

5.1.1 Issues to be addressed for wind integration

Wind power has been rapidly increasing its share in Europe's energy mix and is expected to continue in the years to come. The European Wind Energy Association (EWEA) expects a rise in European wind capacity from ca. 34,000 MW in 2004 to 180,000 in 2020, of which a large proportion of future capacity is expected to come from offshore installations.[5]

The large-scale integration of both onshore and offshore wind raises a number of issues with the various stakeholders involved, from generation, through transmission and distribution, up to the power market and the demand side. A number of issues are technical, such as: a) connection rules and system stability; b) system adequacy; c) grid infrastructure; d) balance management on the generation side;[6] e) operation of the transmission and distribution grids; and f) legal and ownership unbundling of generation and transmission/distribution activities. The capacity of the power system to absorb wind power is, however, determined more by economics and power market operation than by absolute technical and practical constraints.[7]

a) Connection rules and system stability issues

In order to avoid a negative impact on the network, especially if there is a substantial amount of distributed and embedded generation, technical criteria (interconnection regulations and grid codes) for grid connection are being applied for most RES-E generation technologies. The detailed requirements that have to be met by distributed generators (in our case by RES-E generation) mostly depend on the voltage at the point of common coupling between the embedded generator and the grid infrastructure.

In several EU member states the interconnection regulations for wind power are being further refined, in order to allow for larger penetration and at the same time to maintain an adequate power supply. The great variety of national regulations is not always an advantage for the wind turbine manufacturers. Yet at the moment an EU-wide homogenisation of interconnection regulations designed for high penetration situations is not desirable either, partly because the level of wind power penetration is still very low in most member states, and partly because some national requirements pose an unduly heavy impact on the wind turbine design and cost (and hence on the investors and operators of wind farms). Regulations should take into account specific power system robustness and RES-E penetration level. Costly technical requirements – such as fault-ride-through capability and the voltage control possibilities of wind power stations – should be included only if they are technically required for reliable and stable power system operation. The actual wind power technology in any case includes advanced solutions to enable

[5] Offshore wind-installed capacity will reach 10,000 MW (75,000 MW of wind total) by 2010 and 70,000 MW (180,000) in 2020 according to EWEA targets (retrieved from http://www.ewea.org). For further input on wind power issues, see De Carolis & Keith (2005).

[6] For items a, b, c and d, see Ackermann (2005).

[7] See the report by the UK Sustainable Development Commission (2005) and Holttinen (2004).

the wind power plants to contribute to system stability in those few areas where wind power forms a substantial part of the power supply, such as northwest Germany, west Denmark and some areas of Spain.[8]

b) System adequacy issues

System adequacy is related to the long-term effect of RES-E on the power system and more specifically concerns the question of to what extent intermittent RES-E such as wind power can replace some of the conventional capacity – and at the same time enable the power system to adequately maintain power supply at any moment, even in critical grid situations with an unchanged risk. This contribution of wind RES-E is quantified in the parameter termed 'capacity credit'.

The impact of intermittent RES-E wind on the adequacy of power production in the system is determined by the reliability of the RES-E production during peak load situations. From analysis and practical experience it follows that variable sources such as wind power do save on and enable the closing down of thermal capacity. Several studies have examined this issue[9] and all have concluded that the capacity credits of wind power at low wind penetration are at least equal to the average capacity factor. As the amount of wind on a system increases, the capacity credit (as a fraction of the installed wind power) decreases.

Geographical dispersion of RES-E generation facilities (enhanced by more interconnections) and positive correlation between the RES-E power and demand increase their capacity credit in the system, and hence their contribution to the system security of supply. In order to assist the strategic planning of power systems, a continuous effort is needed to improve the insight into the statistical behaviour of the intermittent energy sources, e.g. by systematic output monitoring.

c) Grid infrastructure issues

A number of detailed, country-specific and international studies have been published concerning grid extension/reinforcement requirements and the corresponding costs of the large-scale grid integration of wind power (see Box 5.1). Estimations are based on comprehensive load flow calculations on the national transmission grids.

The studies quantify the grid extension/reinforcement requirements and the related costs incurred by a variety of factors.[10] These factors include requirements for increases in generation to meet demand (in general) and (in particular) necessary measures and costs for large-scale wind integration. The analyses are based on the load flow simulations of the corresponding national transmission and distribution grids, which take into account different scenarios of national wind integration utilising the most favourable sites. The country-specific studies indicate that the grid extension/reinforcement costs caused by additional wind generation are in the range of €0.1 to €5/MWh wind, with the higher value corresponding to a wind penetration of 30% in the system (in the UK). More studies and a consistent approach to the method used are needed to develop a reliable empirical relation between grid extension/reinforcement costs and wind energy penetration. Nevertheless, it may be useful to highlight the problems identified in the studies and the variety of results yielded.

For example, according to the DENA (2005) study, Germany will require 850 km of new 380 kV for the next 10 years to integrate the projected number of wind farms.[11] New line

[8] This assessment comes from EWEA (2004).

[9] See Giebel (2005).

[10] See Auer et al. (2005).

[11] This value is taken from the DENA study (2005); for more information, see Box 5.1.

construction poses a dual challenge, on the one hand being investment and on the other being licensing. Procedures for licensing the construction of new lines can be long and often new lines face public opposition owing to landscape alterations (see also the next section on administrative barriers).

Box 5.1. Cost estimations for wind power integration: Selective assessments

The **International Energy Agency** (IEA) *World Energy Outlook* (2004) expects that by 2030 over 40% of wind power will be generated by offshore wind farms, which will have a substantial impact on generation costs. Unit costs of wind power will range from €35 to €42 per MWh. Additional costs will cover reserve capacity maintenance and balancing as well as grid costs. The aggregate costs for the grid integration of wind energy are estimated at ca. €4 to €12 per MWh.

The March 2005 study by the **German Energy Authority** – widely known as the DENA study – examined the interface between wind energy development and grid issues for the German network up to 2020. According to the study's results, extensive grid construction is necessary to accommodate an increasing percentage of wind power in the country that is already the largest wind energy producer in Europe, namely 845 km of new 380kV links and 395 km of reinforcement of existing links. The costs are estimated to be €1.1 billion. The interconnection of offshore wind farms to the mainland network will cost approximately €5 billion by 2015. According to the study's findings, the real costs of every additionally generated kWh of wind energy would amount to 6.3-6.5 €ct (2007). By 2015 costs will be reduced to 4.3 and 3.0 €ct depending on the assumptions of each calculation model (CO_2 prices, additional measures, etc.) (DENA, 2005).

The report by the **Sustainable Development Commission** (the UK government's independent advisory body), *Wind Power in the UK*, estimates that the generation cost for onshore wind power is around 3.2 p/kwh (€0.05) and around 5.5 p/kwh (€0.08) for offshore power. The study calculates that €0.17 p/kwh will be the additional system cost when there is 20% wind power on the system.

Delays in grid construction signify further delays in the integration of RES-E. Public inquiries can also potentially delay construction of essential transmission line upgrades by up to two years and create serious implications for the new planned wind capacity.[12]

One of the solutions could be to better coordinate wind farm development with infrastructure, particularly doing both in parallel. A first step could be to undertake an EU-wide grid impact assessment and the elaboration of what needs be done to accommodate an increased share of wind energy, as was done with the DENA study in Germany.

Another issue is who should bear the costs and whether additional incentives are necessary for new wind-energy related to (but not only) grid infrastructure (i.e. the transmission capacity to bring energy to the grid).[13] Infrastructure improvements are certainly necessary to counter grid congestion. That is not to say that wind energy is the sole – or main – cause of power congestion in a system, since established generators or changes in demand may provoke an equal burden on the grid infrastructure. Yet it should be highlighted that, historically, grid extension and reinforcement costs have not been financed by or paid for by the electricity generation project developers. There may be justification for EU-wide guidelines on who should pay these costs.[14] In any case, on its own the provision in Art. 3 of the Renewables Directive (2001/77/EC), which gives priority access to RES-E in the network, might appear somewhat insufficient to address the issue, especially with regard to offshore wind.

[12] For a concrete example from Scotland, see Ofgem (2004).

[13] For further discussion on the allocation of transmission grid connection charges and an assessment of deep versus shallow connection costs, see Hiroux (2005).

[14] ETSO argues for harmonisation – see ETSO (2003 and 2005).

d) Balance management of operation issues on the generation side

Fluctuations in the overall output of RES-E generation place an additional duty on the remaining generating plants in the system and increase the requirements for system balancing services, especially when these fluctuations become comparable in magnitude with the fluctuations of demand.[15] Key issues to address concerning balance management include:

- *Reduction of uncertainty*. It is important to stress that system balancing requirements are not assigned to back-up a particular plant type (e.g. wind), but to deal with the overall uncertainty in the balance between demand and generation. Moreover, the uncertainty to be managed in system operation is driven by the combined effect of the fluctuations in both demand and generation from conventional and renewable sources. These individual fluctuations are generally not correlated, which has an overall smoothing effect with a consequent beneficial impact on costs. In power systems with high penetration, such as in Denmark and Spain, practice has shown that good wind forecasting is critical to successful operation, because it reduces the uncertainty in the balance between demand and generation.
- *Balancing costs*. System balancing requirements and costs are increased by random fluctuations and forecast errors, of both intermittent generation and load, since these are generally not correlated. Numerous country- and region-specific studies have attempted to calculate additional costs for the increased controllable capacity allocated to wind generation (see Box 5.1). The disparity of estimations makes the case for a study funded by the Community in which the system's needs at present and in the future will be thoroughly assessed and quantified. Scientific evidence supports the view that modest amounts of wind energy up to 10% of peak demand can be assimilated without incurring additional cost or changes in operating procedures.[16] It can be demonstrated that power balancing requirements owing to wind mainly address secondary control and reserve power in the system (tertiary control), which in general is offered on the balancing market. The regulation costs should be allocated to the corresponding balancing markets. In practice, the balancing market prices should send out the correct price signals to the market competitors so that the network remains stable. It is worth underlining that balancing power needs and costs can be significantly reduced by establishing intra-day, hour-ahead national and international commercial trading possibilities, and by establishing common, international regulating power markets that always utilise the cheapest available resources within the available transmission capacities.
- *Curtailment of RES-E*. If wind generation reaches large penetration in a system with other forms of dispersed embedded generation on line, there may be occasions when the number of conventional large generation units needed to supply the remaining load will be so few that adequate capacity of central short-term balancing services cannot be maintained. In some situations, renewable generation could potentially exceed demand during a few hours of the year. A number of pre-planned actions are essential to deal with such potential surpluses of renewable generation, as prioritised with respect to cost. The easiest strategy – interconnection being set apart – is to have some renewable plant under central control and for this to be curtailed, as with fossil thermal plants. The least costly options could be to increase demand under 'demand-side management', for example by additional pumping at pumped storage facilities and water supply reservoirs or in the future by hydrogen production. Modern wind turbines will be able to provide response and reserve power to at

[15] See Giebel et al. (2003).

[16] See EWEA (2004).

least 10% of their output. If there is still surplus generation left, some of the renewable generation would need to be taken off-line, starting with the technologies with the highest marginal costs (highest fuel costs), such as biomass.

- *Ancillary services for generation*. Apart from balancing requirements from the energy perspective, the power system requires so-called 'ancillary services' supplied by generators, ranging from operating reserve and reactive power to short-circuit current contribution and black-start capability. Intermittent RES-E is not suitable for producing such services in a dispatchable, controllable way; thus in parallel with the implementation of RES-E in the system, appropriate equipment should be maintained to provide the ancillary services.

e) Operation of the transmission and distribution grids

- *Transmission level*. In addition to the considerations of managing energy and power balance in the transmission system (discussed above), high levels of intermittent generation also have other implications for the operation of the transmission system. Active voltage control in the system (for example in the neighbourhood of large wind farms) may be required in order to cope with unwanted voltage changes. Another issue is the management of the power flows and possible congestions in the grid. For this purpose, transmission system operators (TSOs) also need to be provided with high quality wind forecast tools. The forecast errors need to be acceptable up to a few hours ahead, meaning that the errors are small enough to enable the TSO to cope with the actual situation at an acceptable cost.

- *Distribution level*. The addition of RES-E (distributed/embedded generation) to distribution grids has implications for system operation:
  - There is very little so-called 'active' management of distribution grids.
  - The 'distributed generation' adds a further set of circumstances (e.g. changes from full generation to no generation) with which the grid must cope, without reducing the quality of supply seen by other customers.
  - The direction and quantity of real (active) and reactive power flows change, which may affect the operation of grid control and protection equipment.
  - Design and operation practices may no longer be suitable and need modification.

  On the other hand, RES-E brings along the following advantages:
  - Weak grids, with reduced voltage under load, can be reinforced by the RES-E.
  - Associated power controllers for the embedded generation can improve both active and reactive power characteristics.
  - The power from the embedded generation does not entail transmission costs if, as is likely, this power is consumed within the distribution grid network.
  - Local 'island' operation may, in principle, be possible in the event of transmission failures.

Distribution grids may have to become more 'actively managed'. This approach implies costs, and requires the development of suitable equipment and design principles, but the improved grid yields collateral benefits for the distribution grid operator.

Cross-border cooperation and coordination can facilitate solutions. Steps in this direction would entail better coordination among the stakeholders involved (TSOs, farmers-E operators and other generators) and efforts towards enhanced coordination among member states to improve the integration of RES-E in the European electricity system. It may even require the harmonisation of national support schemes to offset concentration, and the increase in renewable electricity could initiate a reconsideration of unlimited priority dispatch. The question for policy is at what percentage of renewable electricity entry this could be considered.

5.1.2 Market re-design issues

In view of the issues discussed above, many European electricity markets still have structural deficiencies and inefficiencies in their balancing and settlement procedures that discriminate against intermittent RES-E generation. Therefore, a re-design of corresponding market structures and procedures is seen as a precondition for integrating a significant total capacity of intermittent RES-E into the national and international networks. At present this especially applies to wind power, for which there are capacity expectations.

Addressing technological development in the short to medium term, the implementation of improved forecasting tools will mitigate the intrinsic intermittency of wind generation and, subsequently, reduce corresponding costs for balancing the system. Furthermore, interconnector capacity has to be increased, also to facilitate a better functioning of the internal electricity market. The future role of new, advanced storage technologies, such as battery and fuel cell systems, in providing corresponding balancing services is not yet clear. Therefore their market entry cannot yet be predicted or quantified.

Long-term and fundamental market re-design should focus on having manageable loads on the demand side. Such loads should change sympathetically with changes in generation, especially of intermittent generation. This kind of management will reduce both system balancing and system capacity requirements substantially and hence their costs. The preconditions for the significant implementation of demand-response applications are: i) the implementation of known and future technologies for communication between supply and demand; and ii) tariffs that encourage rapid and sufficient demand-side load changes in response to the needs of supply, i.e. that have minimal transaction costs for consumers.

Nevertheless, the active integration of the demand-side response in overall system operation is indispensable. This will subsequently minimise the additional requirements on the system related to substantial intermittent RES-E generation in the future.

5.1.3 Horizontal policies

Better integration of RES-E (and wind in particular) into the electricity network has to take into account both the member-state and the cross-border dimensions. The latter is especially important for those geographic locations in the EU where proximity among national systems allows for frequent RES-E cross-border presence. A number of actions to facilitate integration could be taken:

- *ex ante* (i.e. forward) rather than *ex post* (i.e. reactive) planning to address grid extension, balancing and administrative concerns in relation to RES-E projects would allow for more efficient grid integration;
- greater coordination and information-sharing among regulators and TSOs in order to benefit from best practice and develop common RES-E integration strategies;
- EU harmonisation of member-state grid access codes and standards for network equipment to improve efficiency and avoid the duplication of costs and resources;

- increased funding for research, development and demonstration (RD&D) related to grid integration issues for EU member states, particularly on the topics of
  - cross-border load management and coordination;
  - the design of modern grid systems capable of handling increased amounts of RES-E;
  - the elaboration of a methodology for extra transmission cost allocation (more specifically, is it the taxpayer or the customer who should pay?);
  - improved forecasting, storage and grid infrastructure; and
  - proposals for how to maximise the potential of distributed generation as an instrument that will also contribute to system stability;
- consideration, after wind reaches a certain level of market maturity, of the re-examination of priority rules and the participation of RES-E in the maintenance of a stable system; and finally,
- greater support for distributed generation in relation to renewable electricity integration as a complementary policy. While not a panacea, it is still an important factor for cost-efficiency and better utilisation of the existing network and capacities. The discussion about distributed generation is elaborated in Annex A.

5.2 Administrative barriers

5.2.1 Authorisation issues

Authorisation relates to another set of issues that project developers face in obtaining the necessary permits to set up a renewable power plant. The focus here is on wind power projects, but similar issues apply to other renewables if not always to the same extent.

Legislative and regulatory barriers

In most member states project proposals will be screened on their compliance with a range of legal requirements. Legislation is mostly concerned with spatial planning (i.e. the location of plants and surroundings) and other effects such as noise and natural diversity (Box 5.2).

As a consequence, project developers have to cope with an accumulation of authorisation procedures, each of them providing scope for other stakeholders to prolong or even block the eventual authorisation altogether. Typically, a substantial part of the complaints filed have a tacit or explicit NIMBY (not in my backyard) content. For onshore wind projects authorisation procedures may take two to seven years,[17] and in some cases (Greece) it has led to accusations of totally 'freezing' the development of the market.[18] The track record of authorisation procedures for offshore wind projects is even more inefficient, as until recently no clear procedures were established on the division of responsibilities among the different government authorities concerned (in the Netherlands).

One must ask the question of why so much legislation is enacted for RES-E. The answer would mainly refer to the fact that we are still on the steep upper slope of the learning curve and have little experience to use for improvement. In this sense – and also in connection with the next section on public opinion – the present state of legislation reflects the need for improved consultation and process-streamlining.

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[17] This period applies in the Netherlands and Scotland.

[18] Note, for example, the press article in the To Βήμα newspaper (13 April 2005) concerning the race for renewable energy sources in Greece.

Box 5.2. Legislation concerning wind projects

- *Spatial planning laws* involve competent authorities on different hierarchical levels (e.g. central, provincial and local government) while *civil construction works laws* involve the local government as the competent authority.
- *Environmental management laws* warrant favourable environmental impact assessment for granting the environmental permit.
- *Noise disturbance laws* intend to limit noise 'pollution'. Competent authorities are typically at the local and/or provincial level.
- *Nature diversity laws* aim at protecting endemic plants and animals, notably birds. The competent authority is typically the central government.
- *Laws for the management of water and road infrastructure* seek to protect and promote the efficient use of the public infrastructure. The competent authority is the central government.
- *Electricity laws*, while focussing on transmission and supply of electricity, may have mandatory market access for eligible renewable generators under their purview as well. Typically, the national regulatory authority of the electricity sector establishes the grid connection costs and whether an applicant renewable generating facility is eligible for preferential treatment.

Public opinion and mixed competence barriers

The increased penetration of RES-E and wind power in particular has meant that an increasing number of wind turbines are present in areas closer to cities and villages. The visual impact of turbines and the noise generated are potential deterrents of public support and could provoke opposition. NIMBY attitudes are usual and frequent, especially in tourist areas or those with tourism potential. The involvement of local communities in the planning and authorisation procedures is a good strategy for raising public awareness but often results in delays and postponements. What is therefore needed is a differentiated approach per region, not so much for the planning aspects but for communication.[19] There is a need to better justify projects, which could be done through information campaigns and transparent consultation procedures that facilitate full public participation.[20] It must be noted that domestic and SME consumers would prefer to buy electricity generated from renewable sources rather than from coal, gas or nuclear plants.[21]

Another issue that could hinder the greater presence of renewable energy sources is the existence of several layers of competence governing the authorisation of generating units. Requirements by the numerous authorities involved (national, regional and municipal) often lead to investment uncertainty, a multiplication of efforts and potentially greater demands for incentives by developers in order to offset investment risks or the initial capital intensity of the project (see Box 5.3).

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[19] See *Best Practices on Successful Implementation of Wind Energy on a Regional and Municipal Level* by the SIWERM Project (2005) (retrieved from http://www.siwerm.org).

[20] See Egenhofer & Legge (2001), p. 21.

[21] This indication has been among the main findings of the report by Arvidson et al. (2003), *Consumer Attitudes to Electricity Disclosure in Europe* (retrieved from http://www.electricitylabels.com/downloads/4CE_Consumer_Attitudes.pdf).

*Box 5.3. Conditions influencing the development of RES-E at the national, regional and municipal levels**

- National policy and legislation
- Local political context and knowledge about RES-E and issues
- Mobility of local RES-E actors to boost public awareness and support
- Cultural differences
- Stakeholder interaction
- Interrelations with other policies
- Moving forces for RES-E expansion

*These points are an elaboration on the findings of the SIWERM Project (2005).

5.2.2 Steps for improvement

As the situation on authorisation procedures differs appreciably among the member states, measures for improvement can only be formulated in a broad fashion. The Renewables Directive (2001/77/EC) mandates shortening the complete authorisation process. This can only be realised by the strong commitment and involvement of central governments together with regional and municipal authorities – but with very clear competences for each level. The following measures can help facilitate compliance with the spirit of the Renewables Directive. A distinction is made between policy objectives for an EU RES policy and those measures aiming at improving authorisation procedures at the member-state level.

Policy objectives and best practice

- There is a need to differentiate between the two policy objectives, i.e. the promotion of RES-E in the EU energy mix in the long term and the establishment of the necessary measures to expedite the authorisation procedures for RES-E generation units, and the relative appropriate connection capacity to the grid in order to meet set targets on time.
- The two objectives are directly related, yet each requires a different approach. The former is based on setting the necessary framework in place such as long-term network improvements, improved methodologies for load management and enhanced cooperation among TSOs, awareness campaigns about the role of RES-E, and their potential impact on landscapes and communities. The latter initially appears as a short- to medium-term issue since it deals with the facilitation of RES-E projects per se in a managerial manner. The added value of meeting this objective applies to both the successful implementation of short-term RES-E penetration targets and the demonstration of best practice for future projects and longer-term commitments.
- The implementation of these two policy objectives is a member-state competence. There is scope, however, for a review by the Community of procedures that obstruct market development for RES and accordingly the proposal of policies based on best practice from member states.

Facilitation of authorisation procedures

- There is a need to establish regional one-stop authorisation agencies that will be in charge of processing authorisation applications and providing assistance to applicants.
- The authorisation procedures need to be streamlined; those related to the filing and addressing of complaints by other stakeholders should be integrated, with clear timescales for their completion. The decision structures also need to be simplified with clear attribution of responsibilities. The European Commission may specify guidelines on the total length of the authorisation process for specific generating technologies as well as transparent and affordable opportunities for applicants to appeal.
- Suggestions have been made to limit the power of lower-level authorities, in such a way that they cannot obstruct authorisation of renewable electricity plants on ‘unreasonable’ grounds or by imposing ‘unreasonable’ constraints, for example, on the equipment size. A possible solution could come from Germany, where municipalities are required to assign locations that are available to project developers for a targeted level of renewable-electricity generating capacity. On the other hand, ‘top-down’ solutions can raise intense opposition. Member-state traditions would provide the best indicators of how to proceed in each country.
- The engagement of the public through better (i.e. open) communication is a prerequisite for public acceptance, but what is most important is that developers consider the specific characteristics of each region.

Chapter 6
Harmonisation or Coordination of National Policies

The EU has set overall objectives for renewable energy sources (RES) but leaves it largely to member states as to how to achieve these objectives. Member states are free to choose whatever instrument they see fit. Nevertheless, support schemes need to be in accordance with EU law. Most notably, EU member-state policies need to comply with internal market and competition rules[1] as well as the subsidiarity principle.

6.1 National support schemes in the internal energy market

All marketable goods and services (other than pure military items) are in principle traded, actually or potentially, in the internal market. The EC Treaty imposes both the establishment *and* the proper functioning of the internal market, as only when both are ensured can one reasonably expect the economic objectives of market efficiency to be achieved. Therefore, the internal market combines the free movement of goods, services, capital and workers as well as the right of free establishment across intra-EU borders, combined with the necessary regulation to deal with market failures at the EU level and competition policy to make it function properly. Although national support schemes are not in contradiction of the principle of freedom of establishment, as long as there is no discrimination of investors, they could ultimately be found in contradiction of the free movement principle if member states are not prepared to grant renewable electricity (RES-E) generators from other member states access to the RES-E support system under their jurisdiction (see section 2.5, Stakeholder analysis).

Once an internal energy market genuinely exists, restrictions related to this general principle will be very difficult to uphold by member states. Yet liberalisation of the EU electricity (and gas) market was designed to be a gradual process. The framework set by the Electricity Market Directive[2] fixed a minimum level of competition at member-state level by way of common rules while progressively bringing down barriers to cross-border trade. It was expected that market dynamics would unleash competitive forces, which would remove remaining barriers to the functioning of a fully competitive and integrated EU market.

This framework does not, however, automatically imply that in order to function properly there is a need for total harmonisation, but rather for a common framework. For shared competences, as in the case of the internal energy market, Art. 5 concerning subsidiarity[3] stipulates that "only if and in so far as the objectives…cannot be sufficiently achieved by member states" should these be achieved by EU action. Any action by the Community shall not go beyond what is necessary to achieve the objectives of the Treaty, i.e. the proportionality principle.

The subsidiarity principle, as a means to identify the proper level of government in a multi-tier system, provides guidance on how to assign competences to the appropriate level of government, i.e. the EU, member-state, regional or local levels. In this manner subsidiarity is a two-way

[1] This includes secondary and case law.

[2] See the initial 1996 Directive concerning common rules of the internal market in electricity (96/92/EC) as recently amended by 2003/54/EC (European Council, 1996), plus Regulation (EC) No. 1228/2003 on conditions for access to the network for cross-border exchanges in electricity (European Council, 2003d).

[3] Art. 5 TEC on subsidiarity stipulates that for "areas which do not fall within its exclusive competence, the Community shall take action, in accordance with the principle of subsidiarity, only if and in so far as the objectives of the proposed actions cannot be sufficiently achieved by member states and can therefore, by reason of the scale or effects of the proposed action, be better achieved by the Community. Any action by the Community shall not go beyond what is necessary to achieve the objectives of the Treaty".

principle. The application of the subsidiarity principle could result in assigning a government function to the EU, member states or the sub-national level. Subsidiarity seeks to maximise the benefits of centralisation by moving beyond the regional/country level for a number of specific reasons that are enumerated; first there are *economies of scale* (e.g. research in new energy, administrative centralisation such as common inventories or larger and hence more efficient markets); and second, there are *cross-border externalities* (e.g. negative externalities such as beggar-thy-neighbour policies or grid effects, or positive externalities such as increased security of supply for the EU) (see for example Pelkmans, 2001).

The proportionality principle necessitates a justification for assigning a specific function to the EU. If a subsidiarity test concludes that there is a *need to act* at the EU level, the next step is to identify the most suitable, i.e. 'proportional' instrument. In some cases, coordination of member-state policies may work or a comparison of best practices may be appropriate. If coordination does not work, more centralising approaches would be needed such as EU-wide regulation.

6.2 The timing of harmonisation and coordination

While gaining significant experience in the EU with renewables support schemes, competing national schemes could be seen as healthy at least in a transition period. Competition among schemes should lead to a greater variety of solutions from which to choose. As long as volumes remain relatively low, cross-border externalities should remain limited. Such competition will find its constraints where national schemes erect barriers to trade or distort competition. Nevertheless, the recently observed cross-border effects of large quantities of wind-based electricity generation suggest that the cross-border consequences of national renewables policies have to be properly taken into account.

As such, policy harmonisation will be beneficial for reasons of cross-border externalities (e.g. impact on the grid and the security of supply for neighbouring countries and more generally, potential effects on the functioning of the internal energy market) or economies of scale, should a tradable certificate scheme be chosen (i.e. leading to larger, more liquid and efficient markets). If national policy frameworks develop largely independently from each other, future coordination or harmonisation across member states could be more difficult. Once different national or even regional schemes have fully taken root, convergence may well become more difficult as has been witnessed in many cases, such as with value added taxation (VAT) schemes. There are effectively three co-existing VAT schemes: a national one, a scheme for EU-wide transactions and a scheme for external transactions. Although the EU-wide scheme was meant to be transitional and eventually merged with national schemes, member states did not agree and operators got used to the situation and came to accept matters as they were. Among other reasons, this is why the European Commission has decided in the case of greenhouse gas (GHG) emissions trading to develop an EU-wide scheme, later to become the EU Emissions Trading Scheme (ETS) (see for example Egenhofer & Mullins, 2000; Zapfel & Vainio, 2002). The proliferation of national schemes such as those in Denmark and the UK as well as other countries that have planned similar schemes has been seen as a threat to the integrity of the internal market (Egenhofer & Legge, 2002).

In the short-term, it can therefore be argued that the potential cross-border effects need to be balanced with the reality that support schemes are emerging through a bottom-up approach, i.e. member states are experimenting with how to make such schemes best fit into national circumstances. There is, however, a medium- and long-term need for harmonisation of the entire sphere of RES-E. To differentiate this sphere, national support-scheme frameworks can be separated into three distinct parts: i) level of support, ii) support-scheme models and iii) the legal framework including regulatory issues.

The level of support has a direct impact on decisions related to project development by providing locational signals. Hence, different levels of support schemes may distort investment decisions and provide incentives for gaming. Gaming generally undermines the efficiency of markets and risks creating development imbalances across borders, such as the problems associated with concentration as described in chapter 4. Moreover, it may lead to inefficient investment decisions, whereby a location is chosen on the merit of the support scheme rather than its resource endowment. The level of support would also include benefits that accrue from the fact that renewables will not have to pay for the full costs in all cases. Harmonisation of the level of support would reduce incentives for gaming.

Another area is harmonisation or coordination of the different models of support schemes. In order to avoid a negative impact on the internal energy market or the internal market as such, at some stage there will be a need to agree on a common support scheme at least for the same technologies. There may be no need to have a uniform system across the EU for all technologies. But the same technologies should fall under a support mechanism to be agreed upon by all member states.

The third level of harmonisation of support schemes is the creation of an EU-wide regulatory framework for support. While many aspects will remain the responsibility of the member states, such as permitting and more generally the administration, the implementation of renewables support policy will need to be undertaken within a common EU framework. Different elements of this framework can be developed within different timeframes.

6.2.1 Support schemes

From the perspective of transition towards one internal electricity market, the issue of harmonisation of support for renewable generating technology arises. So far, the market shares of renewable generating technology eligible for market support are still fairly modest in most member states. Yet stocktaking and information dissemination of best-practice design features should take place. Further, it is imperative that reliable, standardised data be collected on aggregate support levels to promote the market uptake of distinct technologies in each member state. This enables policy-makers to compare the intensity of policy efforts on the one hand and to expose undue market distortions on the other, allowing for differences in national renewable resource endowments.

6.2.2 Renewable electricity targets

The European Commission should provide further unequivocal clarification on the nature of renewable electricity targets at member-state level. For the proper functioning of cross-border trade in RE-GOs and transparency for the consumer's choice, the property right to (all of) the attributes endorsed by RE-GOs should be with the legal holders of such titles. Therefore, an unequivocal interpretation of the RES-E targets specified in the Renewables Directive (2001/77/EC) is recommended. These targets are consumption targets in that the denominator of the indicative RES-E targets mentioned in the Renewables Directive is clearly gross electricity consumption. Yet there are no indications that member states wish to relinquish the right to count renewable electricity generation on their territories towards their respective targets. Therefore, interpreting the nominator as a production target will not only create transparency and pre-empt the need to create additional 'target attributes' for RE-GOs, but will also be in keeping with current realities. As a result of this interpretation, cross-border trade in RE-GOs will not be hampered by the red tape or transaction costs associated with target attributes.

To promote a stable investment climate for renewable industries and to provide more certainty for all the stakeholders involved, it is desirable to set long-term targets with a roll-over procedure. In doing so, due consideration will have to be given to limiting the additional costs for electricity users.

6.2.3 Guarantees-of-origin schemes

The Renewables Directive envisages a role for RE-GOs to facilitate trade in renewable electricity and to increase transparency for the consumer's choice. To be able to achieve these objectives, it is imperative to implement harmonised (fully compatible), reliable and accurate RE-GO systems covering renewable electricity on a comprehensive basis. To that effect, cross-border externalities related to trade in renewable electricity guarantees and consumer protection are compelling arguments. Furthermore, such RE-GO systems are indispensable for the facilitation of a range of other commercial and official applications, not least of which is reliable and accurate generation-attribute disclosure. Introduction of harmonised, dependable and accurate RE-GO systems is a key stepping stone towards a fully comprehensive GO system. This, in turn, will help to prevent the duplication of effort in electricity certification for other policy purposes such as (reliable) generation attribute disclosure and certification of electricity from high-efficiency heat and power plants. Clear guidance by the Commission is warranted to define the details of harmonised RE-GO systems.

A stepped approach could be envisaged, which involves:

1. implementing standardised, compatible, national RE-GO systems of the 'partial policy integration' or 'full policy integration' variant, with EU-wide mutual recognition. To ensure genuine transparency for the consumer's choice, this should be done rapidly by 2006;
2. encouraging member states to agree bilaterally or multilaterally on conditions for the cross-border trade of RE-GOs, with the possibility of using tradable guarantees of origin to fulfil national RES-E targets. It is obvious that opportunities for multiple counting must be eliminated in this context;
3. fostering harmonisation of demand-pull systems for RE-GOs (feed-in tariffs and premiums, renewables portfolio standards, etc.); and
4. promoting EU-wide interlinkage of all fully compatible, national RE-GO systems.

6.2.4 Grid integration and authorisation procedures

Grid integration for RES-E will require the forward planning of grid extension, balancing and administrative issues in relation to RES-E projects. In this way, the RES-E share will increase and at the same time the necessary infrastructure will be in place to support it. Towards that end an EU-wide study of grid needs will be necessary. The results and success of the next steps will depend on the degree of coordination and information-sharing among system operators. A first step would be to harmonise member-state grid access codes and standards for network equipment to improve efficiency and avoid duplication of costs. Research, development and demonstration funding should be increasingly focused on improved forecasting, storage and grid infrastructure, among other issues.

The Renewables Directive mandates the shortening of the entire authorisation process. This is a member state-led process and not many actions can (or should) come from the Community. 'Learning-by-doing' and best practice imported from other member states can foster the growth of RES and preserve national traditions and priorities. The establishment of one-stop authorisation agencies at the regional level, the streamlining of procedures for licensing and complaints, and the clear allocation of competences among national, regional and municipal authorities will accelerate authorisation processes and reduce investment uncertainty. Engagement of the public through open consultation and a better justification of projects will facilitate full and long-term participation by the public.

6.2.5 The relation between the EU ETS and the Renewables Directive

The EU Renewables Directive aims at having renewable sources provide the power for 21% of the electricity generated in the EU-25 by 2010. The overall EU target has been broken down into national targets, which are set out in the annex of the Renewables Directive. The Renewables Directive requires member states to support development of renewable sources through support mechanisms, which in most cases takes the route of financial support. The two policy instruments – the ETS and support for RES-E production – pursue different objectives. One aims at increasing the share of renewables (i.e. supply) while the other at reducing GHG emissions (i.e. supply and demand measures).

There is, however, an important interaction between the two instruments and their two aims. The amount of emissions from the covered installation will correspond exactly to the amount of allowances allocated plus the amount of certified emission reductions and emission reduction units allowed into the ETS market through the Linking Directive (2004/101/EC). The purpose of the ETS is to ensure GHG emissions reductions. This means that additional RES-E production has no CO_2 effect as the caps under the National Allocation Plans (NAPs) remain unchanged. If the renewable power production increases, the covered sector will either sell or bank surplus emissions rights (which accrue from the increased carbon-free renewable production) or use the allowances to increase generation from fossil fuels. Hence emissions remain the same. As member states with relatively ambitious RES-E targets do not enjoy CO_2 benefits, inequality in the burden of RES-E stimulation among member states may trigger political opposition within those states where this burden is perceived to be most onerous. This is an important challenge facing the EU.[4]

6.2.6 Interactions with other environmental policies

Renewable electricity stimulation may interact significantly with other environmental Community policies. For example, in Austria and Italy – where hydro power is the most important source available for generation of renewable electricity – implementation of the Water Framework Directive (2000/60/EC) is limiting the use of available hydro power potential to a considerable degree.[5] This raises the issue of coherence and better coordination among Community initiatives.

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[4] As allowances will be traded on the ETS market, affected installations will be facing an opportunity cost of the additional CO_2 they emit. Power prices are expected to increase as a result of this opportunity cost. The expected higher prices of electricity will benefit investments in RES-E production. It is generally acknowledged, however, that the present level and expected future prices of allowances will not make the need for supporting RES-E production redundant. Expansion of RES-E production will of course reduce emissions from the power sector – *ceteris paribus* – compared with a situation without the increase in RES-E production. The effect would be one of two possibilities: the power sector could obtain a surplus of allowances owing to RES-E production and they will sell this on the ETS market; or, they will purchase fewer allowances on the market. In either situation, the price of allowances will be reduced and any surplus from the power sector would be absorbed by purchase from other ETS sectors. Hence, the level of emissions from all installations under the ETS sector will not be affected by an increase in CO_2-free RES-E production.

[5] See the presentation by Bussi (2005).

6.2.7 The international dimension

From the perspective of both enhancing the security of energy supply and promoting sustainable development, the EU has embarked on constructive engagement with neighbouring countries. Therefore, concerning renewable electricity the following should be given due consideration. Neighbouring countries that are willing to fully transpose the Renewables Directive onto their respective national legislation including the adoption of indicative targets to be agreed upon with the European Commission should be allowed to share not only its obligations but also its benefits. For example, neighbouring countries with large endowments of RES-E (hydro, wind and sun) should be allowed to transfer RE-GOs to EU member states for disclosure applications. This action could provide additional revenue streams for, and facilitate financing of, renewable-electricity generating projects in these countries. This policy may apply to EEA countries (such as Norway) and to Switzerland (through its bilateral agreements with the EU), yet in the medium term equally well to countries that are part of the European Neighbourhood Policy area.

6.2.8 Recommended timeframe for coordinated actions

The following tentative timeframe for coordinated action at the EU level is recommended for further consideration (Table 6.1).

Table 6.1 Timeframe for action

Action	**Timing of introduction**		
	Before 2007	Before 2010	After 2015
Analysis of best practises of support schemes*	√		
Harmonisation of support mechanisms			
a) Total level of support	√		
b) Support schemes		√ **	
c) EU framework		√	
Removing mandatory support			√
Preparation of harmonised RE-GO schemes	√		
Introduction of harmonised RE-GO/GO schemes		√	
Grid integration			
a) Grid extension planning	√		
b) Coordination and information sharing among regulators and TSOs	√		
c) Harmonisation of member state grid access codes and standards for network equipment		√	
d) RES-E priority dispatch re-examination		√	
Authorisation procedures			
a) Promotion of streamlining of authorisation procedures based on best practice	√		
b) Promotion of regional one-stop authorisation	√		

* This action assumes agreed data collection.

** Given a seven-year transition period, the implementation of harmonisation decisions will come fully into operation by 2014 at the earliest and 2016 at the latest.

Source: Authors.

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Annex A. Support for CHP and Distributed Generation in Relation to RES-E Stimulation

CHP support

The CHP Directive (2004/8/EC) is meant to provide a supportive legislative framework for high efficiency co-generation of (useful) heat and power (CHP). This Directive leaves the specification of support mechanisms in favour of CHP up to the member states. But it mandates the streamlining of authorisation procedures and a level playing field regarding the access of CHP and other generators to the electricity grid.

No clear guidance is given in the CHP Directive on the compatibility of combining support for renewable electricity sources (RES-E) with CHP support measures, notably in the case of biomass-based CHP. The guidelines on state support for environmental protection appear to forbid, within a context of 'non-cumulation of aid', support for RES-E electricity in excess of RES-E costs. Yet CHP generators in several member states complain that their heat production is not usually assisted by prevailing support frameworks. The EU Emissions Trading Scheme (ETS) (Directive 2003/87/EC) would even introduce negative biases regarding the economics of new CHP plants. Hence, in the case of several potential subsidy sources there seems room for the design of national CHP support schemes that avoid non-cumulation clauses by relating one such source to the heat output as opposed to the electricity output of CHP plants.

Distributed generation

Grid access plays a major role in the discussion of distributed generation (DG). A large deployment of DG cannot be efficient or cost-effective without an adequate reorganisation of the distribution sector. Basically, the system has to switch from a passive configuration of unidirectional flows (from centralised generation to end customers) to an active configuration, where electricity is injected and traded in the low voltage grid.

The key point is that the role of the DSO (distribution system operator) would have to evolve in order to provide the adequate connectivity to the network. Given that an active system would require considerable investments in terms of infrastructure, R&D and personnel training, investments would require the support of an adequate regulatory framework that would provide incentives for actions aiming at integrating DG.

Even if an increase in DG resulted in some sort of decentralisation of the system functions, in order to properly reach the objectives there is still the need to have common guidelines, since the required level of coordination is possibly higher than in traditional systems.[1]

Other conditions for optimisation are the variations in costs according to the location and load profile of end customers. This implies that access costs should be differentiated in order to capture the benefits/costs accrued to the system. The main messages related to support for DG are:

- With regard to grid impact, a large deployment of DG requires a reorganisation of the distribution sector in both technical and economic terms. This would require a medium- to long-term investment policy on infrastructures.
- Concerning EU policy, there are large economies of scale to be achieved through common standards (regulatory/economic and technical).

[1] The number of actors involved in the market increases with the introduction of DG.

- DG users should operate in a highly regulated environment – decentralisation does not imply anarchy. Only through coordination is it possible to achieve efficiency in operations and investments.
- DG is profitable only for customers with specific grid locations and/or load profiles. DG should not be installed as a general solution, but only for customers having certain favourable characteristics.

DG has a number of specific advantages, which include:

- transmission and distribution investment deferrals, which may actually lead to an increased focus on the demand side rather than on additional construction of high voltage lines;
- reduction of losses – generating the electricity close to the end-user reduces the electricity losses associated with the power transport;
- a variant for power reliability, reducing the number of interruptions for the customers owning DG units;
- savings on electricity and heating bills;
- increased power quality – by controlling the power output and current waveform of distributed energy resource (DER) units, improved power quality and reliability can be achieved for some customers; and
- generation capacity deferral – DG allows the avoidance of lumpy investments, reducing the risk of error in forecasting long-term load growth.

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