Disclaimer

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4CE Final Report

Prepared as part of the ALTENER project
"Consumer Choice and Carbon Consciousness
for Electricity (4CE)"

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4CE

Consumer Choice and Carbon Consciousness for Electricity

The 4C Electricity Project

The project "Consumer Choice and Carbon Consciousness for Electricity (4C Electricity)" has been carried out under the framework of the EU Altener programme and in the context of the European Directive 2003/54/EC on liberalisation of the European electricity market, adopted in June 2003. The aim of this project is to promote electricity disclosure, i.e. consumer information about the source of the electricity product they are currently buying and the implications of its generation.

To assist consumers in making an informed choice in the liberalised electricity market place, this project has developed some options for label design (and the information system behind it) that will provide consumers with details of the content of their supply mix and its resulting environmental implications.

By designing an information system which displays details about the primary energy sources used to generate a certain product, these labels provide a tool which can aid consumers and policy makers in greening Europe's electricity supply.

The electricity disclosure scheme has been explored within the context of liberalisation, in order to ensure that a functional and practical scheme is proposed. An assessment of the opportunities and barriers to labelling, and especially for tracking electricity, from the changes to the European liberalised markets was undertaken.

This was achieved through the following activities:

- Phase 1: A study of the ability of suppliers to access and provide the information needed for an electricity label within the context of liberalisation.
- Phase 2: A study of what the label will mean for consumers and what consumers want by consulting with them through focus groups, a telephone survey and one-on-one interviews.
- Phase 3: Interaction with existing policies and development of new policies to maximise the impact of the label, as well as investigating the need for associated policies to ensure effectiveness. This final phase estimates the cost of implementing a disclosure scheme, assesses the label in the context of a policy framework towards a lower carbon future and suggests a policy toolbox that can be employed to build on the label.

In the course of the project, two workshops were held, forming key deliverables of the 4C Electricity project. The project ran from January 2002 to September 2003.

Further information on the 4C Electricity project is available on the project website: http://www.electricitylabels.com

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Executive Summary

Electricity disclosure will be introduced into Europe as part of the European Directive 2003/54/EC on liberalisation of the European electricity market, adopted in June 2003 and due to be implemented into Member State legislation by July 2004.

Disclosure has the potential to be a powerful policy tool and is an essential part of the liberalisation of the electricity market, providing consumers with reliable and useful information and thus allowing them to make an informed choice of electricity supplier and electricity supply.

Essence of electricity disclosure

- In essence, electricity disclosure is an educational tool – improving the availability and reliability of information about electricity and its associated environmental impacts to consumers.
- Electricity disclosure is going to happen, therefore it is crucial to ensure that it happens in the most effective way possible, particularly from the consumer perspective.
- Electricity disclosure is a key part of liberalisation – ensuring free flow of information to all market players, including the final consumer, enabling consumers to influence the generation mix through their purchasing decisions.
- Electricity disclosure is possible at a relatively low cost: a fully-functioning electricity disclosure scheme will cost less than 0.01 €cent/kWh.
- It is likely to take around 4 years before a fully functioning disclosure scheme is in place, allowing for time to set up the tracking mechanism, collect data for the first year, verify the information and then incorporate the information with customers' electricity bills and promotional materials.

Requirements of the Directive

- Fuel source information is provided in or with the bills and promotional materials.
- Environmental information, at least in terms of CO_2 emissions and radioactive waste, is provided on an existing reference source at a minimum.
- Disclosure information relates to the supplier portfolio (not individual products) for the preceding year.
- Member States must ensure that information provided to consumers by suppliers is reliable. This implies that Member States must introduce some form of tracking mechanism to trace electricity from generator to supplier – the use of statistical averages would not be sufficient. Verification of the disclosure information is also essential.

- The Directive provides no guidance on the display format of the disclosure information, the details of the tracking mechanism or harmonisation at a Member State or European level.

Consumer views

- Consumers are concerned about climate change.
- There is also a high level of concern about radioactive waste amongst consumers.
- Consumers would prefer to buy electricity generated from renewable sources and many are prepared to pay a small premium for such electricity.
- Consumers want to be provided with information on both the fuel sources and environmental impact of their electricity with their bills

Minimal compliance

- A disclosure scheme based on the minimum required in the Directive would not provide consumers with sufficiently precise information for them to make a reliable informed choice of electricity supplier.
- Comparability of information between suppliers would also be low.
- Reliance on web-based information for the environmental indicators would disadvantage many consumers.
- A minimal disclosure scheme is likely to result in an anti-nuclear rather than an anti-carbon vote from consumers, based on the fuel source information provided in or with their bills and promotional materials.
- Minimal compliance disclosure is not recommended since it would be difficult to then progress to a more advance system as this would require major alterations to the disclosure scheme. Member States should therefore be encouraged to go beyond minimal compliance.

Presenting the information to consumers

- Harmonisation of the disclosure information display is essential, at least at a Member State level, to ensure ease of comparability between suppliers and allow full consumer choice.
- Information on the fuel source and environmental impact of the electricity should be provided on a separate leaflet or insert sent out with the bill.
- Fuel mix information should be presented in a variety of formats since people's comprehension of different presentation styles varies. The recommended format is a combination of a pie chart and a table which includes a detailed breakdown of renewable sources.

- Environmental information should be displayed as a ranked (e.g. on a scale of A-G) or indexed label, including absolute figures for CO_2 emissions and radioactive waste. Further research is required to find the most effective format for the display of the environmental information from a consumer perspective.
- The environmental indicators for CO_2 emissions and radioactive waste should always be displayed together and not in separate locations.
- Promotional materials should display the disclosure information based on the same display formats as used in the separate leaflet or insert.

Tracking the electricity

- European harmonisation of the tracking mechanism is essential for proper functioning of the European electricity market.
- Reliability of data can be ensured through the use of an appropriate tracking mechanism and verification systems.
- The tracking mechanism should be based on a central registry approach. Member States should specify whether market participants trade electricity on the basis of tags or certificates or both.
- The central registry provides the suppliers with the data to be disclosed to consumers, including data on differentiated electricity products if required.
- Member States agree on joint definitions of the information to be provided, procedures for data calculations and interfaces for communication across borders.
- CO_2 emissions and radioactive waste are tracked on the basis of plant-specific factors which reflect the benefits of increased plant efficiency, higher fuel quality and cogeneration.

Supporting disclosure

- A national or European educational campaign before and after the introduction of the disclosure scheme would help ensure effectiveness.
- An independent catalogue listing what is offered by all suppliers on the basis of the disclosure information should be compiled at a national level to enable consumers to compare suppliers and thus make a properly informed choice.
- Existing schemes, such as the EU Emissions Trading Scheme, can support disclosure through the provision of plant-specific reporting data for disclosure purposes, thus limiting costs.
- Member State systems for Guarantees of Origin developed under the Renewables Directive 2001/77/EC and the draft Cogeneration Directive and systems under the voluntary Renewable Energy Certificates Scheme (RECS) should be merged with the disclosure tracking mechanism into one single scheme.

Building on disclosure

- Differentiated tax rates on electricity consumption according to the carbon emissions and/or radioactive waste content resulting from its generation could be implemented at a Member State level.
- Carbon caps could be placed on suppliers and minimum standards on products to limit carbon emissions or nuclear content of electricity sales.
- Disclosure could form the cornerstone of a downstream emissions trading scheme.
- Environmental impacts of electricity could be incorporated into procurement specifications for goods and services.
- Mandatory disclosure of fuel mix information and associated environmental impacts of energy purchases in company reports would strengthen the demand for reliable and precise disclosure information.

Interacting with disclosure

- Disclosure does not aim to promote specific fuel sources. Award labels (e.g. for green electricity) will still have a role to play in identifying electricity from renewable sources which is truly additional i.e. new generation that is not fully supported or subsidised through other schemes, such as feed-in tariffs or renewable obligation targets.
- In order to avoid double-counting of the electricity attributes through disclosure and other existing renewable support schemes, clear rules should be established regarding the role of each. If there are a number of different certification schemes, these could be combined so that only one type of certificate or tag is in use.

Benefits of disclosure

- Increased availability of reliable information on electricity and its environmental impacts and hence better informed consumers.
- Increased demand for electricity generated from renewable sources in the order of up to 25 TWh/year in the EU resulting in a reduction in the level of CO_2 emissions, in the order of 10.4 million tonnes of CO_2 per year in the EU, and radioactive waste through the replacement of electricity generation from fossil and nuclear fuels.
- A higher contribution of renewables to the electricity sector will result in an increased level of employment in the renewables industry, improved security of supply, increased fuel diversity and less concentrated generation patterns.
- In order to determine the extent of the benefits resulting from disclosure and the effectiveness of the scheme, it is recommended that Member States undertake monitoring and evaluation of the disclosure scheme.

1 Introduction – context setting

Electricity disclosure can be a powerful tool. Its essence is to provide information to consumers about the electricity which they buy. It is an essential element in the operation of a fully liberalised market, which, in order to function well, requires information to be provided to all market participants, including the final consumer. Through the provision of information, consumers are able to exercise choice on the basis of their personal values. Electricity disclosure is distinct from quality labels, such as the eco-label or green electricity labels which indicate to the consumer that a product has been officially approved and complies with a certain standard.

Electricity disclosure is part of the European Directive 2003/54/EC[1] on liberalisation of the European electricity market, adopted in June 2003 and due to be implemented in July 2004. Under the Directive, Member States are required to fully liberalise their electricity markets by July 2007. To date, only seven Member States have opened their markets completely (Austria, Denmark, Finland, Germany, Spain, Sweden and the UK).

The central aim of electricity market liberalisation is to promote better services and lower prices through greater openness, competition, transparency and interconnection. A competitive market is one in which suppliers can sell nationally and internationally and all customers can choose a supplier which best meets their needs. However, in those electricity markets that have been fully liberalised so far, price is the main, and sometimes the only, criteria available to customers on which they base their choice of supplier. Generally they are not able to base their choice on the source of the electricity, except in a few cases where green electricity products are available. In other words, consumers do not currently have all the information they require in order to make an informed choice which reflects their values.

Liberalisation and electricity disclosure take place within the context of global climate change. Atmospheric concentration of CO_2 has increased from 280 parts per million (ppm) in 1750 to 367 ppm in 1999 (an increase of 31%). Global average surface temperature has increased by 0.6 ± 0.2 C since the late 19th century (IPPC 2001). The IPCC's latest projection is that globally averaged surface temperature is likely to increase by 1.4°C to 5.8°C over the period 1990 to 2100 (IPPC 2001).

The Kyoto Protocol, signed by 84 Parties and ratified or acceded by 111 Parties as of 10 July 2003, could be the first legally binding treaty aimed at cutting emissions of the main greenhouse gases. As part of the Protocol, EU Member States jointly agreed to undertake an 8% reduction of six key greenhouse gases from 1990 to the average of 2008-2012. The latest findings show that the EU has delivered its Rio commitment to stabilise CO_2 emissions at their 1990 level by 2000. However CO_2 emissions actually rose between 1999 and 2000 and more than half the EU countries (Austria, Belgium, Denmark, Greece, Ireland, Italy, the Netherlands, Portugal and Spain) are likely to overshoot their share of EU greenhouse gas emissions by a wide margin (EEA, 2002).

[1] Referred to as the Directive in this report.

It is clear that more needs to be done. The electricity industry in many EU countries is very carbon intensive. The use of nuclear power is often put forward as a way of reducing CO_2 emissions from electricity generation. However, the problems of dealing with the resultant radioactive waste is still a major issue of concern for countries within the EU (and beyond) and evokes a strong reaction amongst many consumers. In addition to the waste issue, there is wide-spread concern about the risk of nuclear accidents.

Electricity disclosure could play a crucial role in achieving reductions in CO_2 emissions and radioactive waste levels by providing a tool to allow consumers to choose electricity on the basis of their values. Disclosure could also act as a foundation for future policies working towards similar environmental targets. Consumer research shows that concern about climate change and the environment is high. For the electricity sector, disclosure could provide people with the means by which they can express this concern and take action through the choice of the electricity they buy. Within a proper functioning market, this could ultimately contribute towards transforming the electricity market towards renewables, in line with consumer preferences expressed in the 4CE focus groups and telephone survey.

This report looks at how an electricity disclosure scheme needs to be designed in order to meet consumers' information needs and so allow them to exercise free choice in the electricity market. Article 3 of the Directive relates to electricity disclosure (the 'labelling provision') and states the following:

6) 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;

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 the overall fuel mix of the supplier over the preceding year is publicly available.

With respect to electricity obtained via an electricity exchange or imported from an undertaking situated outside the European Union, 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.

This outlines only the minimum requirements for a electricity disclosure scheme and provides no guidance on the more detailed aspects of the system, e.g. the display format for the disclosure information or how the electricity is tracked from generator to consumer. Member States are free to go beyond these minimum requirements if they wish, although there are no requirements for harmonisation between countries.

Based on the extensive research carried out in the 4CE project, the following sections discuss the views and needs of consumers in relation to electricity disclosure and how

these needs can be met through the appropriate design of a disclosure scheme. This covers both the label design and the mechanism for tracking the electricity. The likely costs and impacts of electricity disclosure are then outlined before the final recommendations of the 4CE project are presented.

This report represents an overview and summary of the work done over the duration of the 4CE project. A more detailed discussion and analysis relating to the various phases of this project, referred to as the phase reports within this report, are available on the project website: www.electricitylabels.com

2 The European electricity market

2.1 Status of liberalisation

The first Electricity Market Directive (96/92/EC), adopted in 1996, required EU Member States to gradually liberalise their national electricity markets. To date, most EU Member States have adopted the appropriate legislation to implement this Directive. As of January 2003, the average level of declared market opening of the European electricity market was approximately 79% (EU COM 2003). Many Member States have opened their national electricity markets far beyond the minimum requirements of the Directive, with nearly half having completely opened their electricity markets (Table 1), giving all customers the right to choose between different electricity suppliers, although obstacles to switching still exist. Other Member States have only opened their markets in accordance with the minimum required by Directive 96/92/EC. In these countries large consumers are eligible to switch between suppliers but domestic consumers are not.

Table 1 Declared market opening of national electricity markets in Europe

	declared market opening 2001	**expected full opening date**
Austria (A)	100%	--
Belgium (B)	52%	2007
Denmark (DK)	100%	--
Finland (SF)	100%	--
France (F)	34%	2007
Germany (D)	100%	--
Greece (GR)	34%	2007
Ireland (IRL)	56%	2005
Italy (I)	70%	2007
Luxembourg (LUX)	57%	2007
Portugal (P)	45%	2004
Spain (E)	100%	--
Sweden (SW)	100%	--
The Netherlands (NL)	63%[2]	2003
UK	100%	--
Norway (NOR)	100%	--
Switzerland (CH)	0%	unknown

Source: EU COM 2003

In accordance with the revised Electricity Market Directive 2003/54/EC, by 1 July 2004 all non-household customers will be eligible to choose their supplier, extending to all customers by 1 July 2007. In addition to market opening, the Directive envisages legal unbundling for Transmission System Operators (TSO) by 2004 and for Distribution System Operators (DSO), serving more than 100 000 connected customers, by 2007. Mem-

[2] As of July 2001 the market for green electricity has been fully liberalised.

ber States will be required to ensure grid access on the basis of published tariffs. The methodology for the determination of grid tariffs has to be approved in advance by a nominated regulatory body. Furthermore, the Directive also requires Member States to implement electricity disclosure as outlined in Section 1.

The Directive will apply to the current 15 Member States and, from when they join in May 2004, the 10 Accession Countries[3]. The degree of market opening in the Accession Countries is currently in the range of 10-65%. Several Accession Countries have already implemented regulations which go beyond the current minimum requirements. For example most Accession Countries have adopted legal unbundling for TSOs.

Implementation of electricity disclosure in Europe should also consider countries outside the EU, such as Norway and Switzerland, which are involved with the European electricity market through imports and exports of electricity but are not required to implement the Directive. Norway is an integral part of the Nordic and European electricity markets. Due to its central geographical location, Switzerland is an important electricity hub for trans-European electricity trading and is strongly linked to the European electricity market. The Swiss government has been pushing for liberalisation of the Swiss electricity market in order to join the European development. However, the referendum on liberalisation, which included electricity disclosure, was rejected in September 2002 and so liberalisation of the Swiss market has been postponed for the time being.

2.2 Fuel mix of electricity generation

In 1999, the EU-15 average fuel mix of gross electricity generation[4] was approximately 35% nuclear, 26% coal[5], 17% gas, 14% renewables[6] (of which 12% was from hydro), 7% oil, and 1% waste (municipal and industrial). The generation fuel mix varies significantly across the EU Member States. Differences arise due to dissimilarities in the countries' geographical conditions, the availability of national fuel sources (e.g. fossil fuel sources, potential for renewable sources), historical structural developments in the electricity sector, and national energy policy (Figure 1).

The overall fossil share (coal, gas, oil) in the EU-15 is largest in Ireland (95%), the Netherlands (90%), and Greece (90%). In Sweden fossil fuels contribute only 2% to gross electricity generation.[7] In Greece, Germany and Denmark coal contributes more

[3] Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia.

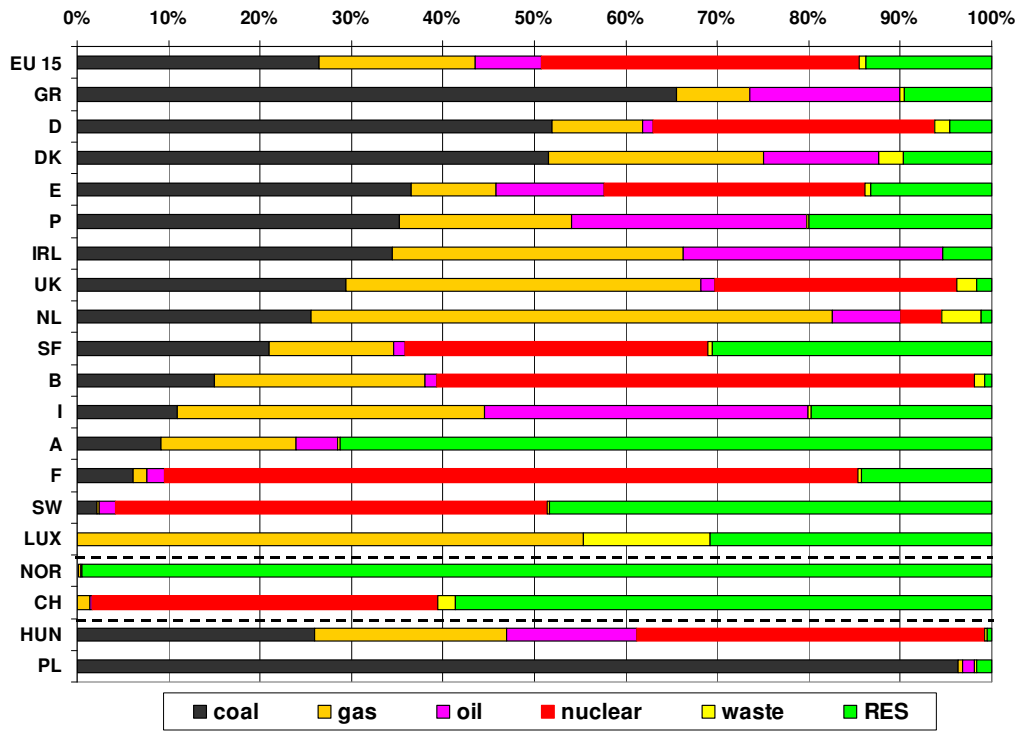
[4] Gross electricity generation is the total amount of electricity produced by a power plant as measured at the terminals of all alternator sets in a station; it therefore includes the energy taken by station auxiliaries and losses in transformers that are considered integral parts of the station.

[5] Including all types of coal and by-products extracted from coal combustion e.g. hard coal, patent fuel, sub-bituminous coal, lignite, peat, coke-oven gas, blast furnace gas.

[6] Including hydro power (excluding pumped storage), wind energy, biomass, solar energy, geothermal energy and ocean energy (tides, waves).

[7] Phase 1 of the 4CE project includes an analysis on the electricity sectors of all EU Member States and a couple of Accession Countries, with the five partner countries (Austria, Germany, Sweden, UK, and Hungary) and Poland analysed in more depth.

than 50% to electricity production. In some Accession Countries the share of coal is even higher: 96% in Poland and 70% in the Czech Republic.



Source: IEA 2001

Figure 1 *Fuel mix of gross electricity generation in 1999 (EU-15, Norway, Switzerland, Hungary and Poland)*

Eight Member States operate nuclear power plants, with about 60 nuclear reactors contributing 35% to EU electricity production. France has the largest nuclear share in the EU.

The share of renewables depends mainly on the potential for hydro power. Potential is high in countries such as Austria and Sweden where a large proportion of electricity is generated from renewable sources. In Norway nearly 100% of gross electricity production is generated from hydro power.

This wide variety in national fuel mixes has an impact when deciding the most appropriate reference figures (EU, national, regional) if Member States choose to display comparative figures as part of disclosure of the fuel mix (Section 4.4.1).

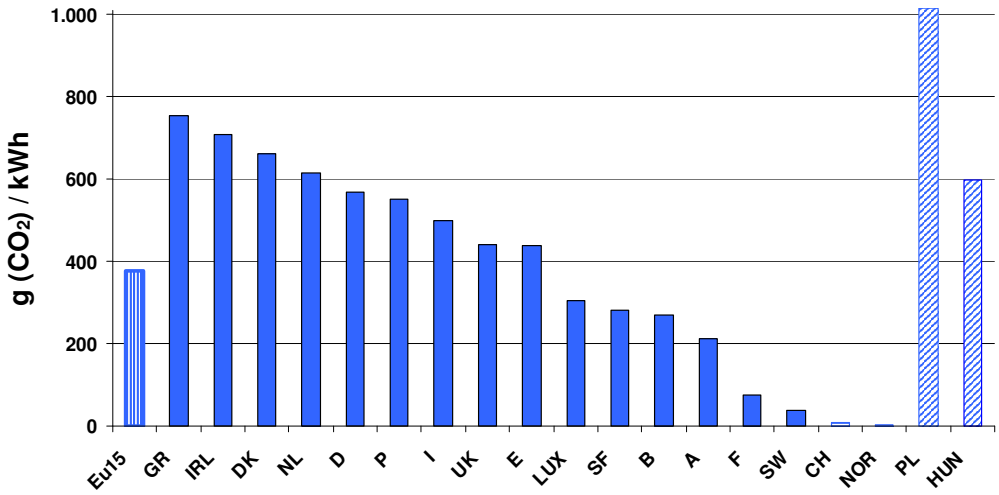
2.3 Environmental impact of electricity generation

The environmental impacts of electricity generation are wide ranging. Electricity generation from fossil fuels results in greenhouse gas (GHG) emissions, air pollutants such as acidifying emissions (e.g. NO_x and SO_2), emissions of organic compounds and

as acidifying emissions (e.g. NO_x and SO_2), emissions of organic compounds and particulate emissions (e.g. dust). Nuclear power plants produce different categories of solid, liquid and gaseous radioactive waste containing long lasting nuclides with half-lives of several thousand years. Electricity generation from nuclear power is also linked to the risk of accident and the unresolved question of radioactive waste disposal. Other impacts of conventional electricity generation include negative impacts on water quality (cooling water) and the destruction of wildlife habitats (e.g. large hydro plants).

Since the beginning of the eighties, EU legislation (e.g. the Large Combustion Plants Directive 88/609/EC) has led to substantial reductions of many air pollutants, mainly acidifying emissions. Although these emissions are still a major problem in some Accession Countries, these countries will – in the course of implementing EU legislation – be obliged to gradually reduce these emissions. Thus these emissions can be considered less relevant with respect to environmental information presented on a disclosure label (Section 5.3).

The wide variation in the proportion of fossil fuels in the national fuel mixes for electricity generation results in a corresponding variation in average CO_2 emission factors between Member States (Figure 2). The average emission factors for each Member State were determined by allocating the total CO_2 emissions from the national electricity generation to its annual electricity generation, showing a range of more than one order of magnitude. The inclusion of Switzerland and Norway, as well as the Accession Countries Hungary and Poland, in this comparison means that CO_2 emissions factors vary by three orders of magnitude.



Source: IEA 2001, IPCC 1996

Figure 2 *Specific CO_2 emissions from electricity generation (EU-15, Norway, Switzerland, Hungary and Poland)*

Each year about 30 tonnes of high-level spent nuclear fuel is produced by each large nuclear power plant in Western Europe. Lacking safe and reliable final storage facilities for spent nuclear fuel, radioactive waste can be – in addition to GHG emissions – identified as another important environmental impact of the EU electricity sector.

2.4 Electricity trading between Member States

A key objective of the EU is to create a European-wide internal electricity market which will enable trading of electricity between Member States. Electricity cross-border trade can represent a challenge to electricity disclosure, if the two countries involved do not have a harmonised disclosure scheme in place. Electricity imported into a disclosure region has to be assigned the attributes required by the disclosure scheme of the importing country if it is to be sold. It is important to have clear rules on how to handle imports for the effective operation of a disclosure scheme – these are discussed further in Section 5.6.

The relevance of cross-border trade to the accuracy of electricity disclosure depends on two key aspects. Firstly, the amount of electricity traded across the borders between Member States and with their non-EU neighbours in the future. Secondly, the extent of harmonisation of the electricity disclosure scheme between Member States.

The development of cross-border trade between Member States and with neighbouring non-EU countries is primarily dependent on three factors:

- The availability and the development of interconnector capacity between countries;
- The regulative framework for cross-border transactions (including tariff setting, congestion management, capacity allocation); and
- The availability and cost of electricity generation capacity in different countries.

The extension of interconnector capacity is a key objective of EU policy. In June 2003 the Energy Council and the European Parliament adopted a Decision[8] emphasising the need to strengthen the trans-European electricity network. This covers the reinforcement of interconnector capacities, the development of new interconnector lines between Member States and connecting to the transmission networks of neighbouring countries.

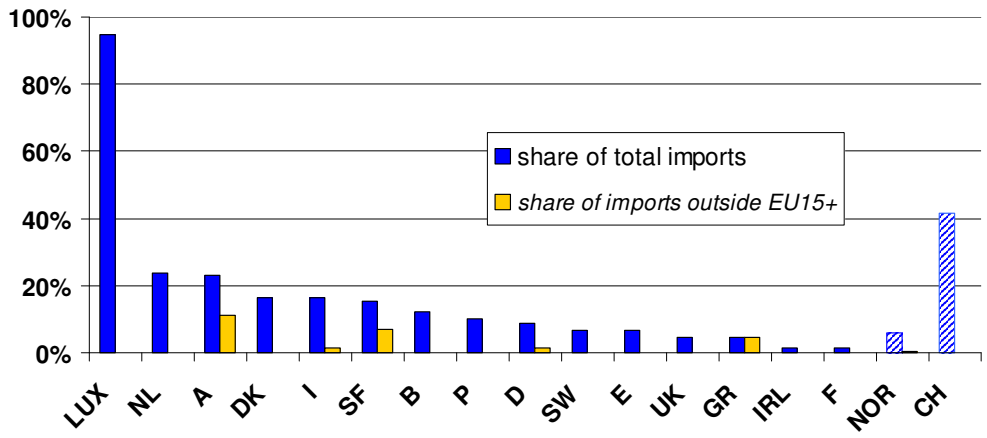
With regard to the regulative framework shaping the development of cross-border trade, considerable progress was reached in the first half of 2003. In June 2003, the Energy Council and European Parliament adopted a Regulation[9] which aims to set fair rules for the cross-border exchange of electricity, such as harmonisation of cross-border transmission charges and the allocation of interconnector capacity between national trans-

[8] Decision laying down a series of guidelines for trans-European energy networks (No 1229/2003/EC), 26 June 2003.

[9] Regulation on conditions for access to the network for cross-border exchanges in electricity (No 1228/2003), 26 June 2003.

mission systems. In addition to this, at its 10th meeting in July 2003, the Florence Forum[10] agreed to remove the additional network charges formerly applied to cross-border transactions, so that from 1 January 2004, these transactions will be treated and charged in the same way as national transactions.

To illustrate the magnitude of this issue, Figure 3 shows the share of physical annual electricity imports relative to the annual electricity consumption for each Member State. In seven countries the imported electricity exceeds 15% of national annual electricity consumption. In Luxembourg, the extremely high level of imports at 95% arises from the small national production capacity currently available as of 2001. The actual volume of electricity traded across borders may be much higher than the volumes of imports shown since these only reflect the balance of all relevant trading arrangements. Figure 3 also shows the share of imports from outside the EU15+.[11] At present, the share of imports from outside the EU15+ is only greater than 5% of total national annual electricity consumption in two countries: Austria and Finland. Austria imports significant volumes of physical electricity from the Czech Republic, Finland from Russia.



Source: IEA 2001

Figure 3 Electricity imports to EU15+ Countries in 1999

[10] The Florence Forum consists of national regulatory authorities, Member States, European Commission, Transmission System Operators, electricity traders, consumers, network users and power exchanges. The Forum was set up to discuss issues regarding the creation of a true internal electricity market that are not addressed in the former Electricity Directive. One of the main foci of the Forum's agenda has been tariff-setting for and management of cross border electricity transactions.

[11] EU15+ includes all current EU Member States (EU-15) plus Switzerland and Norway. For analysing imports EU15+ was used as the reference as it was assumed that both countries, Switzerland and Norway, will implement disclosure following the EU legislative framework, at least in the medium term.

2.5 Structure and institutional arrangements of the wholesale market

Within the European wholesale electricity market, the majority of electricity is traded via bilateral arrangements (contracts) between the generator and supplier. Bilateral trading transactions cover a wide range of different contract periods from one day ahead to up to several years. Regardless of any further integration of the European electricity market, it is expected that bilateral non-standardised contracts between suppliers and generators will have a significant role on the wholesale market, even in the longer term.

In addition to bilateral trading markets most Member States (and several Accession Countries) have established power exchanges. Power exchanges play an important role in setting a transparent market price for electricity, provided there is sufficient liquidity within the exchange. Typical products traded at the spot markets of power exchanges are standardised hour or block contracts (e.g. baseload or peakload blocks) for the following day. As risk hedging increases in significance in the liberalised electricity market, exchanges start to establish more markets for electricity derivatives alongside the physical electricity market.

Electricity volumes traded via power exchanges are still lower than expected in most Member States. Nordpool, the power exchange of the well integrated Scandinavian electricity market, covers around 30% of the electricity market.

Regarding the institutional set-up of the wholesale markets, there is still a significant degree of concentration in generation despite liberalisation, although this varies widely between Member States. In most Member States a small number of dominant generation companies control more than 60% of national generation capacity (EU-COM 2003). In markets which are characterized by former centralised state monopolies, concentration within the market either remains very high or has even been increasing. This is also true of the German electricity market, historically characterised by a diversity of power generation and power supply, where recent mergers have increased concentration on the market to much higher levels than existed before market opening in 1998 (Matthes/Poetsch, 2002).

2.6 Retail market and consumer activity

Consumer activity on retail markets is influenced by the following aspects, amongst others:

- The degree of retail market opening (Section 2.1);
- The number of supply companies and their market shares;
- The number of different products/tariffs supply companies offer to final customers; and
- The awareness amongst consumers of the choices and opportunities available to them.

The number of licensed electricity suppliers varies significantly between Member States, covering nearly three orders of magnitude. For example, in 2002 there were 160 suppliers to choose from in Sweden (Swedenergy 2002) but only around 22 in the UK (Electricity Association 2002). In many Member States, concentration on the retail market is quite high. In 2000, the largest three suppliers controlled more than 50% of the supply markets in 10 out of the 15 Member States (EU-COM 2003).

A large number of supply companies does not necessarily mean a high degree of competition. For instance, in Germany, there are between 1100 and 1200 companies selling electricity to final consumers. This large number of retailers reflects the retail market structure before liberalisation and roughly corresponds to the organisation of the distribution networks. However, only a few companies actively offer their electricity for sale nationwide, so competition is low.

By opening the retail market to households, domestic consumers become eligible to switch between electricity suppliers or products or to negotiate new tariffs. Although several Member States have opened their retail markets fully, so far there has only been a significant level of switching suppliers amongst customers in Sweden and the UK. In Sweden more than 40% of domestic and small commercial consumers have either changed to a new supplier or renegotiated the contract with their default company. In the UK, 30-50% of domestic and small commercial consumers have switched suppliers (EU-COM 2003). In other countries with a high degree of market opening, e.g. Germany and Austria, only few eligible consumers have actively switched.

Low switching rates indicate that there are still obstacles or market barriers preventing consumers from exercising their right to choose and change supplier. In relation to electricity disclosure, two observed barriers should be mentioned: firstly, the relatively high transaction costs associated with obtaining the correct information and making comparisons.[12] This is due to the lack of standardised formats for publishing product information, such as tariffs, or additional information such as the fuel mix or environmental attributes of the electricity. Secondly, most consumers consider electricity a 'low interest' product.

Expected cost savings are a major driver for consumers to switch suppliers or to renegotiate electricity contracts with their default suppliers. This is partly because they currently have few other factors on which to base their decision, although a market for green electricity has been established in many Member States in the recent years, enabling customers to switch supplier for environmental reasons. In Sweden, electricity labelled as 'green' by the Swedish Nature Conservation Association has become well established on the market and represents almost 15% of all electricity sold. However, cost differences between green and normal electricity pose a barrier to switching in

[12] A Swedish survey showed that 25% of consumers were unaware of their approximate level of annual electricity consumption and more than 80% were unaware of the approximate savings that might be achieved. About 40% found it difficult to understand and check their electricity bills. Many consumers have either not tried to compare different suppliers, or found the comparison to be difficult (Swedish National Audit Office 2000).

many countries. In Germany, less than 10% of consumers say they would accept more than a 10% increase in price in order to obtain green electricity (Stern 2002). By contrast, in the Netherlands, the price of green electricity is similar to the average retail market price due to tax exemptions for renewable electricity. The Dutch market for green electricity was fully opened from 2001 and this similarity in price has resulted in a high demand for green electricity. The latest figures indicate that approximately 1.8 million households have switched to green electricity.

For domestic customers the most common billing system is a monthly or quarterly payment based on estimated consumption, balanced by annual meter readings. There is a general trend towards internet billing and payment and growing interest in smart metering techniques[13].

The type of information currently provided on electricity bills varies between countries and suppliers, the simplest showing only price aggregated by consumption, transmission fees and taxes. More complex bills include details on the various tariffs used (peak/off-peak tariff, spot market/fixed contract based price) for each kWh consumed and personalised information relating to the customers' electricity consumption over the previous months or quarters.

Supply contracts with larger customers commonly require more frequent meter readings, often including real-time metering. Billing is often streamlined so that one bill includes meter readings from several different locations.

2.7 Policies of relevance to electricity disclosure

At the EU and Member State level, there are several policies which will potentially interact with electricity disclosure. In order to guarantee the proper functioning of a disclosure scheme it is necessary to identify these interactions and develop sound interfaces between the different policies.

At the EU level, disclosure will interact with the Guarantee of Origin (GO) for renewable electricity, as specified under the Renewables Directive 2001/77/EC[14]. The aim of the GO is to enable producers and traders of electricity from renewable energy sources to demonstrate that the electricity they sell has been produced from an acknowledged renewable energy source. The rationale behind this is to enable progress towards the indicative consumption targets for renewable energy set by the Directive to be tracked rather than to provide consumer information. The Directive does not specify the mechanism on which the verification system should be based, but this must be considered in relation to a disclosure verification system in order to avoid any inconsistencies which might result in e.g. double counting of renewable electricity (Section 5.4).

[13] Smart meters allow automated meter readings providing up-to-date and accurate billing information and can also incorporate other services, such as feedback on consumption and payment of bills.

[14] Concerning the promotion of electricity produced from renewable energy sources in the internal electricity market, adopted on 27 September 2001.

Similar to the Renewables Directive, the draft Directive on cogeneration[15] foresees the introduction of a GO for electricity from cogeneration. A cogeneration GO would specify the fuel source from which the electricity was produced, the quantity of electricity and heat from cogeneration, as well as the date and place of production. In the draft Directive, the Commission directly links this GO to the rules for electricity disclosure as adopted in the Electricity Market Directive 2003/54/EC.

The interaction of emissions trading with disclosure is outlined in Section 6.3.3.

At the Member State level, the national policies which could interact with an electricity disclosure scheme are primarily existing support schemes for renewables and cogeneration. Major support instruments include feed-in or bonus systems, obligation schemes and tax exemptions.

In addition to the legislative framework, there are some market based instruments which might also interact with electricity disclosure. These include existing power certification schemes, such as quality labels for green electricity tariffs, and voluntary green certificate systems, such as the European RECS system. [16]

2.8 Conclusion

From 1 July 2007, all European consumers will be eligible to participate in the European electricity market. Consumers will be able to choose an electricity supplier based on their values provided electricity disclosure provides a sufficient level of market transparency.

When implementing electricity disclosure, two key aspects need to be considered: firstly, due to large geographical, historical, political and social differences, the electricity markets of EU Member States vary widely with respect to the degree of market opening, market structure, generation portfolio and environmental impacts. Secondly, each Member State has its own legal framework which will interact with electricity disclosure in a particular way. In order to guarantee the proper functioning of a disclosure scheme these aspects must be taken into account in the design of the scheme.

[15] Draft Directive of the European Parliament and of the Council on the promotion of cogeneration based on a useful heat demand in the internal energy market; COM(2002) 415 final, July 2002.

[16] See the RECS website for details: www.recs.org.

3 Consumer Choice and Carbon Consciousness

3.1 Who are the consumers?

There are two main categories of electricity consumer: domestic and non-domestic. Domestic refers to private households and non-domestic covers commercial businesses, industry, public administration, agriculture and transport.

In the 4CE project the main focus has been on domestic consumers and small and medium-sized enterprises (SMEs)[17], with some additional research carried out on electricity consumers in the large industry sector. SMEs represent 99% of all enterprises in the EU[18] and, in terms of the electricity market, represent the majority of business customers. Due to their small size, both in terms of manpower and turnover, SMEs are more likely to share characteristics with domestic customers than with large industry.

The supplier-consumer interface is markedly different for domestic consumers and non-domestic consumers. For many large private and public consumers, electricity supply procurement has become standard procedure following electricity market deregulation, with companies having well developed methods for tendering for and evaluating electricity supply contracts. Domestic consumers tend to be less informed about the characteristics of their electricity supply and less systematic in selecting a specific electricity supplier, with a narrower range of options to choose from.

3.2 Consumer research

The three main strands of consumer research under the 4CE project were 20 focus groups[19] and 26 interviews with large industry representatives in each of the five partner countries (Austria, Germany, Hungary, Sweden and the UK) and a pan-European telephone survey of 3000 respondents in 10 European countries.

The focus groups were held between September and December 2002, fourteen with domestic consumers and six with SMEs. The objective of the focus groups was to establish the type of information consumers want to help them in choosing their electricity supply. A number of possible display formats for the disclosure information were tested in the focus groups.

The large industry interviews were conducted between December 2002 and February 2003, with the aim of understanding the process by which these consumers choose their electricity supply and the impact that electricity disclosure could have on them.

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[17] Under EC Recommendation 2003/361/EC, small and medium-sized enterprises are defined as businesses with less than 250 employees and a turnover of less than or equal to €50 million

[18] http://europa.eu.int/comm/enterprise/enterprise_policy/sme_definition/index_en.htm

[19] A focus group is a usually a randomly selected group of 6 - 12 people from the general public used to test and evaluate a concept or product.

The telephone survey was carried out in January 2003 and gathered responses from 200 households and 100 SMEs in each of 10 countries: Austria, France, Germany, Greece, Hungary, Italy, Poland, Spain, Sweden and the UK. The aim of the telephone survey was to provide statistically representative data on views and attitudes towards electricity generation and electricity disclosure.

The following sections are based on the findings from these three investigations. The detailed results are presented in the Phase 2 summary report and the individual task reports.

3.3 What consumers know

Carbon consciousness amongst domestic consumers and SMEs does not appear to be high. Results from the telephone survey indicate that whilst there appears to be awareness amongst consumers that the use of fossil fuels contributes to climate change (79% of households and 81% of SMEs supported this statement), they do not necessarily relate this to carbon dioxide emissions: 70% of households and 59% of SMES incorrectly believe that climate change is caused by a hole in the earth's atmosphere.

In the focus groups, fossil fuels were perceived as 'dirty' and bad for the environment and the impact of fossil fuels on climate change was discussed.

"I think coal is one of the most damaging, if not the most damaging fossil fuel…it's damaged far away places, so I'd be very reluctant to see that continue as long as we've got coal…there's got to be other ways, I think" – domestic participant in the UK

There appears to be some confusion about which fuel sources produce carbon dioxide: 39% of households and 28% of SMEs believe that electricity generation from nuclear power stations is polluting because it emits carbon dioxide and 28% of households and 23% of SMEs believe the same is true of electricity generation from renewable sources. In theory, this could be due to respondents taking into account the fact that under a life cycle analysis the use of nuclear and renewable sources does result in carbon dioxide emissions to a certain extent, but most respondents are unlikely to have been aware of this fact. In terms of direct emissions, it is only the burning of fossil fuels that produces CO_2.

Many of the focus group participants were aware of the main fuels used to generate electricity although some felt they needed more guidance in understanding the pros and cons of different fuels. Although most participants in countries with a liberalised electricity market knew they could choose their electricity supplier, awareness of the availability of green electricity was low, even amongst those who felt that they were environmentally aware.

People are concerned about the environmental impacts of electricity generation, including climate change and the production of CO_2[20].

"Fossil fuels destroy the atmosphere…one does not know how the balance of the gas in the atmosphere are maintained…it may be destroyed…maybe a completely new equilibrium…after which we many not be able to breath" – domestic participant in Sweden

However, consumers expressed the strongest concern about radioactive waste, with 41% of householders giving this impact a score of 10 (on a scale of 1 (low) to 10 (high)). Concern about radioactive waste was also high amongst focus group participants, although many saw nuclear power as a 'necessary evil' based on the belief that it is the only realistic alternative to fossil fuels.

Therefore, at a general level, domestic consumer and SME respondents in the telephone survey seem to be aware that the generation of electricity has consequences for the environment and that there is a link to climate change. Some of the discussion in the focus groups also centred on the wider environmental impacts of renewable energy sources, such as visual impact and the effect on wildlife and their habitats.

Large non-domestic consumers appear to have greater awareness of the relationship between energy use and the environment. It is becoming more common for commercial consumers to specify certain environmental criteria in the electricity procurement process, although this generally relates to gaseous emissions rather than radioactive waste (information on which does not appear to be readily available at present). In some cases they are provided with such information without even requesting it, thus raising awareness of the issues. At present, there is no independent verification of the environmental information provided by suppliers.

Increasingly, large companies are disclosing information about the environmental impact of their activities. This is mainly due to a combination of legislative requirements to disclose environmental information, individual companies creating a 'green profile' for their consumer goods (often as a result of consumer demand) and public demand for information on the environmental standing of companies. In 1999, 47% of the top 100 companies in 11 countries[21] reported on environmental issues related to their operations (KPMG 1999), which often included data on emissions resulting from energy use. Public disclosure of non-financial information to satisfy the needs of shareholders, customers, communities and other stakeholders is a trend that has steadily increased over the past decade. Capability to deal with reporting such issues is growing with the development of tools and guidelines such as the Global Reporting Initiative and the OECD Guidelines for Multinational Enterprises.

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[20] On a scale of 1(low) to 10 (high), the average level of concern about the consequences of electricity generation amongst householders was 7.0 for carbon dioxide emissions, 7.1 for climate change and 7.5 for radioactive waste. The level of concern amongst SMEs was 6.0, 6.3 and 6.4 respectively.

[21] Australia, Belgium, Denmark, Finland, France, Germany, Netherlands, Norway, Sweden, UK and USA.

3.4 What consumers want

It may be that it does not matter if people do not make the correct links between climate change and carbon, provided that their actions assist in the reduction of the environmental impact of electricity. Support for renewable electricity was strong within the focus groups and in the telephone survey (80% of householders and SMEs said that they would be likely to buy electricity from renewable sources). Conversely, only 18% of householders and 27% of SMEs would buy nuclear electricity, whilst 21% of householders and 22% of SMEs would buy electricity from coal.

In support of this, the majority of consumers (82% of householders and 85% of SMEs) would prefer to buy electricity associated with a low impact on climate change and no nuclear waste (Figure 4).

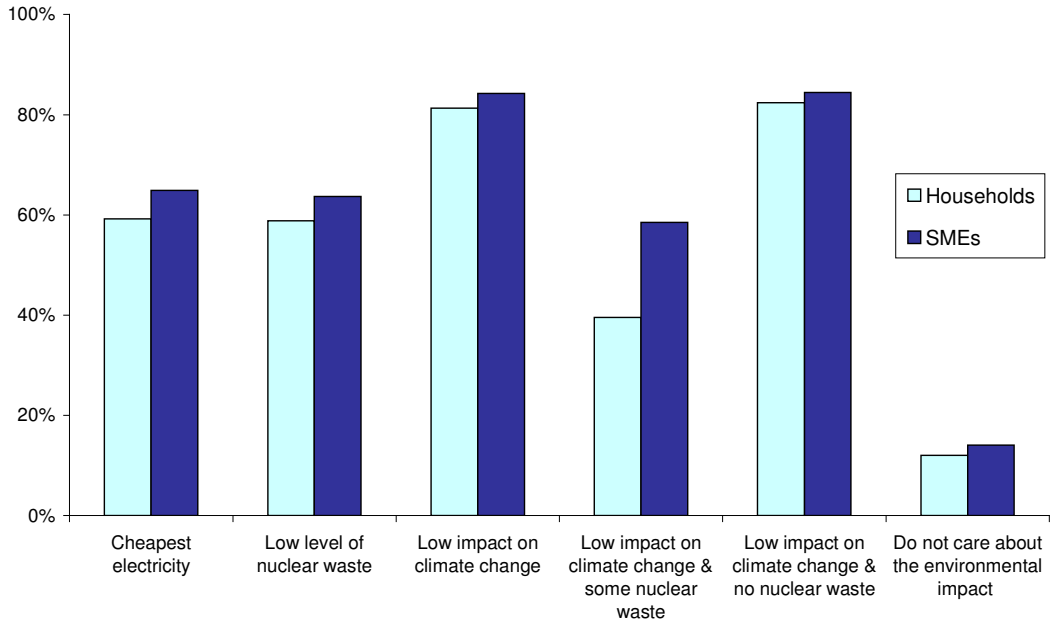

Figure 4 *Preference for electricity associated with a certain environmental impact – domestic customers and SMEs*[22]

Price was less of an issue, with 59% of households and 65% of SMEs saying that they would always buy the cheapest electricity. However, nearly 50% of households and SMEs stated that they would be willing to pay up to 5% more for electricity associated with a low environmental impact. This willingness-to-pay figure should be interpreted with caution since, in reality, people will only contribute between 20% to 40% of what they state (Schulze 1994) i.e. in this case, consumers would probably pay around 1%-2% more for electricity associated with a low environmental impact.

[22] This was a multi-response question – the response for each issue is out of 100%

Therefore, given the choice, domestic consumers and SMEs would prefer to buy electricity with a low impact on the environment in terms of both climate change and radioactive waste and may be willing to pay a slight premium for it.

The country of origin of the electricity was an important issue, particularly amongst domestic consumers. In the focus groups and telephone survey, respondents expressed a preference for electricity that was generated in their own country. The reasons behind this were explored in the focus groups and included support for national companies and employment opportunities, perceived higher environmental risks associated with electricity generated in other countries and lack of security of supply and accessibility of imported electricity. These concerns were expressed particularly in relation to imported electricity from coal and nuclear power.

Another issue raised in the focus groups was dissatisfaction with the way in which information is currently presented in their electricity bills. Pricing information was often difficult to understand and compare between suppliers.

"Today I took a looked at our electricity bill and I was frustrated at how complicated it is" – SME participant in Austria

Other details, such as contract terms and contact information were not always clear. Some focus group participants expressed a strong concern about the ethical and environmental behaviour of their electricity supplier.

"I want it [the electricity disclosure information] to provide a clearer image of the electricity suppliers, which goals they are striving for…where they buy their electricity…and what the producers ambitions are…so that consumers can feel extra satisfied…one does not want to have to deal with coal power plants in Poland" – domestic participant in Sweden

With regards to large industry consumers, many of these select their electricity supplier through a dedicated purchase unit or through a company which specialises in electricity procurement. The four main criteria used for evaluating tenders for electricity supply are: price, administrative streamlining and optimisation (billing and detailed consumption statistics), security of supply (reliable supplier with a proven track record i.e. no financial difficulties) and, in a growing number of cases, primary energy and environmental information.

Companies with a green profile often specify environmental criteria as part of the tender requirements, with the aim of purchasing electricity with lower environmental impact (generally non-fossil fuel and non-nuclear). Even those companies without such a declared policy may be offered environmentally declared or environmentally labelled electricity through the tendering process.

Companies (including SMEs) are also interested in being provided with information on the environmental impact of their electricity to help them in the preparation of their environmental reports. It is also becoming more common for such detail to be requested as

part of the environmental overview of companies within the regular tendering or bidding process in a number of areas.

"We are not environmentally certified, but we have a policy to work for a sustainable society and energy use…partly to keep the consumption down but also regarding choice of fuels…each year when we hand in the environmental audit we ask our suppliers about their energy consumption and emissions…even on stationary…everything we buy we know how much energy has been consumed…we try to choose materials with low energy use and that are recyclable" – SME participant from Sweden

3.5 Consumer support for electricity disclosure

So, consumers appreciate that the use of electricity has an environmental impact and they say that they want to buy electricity with a low environmental impact. Do they also want to be given information on the electricity they buy? In other words, do they support the concept of electricity disclosure?

Participants in both the focus groups and telephone survey expressed support for receiving more information related to their electricity supply. This included a range of aspects such as clear and comparable price information, information about the fuels used to generate electricity, the environmental impacts of these fuels, the country of origin, company policy on environmental issues and transparency of the contract details.

In the telephone survey, 80% of households and 68% of SMEs stated that they would find it useful to have their electricity mix and environmental impact of their electricity shown on a label and identified for them. The focus group participants expressed a strong interest in being provided with details of their fuel mix, although attached less importance to the environmental impact information, partly because they found the way in which the information was presented to them difficult to understand.

"*The more information I have, the easier my decision might be. It is important to know where the electricity comes from and what it offers etc. At the moment I don't have that information. I would have to get it somehow. It is still very difficult to compare the offers" - domestic participant in Germany*

A greater proportion of consumers in the telephone survey would prefer to receive such information annually (47% of householders and 55% of SMEs) rather than with each electricity bill (37% of householders and 26% of SMEs). Participants in the focus groups expressed concern about being sent even more information since many felt they already suffered from information overload in their everyday lives.

When it comes to choosing an electricity supplier, there was wide support for an independent catalogue (in the form of a printed booklet rather than on a website) comparing what is offered by all suppliers (82% of householders and 77% of SMEs). Respondents indicated they would be less likely to use electricity company promotional material or independent websites comparing all tariffs in making their decision.

The majority of large industry representatives interviewed were also in favour of a standardised display for the disclosure information which would make evaluation of tenders more straightforward and allow them to use environmental criteria in the evaluation process. A system for quick and simple comparisons between tenders was supported by those involved in electricity procurement.

3.6 Conclusions

There is awareness amongst consumers that climate change is an issue and that it is linked to the use of fossil fuels. Consumers are concerned about the environmental impacts resulting from electricity generation, especially carbon dioxide emissions and radioactive waste. However, at present, consumers do not have easy access to information about the relationship between their electricity supply and its environmental impacts nor the tools with which to put this information to use in selecting their electricity supplier. There is strong support for receiving information on both the fuel sources and environmental impact of electricity in a standard format with the electricity bills. Not only would this mean that people would be better informed about what they are currently buying, it could also assist consumers in choosing their electricity supplier, provided that there is some way of being able to compare what is being offered by all suppliers (e.g. through an independent catalogue). In addition to this, electricity disclosure could act as a broader educational tool in helping people make the links between electricity consumption and environmental impacts such as carbon dioxide emissions – improving carbon consciousness.

Electricity disclosure is the process by which this can be achieved. Through the provision of reliable and accurate data and the clear presentation of the information, electricity disclosure can provide consumers with what they want and enable them to choose their electricity on the basis of their personal values.

4 Presentation of information

One of the key elements of an electricity disclosure scheme is the way in which the information is presented to the consumer. This includes both the format of the display and the media through which the information is conveyed as well as the actual information that is included in the display. Details on the mechanism by which this information is generated and collected are provided in Chapter 5.

For disclosure information to be useful to a consumer, it must provide them with the appropriate information and level of detail, be clearly displayed and simple to understand, and available at a suitable time and place. It is also important that the information is eye-catching in order to draw peoples' attention to it – this could be achieved through the use of colour and graphics.

A detailed consideration of the various options for the display of the disclosure information is included in the 4CE Phase 3 report. The discussion here focuses on the key findings from this report. The options for display of the information are first considered from the point of view of what is required under the Directive and then from the perspective of the consumer and what they want. Finally, recommendations for the display of the disclosure information and for areas requiring further research are given.

4.1 Minimal compliance

Taking the wording of the Directive as the starting point, this section outlines how the disclosure information could be displayed to achieve minimal compliance with the Directive. Although this represents potentially the quickest and cheapest option, there are a number of disadvantages with this approach, which are discussed below.

4.1.1 Fuel mix information

The Directive requires that information on the fuel mix of the suppliers' portfolio is provided on an ex-post basis ('*over the preceding year*') in or with the electricity bills and promotional materials. There is no further guidance on what format this information should take. Therefore, at a minimum, this could be interpreted as displaying the information as a single line of text somewhere on the bill (e.g. on the front page of the bill or on an additional sheet) and promotional materials. For example:

'Sources of electricity: coal (40%), gas (33%), nuclear (25%), oil (1%), renewables (1%), other (0%)'

This type of display has the advantage that it would be relatively straightforward to include on the current electricity bills, requiring minimal bill redesign, and promotional materials and therefore could be produced at a fairly low cost to suppliers.

However, there are a number of major drawbacks to using this display format, particularly from the consumer's perspective. Only minimal information is provided, with no additional explanation of what the data mean and no reference figures are given to set

the information into context. A simple line of text has no visual appeal and will not stand out amongst the other information given in the bill or promotional materials. Therefore this information is unlikely to be noticed by many consumers.

4.1.2 Environmental impact information

In terms of the environmental impact information, the Directive requires that there has to be a reference in or with the electricity bill and promotional materials to an existing reference source such as a website, where information on at least CO_2 emissions and radioactive waste associated with the supplier's portfolio is displayed. For example:

'For details on the environmental impact of the electricity sold by Supplier X, please see www.supplierx.com or telephone 0800 111 222 to request a copy of this information'

As with the fuel mix information, there is no further guidance as to how this information should be presented. At a minimum, a website could contain basic information on these two environmental indicators as absolute figures per kWh. For example:

'Over the past year, the electricity sold by Supplier X has resulted in the generation of x kilograms of CO_2 & x micrograms of radioactive waste per kWh of electricity produced'

This information would be simple to display on the website at low cost. Presenting the information per kWh also aids comparability between suppliers, provided consumers have some way of finding out what other suppliers are offering.

However, absolute figures by themselves are not easy for people to comprehend – research in the US has demonstrated that the effectiveness of information presented in this way is greatly reduced (Moskovitz et al, 1998). Therefore, such minimal information would again have the disadvantage that it is difficult for the consumer to understand and put into context.

In addition, the location of the information is important. Whilst the internet is an easy and low-cost medium in which to display information, the major drawback is equality of access – currently 62% of households in the EU do not have access to the internet (Eurobarometer 2001). Even those households with internet access might not necessarily look up this information – in the telephone survey, only 51% of households with internet access and 48% of SMEs stated that they would visit such a website. In reality these figures are likely to be even lower since people generally over-estimate what they might do in practice when responding to this type of question. Therefore the impact of any information displayed solely on the internet will be limited.

In terms of achieving equality of access, a phone number or reply-paid postcard for people to order a paper version of the website information could be included in or with the bill and promotional materials along with the website address. However, there is still no guarantee that people would do this and these restrictions represent a barrier to the free flow of information to consumers and increases the associated transaction costs.

4.1.3 Impact of minimal compliance

Minimal compliance with the Directive in the manner outlined above would certainly ensure that there is more information available to consumers on their electricity than at present. However, the issue is the extent to which people will even notice the information on the bill and promotional materials or access the information on the website. Given the basic text display lacking in visual appeal and low access to the website, it is likely that the information will not reach the majority of consumers.

Evidence from the telephone survey indicates that there is a high level of concern about radioactive waste and climate change amongst consumers, but poor understanding of the links between electricity generation and carbon dioxide emissions (Section 3.3). Under minimal compliance, there is no environmental information on the bill nor any explanation provided on the various fuel sources. Therefore, for those consumers who do take note of the fuel mix information on the bill, they are more likely to react against electricity generated from nuclear power than fossil fuels. Given the strong support for renewable sources (Section 3.4), these consumers would probably favour renewable energy instead.

Since the environmental information is not included with the bill, the opportunities for educating people about the links between their electricity consumption and carbon dioxide emissions are limited.

4.2 Existing label designs

There is a wide variety of label designs in use in the twenty or so full disclosure schemes in operation in the USA, both in terms of the information provided and the way in which it is displayed. A full review of the different labels and practices of these schemes is contained in the Electric Product Disclosure Status Report (Sedano, 2002). However, there is no assessment of how well any of the various designs have worked from a consumer or industry perspective. Standardisation is minimal across the states, although this had been recommended at the outset by the National Council on Competition and the Electricity Industry.

In the Austrian disclosure scheme, the only European scheme to date, there was no harmonisation of the information display when the scheme was first introduced, resulting in a wide variety in the display format used by each supplier. Some suppliers presented the information in tables and others used simple text. However, this situation was felt to be unsatisfactory, both for consumers and suppliers, and the scheme is now fully harmonised in terms of the type of information that must be provided (fuel sources). However, there is no standardised display format – suppliers are only required to ensure that the information is ‘readable’ and no other information should be given which may confuse consumers.

Given the lack of evidence from evaluations of existing schemes, it is difficult to draw any firm conclusions as to the successful aspects of the display formats in use.

4.3 Consumer research

In order to establish what type of display format would be best for consumers, a number of options for both fuel source and environmental impact information display were tested in the focus groups (Section 3.2). Some of these options were based on formats already in use in existing schemes.

At a general level, the focus group participants expressed a wish to be provided with further explanation of the information since they felt that numbers and percentages alone were not enough. The preferred options for the disclosure information display are discussed below.

4.3.1 Fuel source display

The focus group participants were given several display formats to choose from: simple text, table listing percentages of the fuel sources (with no breakdown for renewables), table listing percentages of the fuel sources including a detailed breakdown of the renewable sources and pie charts (without percentages).

Many of the focus group participants felt that it was important to use a combination of display options since different people respond to display formats in different ways, finding some easier to understand than others. The majority of respondents preferred a graphical display (pie chart) with the percentages of each fuel displayed, but also wanted a detailed breakdown of renewable sources which would be difficult to display in a pie chart due to the small percentages involved. Hence, the favoured option for the display of the fuel source information was the combination of a pie chart with percentages and a table with a detailed breakdown of the renewable sources. The pie chart represents an eye-catching and visually appealing graphic, particularly if in colour, whereas the table is a suitable format for providing more detailed and comparative figures. There was also strong support for a more detailed explanation of the figures in order to help people put them into context.

The focus group participants were also in favour of being provided with comparative figures, such as the national average fuel mix, as a reference to compare their supplier with. The inclusion of comparative figures also received strong support amongst the telephone survey participants, with over 60% of householders and 50% of SMEs indicating that some kind of comparison would be useful.

There was also support from both the focus groups and the telephone survey for information on the proportion and country of origin of any imported electricity. Figure 5 shows that 74% of householders and 64% said that they would want to know the proportion of imported electricity, whilst 79% of householders and 58% of SMEs stated that they would want to know the country of origin of the electricity). This is not something that is required to be disclosed under the Directive.

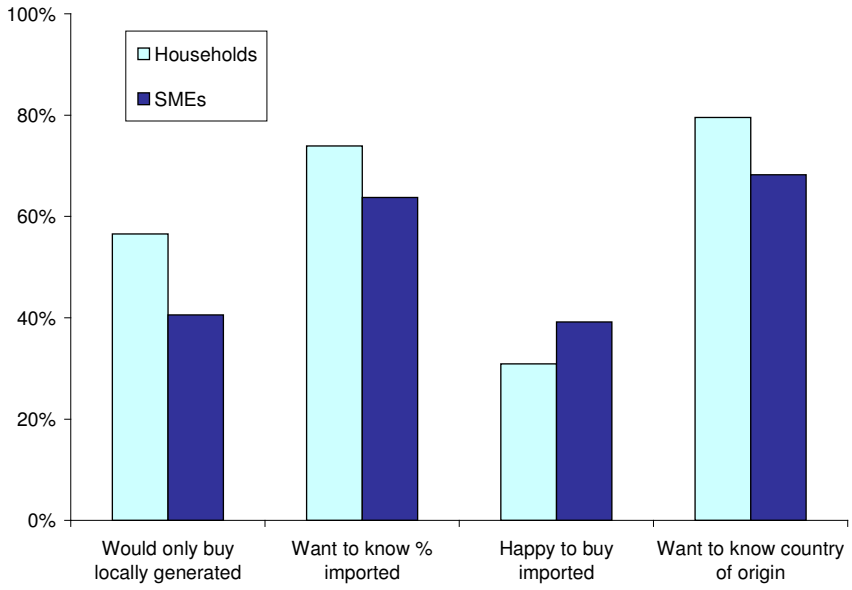

Figure 5 *Attitudes towards imported electricity – domestic customers and SMEs*[23]

4.3.2 Environmental indicator display

Again the focus group participants were provided with a number of different display formats to discuss: a ranked label on a scale of A-G (using colour bars similar to the EU energy label for domestic appliances), an indexed bar chart and ranked information on a scale of A-G presented in a table format.

Although the focus group participants were interested in this information, they found it difficult to understand the display formats presented to them – all need some further explanation of what the labels were trying to convey. Of the three, the ranked 'Energy' label received the strongest support, mainly because people recognised this format from the appliance energy label. The indexed bar chart was the second most popular option, although people had difficulties in interpreting and understanding the indexed scale, particularly the concept of something being greater than a national average of 100.

Despite the problems associated with the display formats tested in the focus groups, the reaction to this information was positive – the participants were interested to know more about the environmental impact of their electricity. Further research is needed in order to identify the most appropriate format to use to convey this information.

The possibility of including other environmental indicator in the display was discussed in the focus groups. This mainly focused on other gaseous emissions such as NOx and

[23] This was a multiple response question – the graph shows 'strongly agree' and 'agree' responses out of 100% for each issue.

SO_2, but the general feeling was that information on CO_2 emissions and radioactive waste was enough to deal with for the time being.

4.3.3 Location of information

There was strong support amongst the telephone survey respondents for the information on the fuel mix and environmental indicators to be displayed together on a 'label'[24] (80% of households and 68% of SMEs). When asked about the most useful way to receive information on the environmental indicators, only 11% of households and 17% of SMEs gave a website as their preferred information source, the majority (55% of households and 52% of SMEs) wanted to receive this information with their electricity bill (Figure 6).

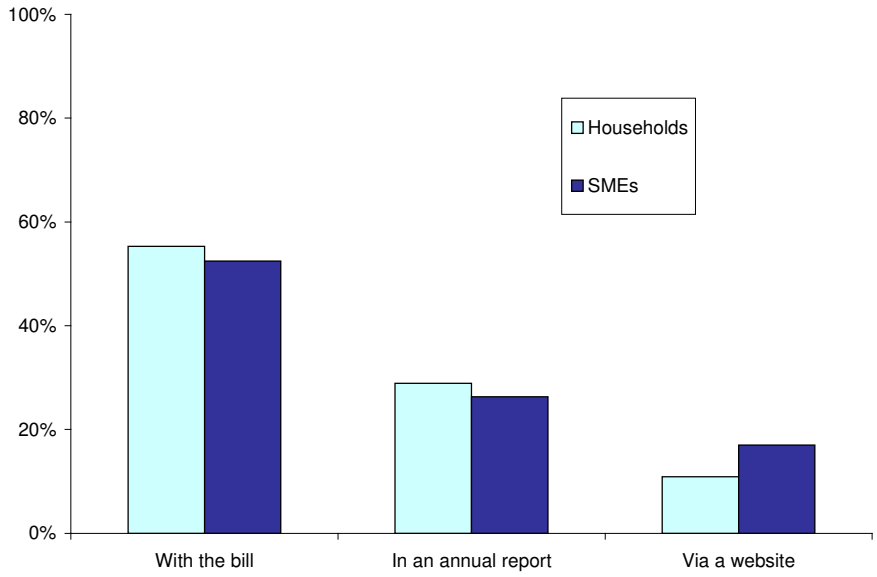

Figure 6 *Preferred channel for environmental impact information – domestic customers and SMEs*[25]

4.3.4 Comparability and reliability

A strong message from the focus group research was the importance of standardised and reliable disclosure information. Consumers need to be able to trust the information provided and compare what is offered by different suppliers to allow them to make a proper informed choice of electricity supply. This highlights both the importance of a uniform display format and of verification of the information.

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[24] Participants were asked to respond on a scale from 'not at all useful' to 'extremely useful' to the following question: How useful would you/your organisation find it to have information on your/its electricity mix **and** the environmental impact of your/its electricity mix shown on a label and identified?

[25] Respondents were asked to choose one of the three options.

Harmonisation of the display format is most crucial at a Member State, rather than EU, level, since the majority of consumers will only ever buy electricity within their own country. Such standardisation would mean that a supplier from one country wishing to sell electricity in another country would be required to use the display format of the country in which they are selling (i.e. not of the country where the electricity is generated).

Harmonisation at an EU level is unlikely to have any major benefits for domestic consumers, although it could benefit non-domestic consumers who operate multi-nationally. It may also be of benefit to the electricity industry through reduced cost, in terms of consumer research and design (which could be done at the EU level rather than in each individual country), and through ease of selling electricity in other countries (since the display format would not have to be changed).

Harmonisation at the EU level is more important in terms of the content of the disclosure information and deciding on common definitions and calculations. This would be of particular benefit to the electricity industry in terms of cross-border trade and would ensure that the information is directly comparable between countries, avoiding any confusion. It would be sensible to base fuel source definitions on those used in other Directives (e.g. Renewables Directive 2001/77/EC). In terms of the environmental indicators, there should be agreement on the units used and the basis on which the carbon dioxide emissions and radioactive waste figures are calculated. This is dealt with in more detail in Section 5.3.

Electricity disclosure provides consumers with information that is relevant for them when choosing their electricity supplier. However, the Directive only requires information be provided to consumers in relation to their current supplier, i.e. on what they are actually buying, rather than information on what is available on the market. Although the disclosure information must also be displayed on 'promotional materials made available to final customers'[26], it is unlikely that every single supplier will send mailings to all potential customers. And this also means that customers would then have to collect and compare all these promotional materials in order to make a proper comparison.

A far simpler option would be to compile an independent catalogue comparing what is being offered by other suppliers, as supported by respondents in the telephone survey (Section 3.4). This is important if consumers are to have access to the necessary information for the proper functioning of a liberalised market. Such a catalogue could be compiled by the industry regulator on the basis of the disclosure information displayed by suppliers and could also include price information. Obviously, standardisation of the disclosure information (e.g. definitions, calculations, units used) would assist in compilation of the catalogue. The catalogue could be provided to consumers annually or on request and the information could also be displayed on a website, for those with internet access.

[26] This is assumed to cover any promotional materials sent directly to the customer. It does not include newspaper or TV advertisements (Katrien Prins, pers. comm.).

Such a catalogue is already provided in Sweden by the Swedish Consumer Agency.[27] This guide is intended for private households that want to compare offers from electricity suppliers on the Swedish market, in terms of price as well as other relevant information such as environmental labels, billing procedures and additional services. In Austria, the regulator E-control provides the 'Tarifkalkulator' catalogue which gives tariff and fuel mix information for electricity available from all Austrian suppliers.[28]

Verification of the information is vital if consumers are to have confidence in the disclosure scheme. The Directive also requires Member States to ensure that the disclosure information provided to consumers is 'reliable'. Much of the verification of data would be incorporated into the mechanism for tracking the electricity (Section 5.4), however, it would still be necessary to check that the information that suppliers provide to consumers is correct and matches the data from the tracking mechanism. This would be the responsibility of the industry regulator or consumer watchdog and should be mandatory, carried out by an independent body. This could be combined with the process of compiling the independent catalogue mentioned above. For instance, the supplier's disclosure information is only included in the catalogue once it has been checked and verified, thereby providing the consumer with a source of guaranteed reliable information on which they can base their decisions on.

4.4 Recommendations

Given the evidence from the consumer research conducted under this project (outlined above and in the preceding chapter) and the disadvantages associated with a minimal interpretation of the Directive, it is apparent that the ideal format for displaying the disclosure information goes beyond minimal compliance. This section presents recommendations for the optimal display format from a consumer perspective, along with their advantages and disadvantages.

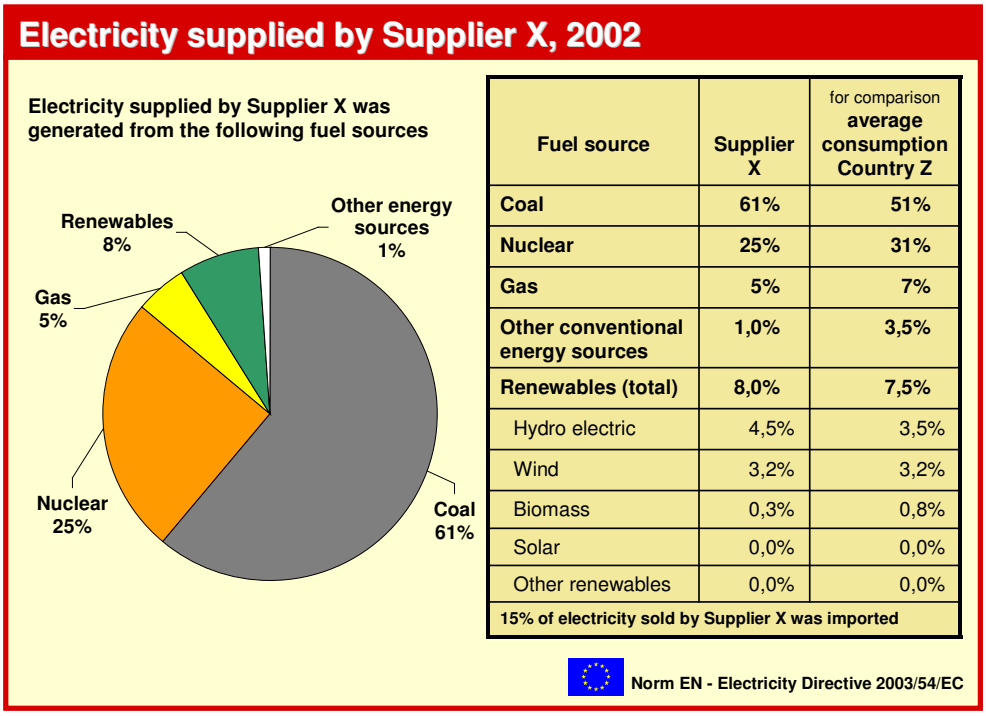
4.4.1 Fuel source display

The recommended option for fuel mix display is a combination of a pie chart and table (Figure 7), as used in the disclosure schemes of Illinois, Michigan and Minnesota in the US. The fuel mix of the supplier's portfolio is displayed in a pie chart and the same figures are also displayed in the accompanying table, along with the national average consumption figures and a detailed breakdown of the renewable sources.

The national average is given in terms of consumption rather than generation so that any transmission losses, imports and exports are accounted for.

[27] http://www.elpriser.konsumentverket.se/

[28] http://www.e-control.at/



Fuel source	Supplier X	for comparison average consumption Country Z
Coal	**61%**	**51%**
Nuclear	**25%**	**31%**
Gas	**5%**	**7%**
Other conventional energy sources	**1,0%**	**3,5%**
Renewables (total)	**8,0%**	**7,5%**
Hydro electric	4,5%	3,5%
Wind	3,2%	3,2%
Biomass	0,3%	0,8%
Solar	0,0%	0,0%
Other renewables	0,0%	0,0%
15% of electricity sold by Supplier X was imported		

Figure 7 Recommended display format for fuel mix information

It is important that the fuel list and display format should be standardised within any one country. It is recommended that there is a fixed list of fuels for all Member States, e.g. coal, nuclear, gas, other and renewables. Renewables are always listed last so as to allow the inclusion of a detailed breakdown of these sources e.g. hydropower, wind, biomass, solar and other. A supplier must always display the full list of fuels, including the detailed breakdown of renewables, even if a source is not represented in their portfolio. A fixed list ensures comparability between suppliers within each country and it will remain relatively constant over time (i.e. it is unlikely that it will need to be altered if there is a change in fuels used nationally). It also alerts consumers to the fuel sources they are not buying from. Common definitions and terms for the various fuel sources should be agreed between the Member States to ensure consistency and comparability. The overall proportion of imported electricity is provided.

Member States should define the colours or black and white shading to be used by suppliers for each fuel source in the pie charts.

The advantages of this display format is that it is line with consumer preferences expressed in the focus groups discussions and it is eye-catching and visually appealing.

The disadvantages are that it requires more space than a simple line of text and is likely to be more expensive to produce since the printing processes to generate graphics (possibly including colour) are more complex. However, if the information is displayed not on the bill itself but on a separate insert or leaflet, these disadvantages are less relevant.

4.4.2 Environmental indicator display

Based on the consumer research under this project, although it is clear that consumers want to provided with environmental indicator information in some format, it is not possible to come to any firm conclusions regarding the best display format to use. The two most popular options amongst the focus group participants are discussed here and shown in Figure 8 and Figure 9, but it is recommended that further research is undertaken in this area to determine the most useful and informative display format for consumers.

It is recommended that absolute figures are provided within the environmental indicator display as a reference to set the information into context. These figures can also help raise awareness of the issues and allow consumers to calculate their own individual emissions if they wish. In terms of CO_2 emissions, absolute figures could be expressed as kilograms per kWh (kg/kWh). In terms of radioactive waste, the Directive does not specify whether this refers to high, medium or low level waste. Calculation of the amount of high-level waste produced is reasonably straightforward, whereas there is wide variation in the amount of medium and low-level waste produced depending on the different options for handling nuclear waste (e.g. reprocessing, interim storage). Therefore it is recommended that the disclosure information is based on high-level waste only, in terms of micrograms per kWh. Although it is unlikely that many people would know what a microgram is, other units used to express the level of radioactivity, such as Bequerels or Sieverts, are likely to be even less familiar to the average consumer.

If Member States decide to go beyond the requirements of the Directive and include other environmental indicators in the disclosure information, the display format should be the same as that used for CO_2 emissions and radioactive waste. The principles underlying the calculation of the environmental indicators are covered in Section 5.3.

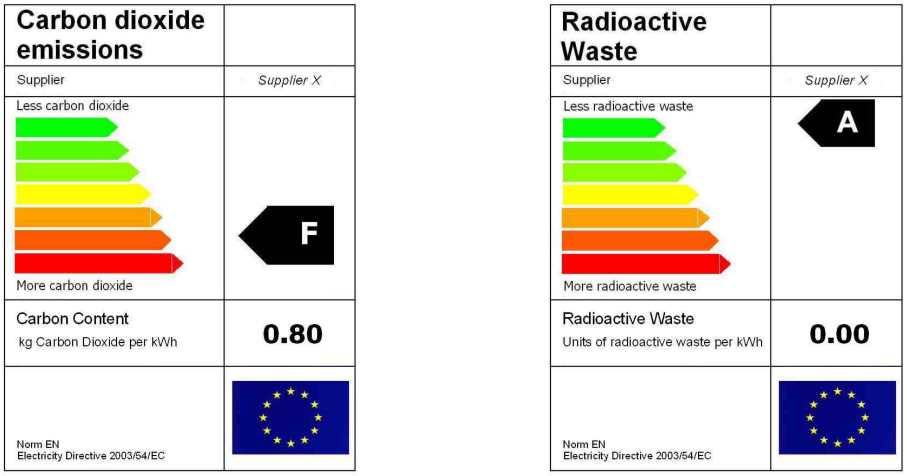


Figure 8 Ranked environmental indicator display

Providing a simple environmental ranking for electricity, such as 'FA', provides consumers with a clear message which is easy to understand and remember. This is also a useful shorthand that could be used by suppliers on the bills and promotional materials as a link to a separate leaflet or insert (providing the full disclosure information) and in newspaper and TV advertisements. The energy label format is also recognisable to many consumers due to its wide usage on the domestic appliance market.

However, there are a number of difficulties with such a ranking, the main one being the perceived value judgements involved in determining the scale. This could be decided at Member State or European level and would need to be done in a transparent manner using a common methodology. Also focus group participants had difficulty in understanding the rankings and thought that it was comparing carbon dioxide with radioactive waste. Another issue to consider is that the EU energy label on appliances provides information on energy efficiency and so it may not be appropriate to use the same format in relation to the environmental impacts of electricity.

Such a display would also be relatively expensive due to the use of graphics and colour and would require a substantial amount of space.

An indexed display for the environmental indicator information (Figure 9) is a common format used in many of the disclosure schemes in the USA, although there are no data available on consumer reaction to this type of display. The index could be based on absolute figures for each supplier (e.g. the CO_2 emissions per kWh) or on the relative proportion of national nuclear or fossil fuel generation (e.g. assuming a national average nuclear share of 34%, a supplier portfolio with a nuclear share of 17% would have an indexed value of 50).

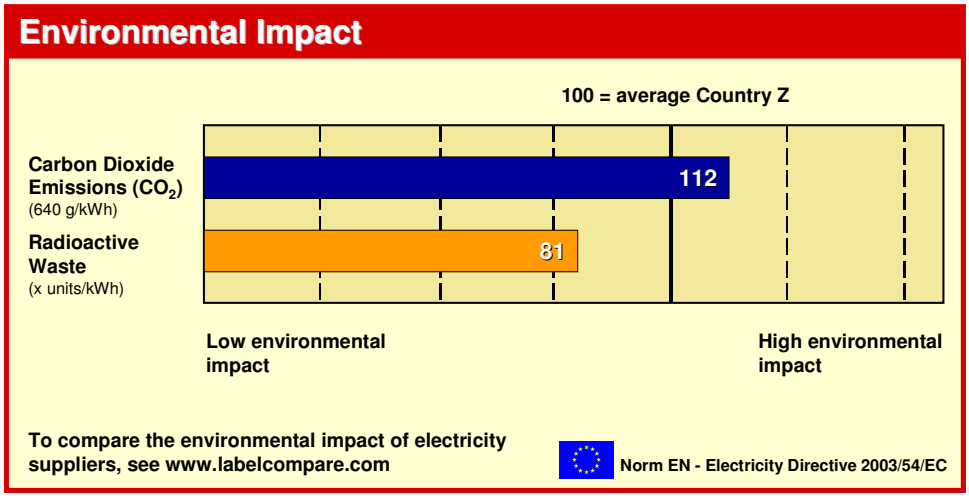


Figure 9 Indexed environmental indicator display

An index has the advantage of being relatively simple and less controversial than a ranking scale. This is also fairly easy to reproduce in black and white and takes up less space than the ranking labels.

The main drawback to an indexed scale is that people may have difficulties in understanding the index – as was the case in the focus groups where the participants had difficulties in understanding the indexed scale.

4.4.3 Location of information

As discussed in Sections 3.5 and 4.3.3, consumers would prefer to be provided with both the fuel source and environmental indicator information together with their electricity bill. They also wanted to be given more details on the information to explain what it means and set it into context.

It is strongly recommended that if the environmental indicator information is provided with the bill then both CO_2 and radioactive waste must be displayed together – both indicators should be treated equally. This is to avoid one indicator being displayed with the bill and the other on a website, giving prominence to one indicator over the other.

The display formats outlined above require a substantial amount of space. Therefore it is recommended that the disclosure information is not displayed on the bill, but shown on a separate leaflet, which is sent out with the bill. A leaflet means there is more space to display the information and provide additional explanation of the data. In addition to this, it has more flexibility in terms of printing, since it does not have to be incorporated into the existing bill printing process and could therefore be cheaper than incorporating the information in the bill. A separate leaflet may also be more useful as a form part of the promotional material for the supplier. The text included in the leaflet should be standardised within each Member State to a certain extent, at least in terms of what information should (and should not) be included. An example of what the leaflet could look like is given in Appendix B.

Alternatively, the information could be brought together on a separate insert, also sent out with the bill, but without any additional explanatory information (as is the case in many of the US disclosure schemes). This would be more in keeping with the concept of a stand-alone label which could easily be incorporated into promotional materials. An example of this insert is provided in Appendix C.

The main drawback with this is that consumers may not notice the leaflet or insert and just throw it away without having read it. Therefore, it is recommended that there is a clear link between the leaflet and the bill, to draw peoples' attention to the leaflet. For example:

'The electricity sold by Supplier X in 2002 resulted in x kilograms of CO_2 emissions & x micrograms of radioactive waste per kWh. See accompanying leaflet for more detail'.

This information could also be personalised, for example:

'Your electricity usage in 2002 resulted in x kilograms of CO_2 emissions & x micrograms of radioactive waste. See accompanying leaflet for more detail'

Such personalised information is likely to be particularly relevant to non-domestic consumers, who may require this detail as part of their environmental reporting or tendering

processes. However, providing personalised information depends on the current metering and billing practices in each country and may not be straightforward for all countries. An alternative option would be to incorporate a standardised emissions calculator on the suppliers' websites to enable consumers to input their electricity consumption data from their bill and identify their own personal emissions in absolute figures.

Although the leaflet may be less expensive in terms of printing costs compared to a redesign of the bill, postage costs could be higher since the leaflet represents an additional sheet added in with the bill. In order to minimise this extra cost, it is recommended that the leaflet is sent out with the bill, rather than as a separate mailing, although where customers are not sent a paper copy of the bill, e.g. if they pay their bills electronically, or if customers request the information, a separate mailing may be necessary. Initially it may be preferable to send the information at least twice a year (at least in countries where bills are sent out more frequently than once a year) to reinforce the message to consumers. In some countries this may incur additional postage costs.

The Directive requires the disclosure information to be displayed in promotional materials made available to final customers. It is recommended that the promotional materials should display both the fuel mix and environmental indicator information in the formats outlined above i.e. the same presentation as provided in the leaflet with the bill. The promotional materials do not necessarily have to contain any additional explanation, as is recommended for the leaflet, but it would be helpful and less confusing for the consumer if the same graphics were used, as in the separate insert outlined in Appendix C. This would also be more straightforward from the point of view of the supplier. Another option would be to just send out the leaflet with the promotional materials, in which case the promotional materials should contain a reference to the leaflet, similar to those described above.

4.4.4 Product versus portfolio

The Directive requires information on the suppliers' portfolio. It is assumed that portfolio refers to all the electricity sold to final consumers, both domestic and non-domestic, by the company that is named on the bill (rather than the parent company). This does not necessarily exclude product information, but this would have to be provided in addition to the detail on the portfolio. In many Member States, suppliers have started to market electricity based on different electricity products, such as green products which rely mostly on renewable energy sources. In some cases the product is equivalent to the supplier's portfolio and in other cases the green product represents a subset of the portfolio.

In order to avoid mis-leading consumers, it is strongly recommended that if a supplier provides product information to one group of customers, the supplier is then obliged to provide product information to all customers, so that no-one is under the impression that they are buying the full portfolio, avoiding the problem of double-counting that would occur if product information was kept optional. For example, if a supplier created a green product and only provided product and portfolio information to those customers buying this product, the remaining customers would be given portfolio information

which includes the green electricity being sold separately as a green product. Therefore, it would appear to these customers that they were buying a proportion of green electricity in the portfolio mix, whereas in actual fact, some or all of this electricity has already been sold exclusively to the green product customers.

Displaying both product and portfolio information of course has implications in terms of space and possible confusion amongst customers. It is recommended that, assuming standardisation of the display format, the portfolio information is always provided in the format outlined above. If suppliers wish to provide product information it could be included as an additional column in the fuel mix table and environmental indicator display outlined above, although this would detract from the standardised portfolio format. It should be made clear what the product information relates to. An example of a combined portfolio and product insert is shown in Appendix D.

4.5 Conclusions

Provision of the disclosure information based on minimal compliance with the Directive is likely to be limited in impact and does not provide consumers with easy access to all the information they require in order for them to make an informed choice of electricity supply. It is likely that such minimal display, with the environmental indicator information not shown in or with the bill, will result in consumers being more likely to express an anti-nuclear rather than an anti-fossil fuel vote.

For maximum consumer information and benefit, it is recommended that the disclosure information content and display format is harmonised at least at a Member State level, with definitions and calculation methods agreed at a European level. The disclosure information should be provided with each bill on a separate insert or leaflet, preferably with a direct link to the leaflet or insert on the bill. The fuel mix information should be displayed as a pie chart and table. Environmental indicator information could be displayed in the form of a ranked or indexed label, but further research is required to establish which is the most suitable display format. Providing information on individual products in addition to the portfolio information is optional, but it is recommended that if a supplier provides product information to one group of customers, the supplier is then obliged to provide product information to all customers. Verification of the information provided to consumers is essential and should be carried out by an independent body.

Whatever display format is chosen, there needs to be a procedure in place for gathering the appropriate data to be displayed. This process is discussed in the next chapter.

5 Provision of reliable information

5.1 Introduction

The Directive states that Member States shall ensure that the information disclosed to consumers is reliable. This implies that the disclosed information has to be correct, complete, consistent, comparable and verifiable.

The reliability of disclosure information is determined by the procedures that generate the information. Generally, data such as fuel source and emissions relate to individual power plants. A disclosure scheme has to aggregate such plant-specific data and assign it to the portfolios of electricity suppliers (and their products, if applicable) in order to provide consumers with the information required by the Directive. This can be a complex task because of the structures and procedures already established in the electricity market in each country.

In order to assign data from power plants to suppliers, it is necessary to create certain linkages between these plants and the suppliers. It is not possible to base these links on the physical electricity flows since any electricity which is fed into the public electricity network flows into a homogenous pool of power and cannot be distinguished with regard to its source. To facilitate trading of electricity, 'virtual' balancing groups have been introduced in European electricity markets to account for certain volumes of generation and demand which are assigned to individual market participants. Electricity disclosure can be based on similar accounting structures, but, in addition to the number of kilowatt-hours, the attributes of electricity also have to be accounted for, including the fuel used for generation and associated emissions. Such an accounting system is known as the 'tracking mechanism' because it tracks the electricity and its attributes from generator to the consumer.[29]

In order to provide reliable disclosure information, Member States will have to implement some sort of tracking. Because of the interaction in the Internal Market for electricity, it is necessary that the tracking mechanisms set up in different Member States are harmonised.

5.2 Framework conditions in the electricity markets

When designing a tracking mechanism for electricity disclosure, the different ways in which power is transferred between market participants within the European electricity markets have to be taken into account (see Chapter 2):

- The majority of electricity is usually traded via *bilateral contracts*, which can be either short-term or long-term. Many suppliers also own electricity generating com-

[29] For more details on options for tracking electricity, see the Phase 1 report of the 4CE project.

panies and therefore could buy power from them through bilateral contracts, although this is not always the case.

- *Power exchanges* allow electricity to be traded on the open market and are important in setting a transparent market price for electricity. Within these exchanges, it is common for electricity traders to trade electricity many times to optimise their portfolio. This increases the complexity of the market and it is not easy to identify an unambiguous relation between the buyer and seller of the electricity.

The physical electricity market is supplemented by diverse financial derivatives, such as futures and options. However, the tracking mechanism only has to deal with these if they are fulfilled by physical delivery (as opposed to financial payments).

In addition to the trading arrangements, there is also *balancing power* in the market. This is required because it is never possible to forecast the demand of consumers exactly, nor to avoid unplanned outages of power plants. Surpluses and deficits of kilowatt-hours in the system account for around 5 % of the total market and are usually balanced out by the transmission system operators.

Every electricity flow along a line incurs *losses*, which must be balanced out as well. The percentage of losses varies between approximately 0.5 % for high voltage to more than 5 % for low voltage systems.

Organisation of the electricity markets is not yet fully harmonised at the European level. With the exception of the Scandinavian region, most electricity markets operate on a national basis. However, in mainland Europe, the UCTE[30] system and the Florence process are working towards harmonisation of the wholesale markets (Chapter 2). A tracking mechanism must reflect possible differences in the regional electricity markets and restricted capacities of interconnecting lines for imports and exports.

Most Member States have already implemented procedures for monitoring emissions from power plants. With regard to CO_2 emissions, a European standard for monitoring will be introduced in the course of the intended EU Emissions Trading Scheme. This scheme will require fossil fuel power plants above a rated thermal input of 20 MW to monitor and report their fuel input and emissions. This data could be used by the electricity disclosure scheme.

Following from the Renewables Directive (2001/77/EC), Member States are required to set up a system of Guarantees of Origin (GO) for electricity from renewable sources.[31] This interfaces closely with the tracking mechanism required for electricity disclosure. It is strongly recommended that Member States consider to merge the GO and the tracking mechanism into one single scheme.

[30] Union for the Co-ordination of Transmission of Electricity, www.ucte.org

[31] A similar system of GO is envisaged for electricity from cogeneration in the draft Directive on the promotion of cogeneration, COM(2002) 415.

5.3 Requirements for the information provided

The Directive requires suppliers to disclose the fuel sources used for electricity generation and information on the environmental impact, at least in terms of CO_2 emissions and radioactive waste. This refers to the electricity actually sold by suppliers, whether imported or not. As discussed in Chapter 4, it is recommended that information on the share of imports is also disclosed to consumers, i.e. the country of origin must be tracked as well. This information must be aggregated at the level of the supplier portfolio. Member States are free to specify the provision of additional information if they choose, e.g. other environmental indicators or data on differentiated products offered by suppliers, such as green products (see Chapter 4 for details). It should be noted that the inclusion of additional environmental indicators might increase the complexity and cost of the tracking mechanism.

Most power plants operate on the basis of a single fuel and information on fuel source is easily available. There are also multi-fuel plants, e.g. using biomass and non-renewable fuels, for which regular verification of the fuel input would be required.[32]

There are two basic alternatives for the determination of environmental indicators:

- A simple solution would be to track only the fuel sources from generator to supplier and then to apply generic emission factors for each fuel at the level of the supplier portfolio. These emission factors could be based on national averages.
- As a second option, plant-specific emission factors could be used which would have to be tracked together with the fuel source information.

The first option would be easier to operate but it would not reflect the significant differences in emission factors between different plants operating on the same fuel.[33] This is of specific relevance to cogeneration plants, which use the heat generated in the process of power production. If the efficiency benefit of these plants is not reflected through plant-specific emission factors, then the share of high-efficiency cogeneration plants as defined by the draft cogeneration Directive[34] could be displayed as part of the disclosure information.

In both cases, emission factors can be based on the direct emissions from a power plant or on total life cycle emissions. However, there is no agreement as yet across the EU on the basis on which indirect emissions (as part of the life cycle emissions) are defined and calculated.

The Directive does not state which power plants must be included in the disclosure scheme. The terms ‘suppliers’ and ‘customers’ used in the Directive imply that disclo-

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[32] In many Member States such verification is already performed, e.g. for fuel taxation purposes.

[33] For instance, there is a 25% variation on specific CO_2 emissions between the best and worst coal-fired power stations in the UK (National Power, 1998). The variation can be even higher if cogeneration plants are taken into account.

[34] See footnote 31.

sure applies to the public supply system and so autoproducers can be disregarded. In order to reduce cost and complexity, it would be sensible to exclude power plants below a certain capacity limit from the tracking mechanism e.g. power plants below 5 MW. Smaller plants could be integrated into virtual large plants using standardised emissions data for the purposes of tracking.

Another way to limit costs would be to base the disclosure scheme as far as possible on data which is already verified for other purposes, such as data collected for the EU Emissions Trading Scheme or fuel taxation. For example, tracking could include all fossil fuel power plants above a rated thermal input of 20 MW, which corresponds to the intended EU Emissions Trading Scheme. Again, standardised emission factors could be used for small plants.

Common definitions of fuel sources, emission factors and rules for the coverage of plants across Member States would enable the tracking systems to facilitate cross-border trade of electricity and international comparability of disclosure information.

It is essential that the information used for electricity disclosure is subject to verification. Such verification must, besides other things, ensure that all generation is tracked and that there is no double counting of electricity from certain fuel sources. A comparable level of verification in all countries connected to European transmission systems would enhance consumer confidence in the disclosure information.

5.4 Options for tracking electricity

There are several options for the method of assigning attributes from power plants, such as fuel source and emissions data, to the portfolios of suppliers (or products). Each is discussed in turn.

5.4.1 Statistical data

It would be possible to use the attributes of certain mixes of power plants, such as national generation averages, the mixes of multi-national transmission systems (e.g. the UCTE mix) or the mix of power plants owned by the respective supplier. If national or EU averages are used, it would not be necessary to collect data from individual plants or to track attributes through the trading procedures, because such averages are already known from energy and emissions statistics. This approach would be unaffected by the proportion of power exchanges in the market as well as balancing power and line losses.

However, this option significantly reduces the meaningfulness of the disclosed information. If all suppliers were assigned the national average data, there would be no consumer choice since each supplier in any one country would have the same portfolio. Electricity disclosure would be reduced to a very general information instrument about the average characteristics of the national electricity systems.

Alternatively, average attributes of power plants owned by a generation company affiliated to the supplier could be used. This would establish a certain level of differentiation

and consumer choice. Such an approach would only cover part of the market, since most suppliers acquire a significant share of their portfolio through trading and there are many suppliers that do not own any generation. Therefore, rules for dealing with traded electricity would also need to be defined. In order to avoid tracking of individual market transactions, average attributes of generation in certain transmission systems (e.g. UCTE or NORDEL) could be applied to traded electricity. However, this would lead to significant double-counting of attributes, because a considerable part of the transmission system mix would consist of supplier-owned generation which has already been assigned to their respective customers.

Therefore, tracking based on statistical data alone does not provide a sufficient level of precision and would not enable consumer choice. However, it may be acceptable to use statistical data to a limited extent if no other source of information is available.

5.4.2 Contract based tracking

Under this approach, the electricity attributes follow the contracts which are made between generators, traders and suppliers of electricity (Figure 10). Most of the US states where electricity disclosure has been introduced have started with this approach to tracking, following the money flow instead of the physical electricity.[35] Attributes of power generation must be accounted for at every step of trading. This can be facilitated in two ways:

- Each participant in the electricity market could set up an accounting system for the attributes of their electricity portfolio on an individual basis. Attributes would be provided in every electricity transaction. For example, if a supplier concludes a bilateral contract with a generator, the generator would provide the attributes of its power plant to be entered in the supplier's accounting system. Similarly the generator has to keep track of the volume and attributes of the electricity it sells. There would be no standardised format for the data held in the accounting systems. However, it would be sensible to maintain the integrity of attributes, e.g. it should not be possible to detach the CO_2 emissions from electricity generated from coal. The disclosure scheme in Austria follows this principle.
- The second option would be to introduce a system of 'tags' which are kept as entries in a central registry database and contain information on the attributes of a certain volume of electricity, e.g. 1 MWh, in a standardised format. These tags would be issued for all electricity generation and transferred from generators to traders and suppliers attached to the electricity contracts. For example, in the case of the bilateral contract mentioned above, the generator would transfer the corresponding number of tags from its registry account to the registry account of the supplier to match the volume of electricity traded. There would be one central registry in each country or

[35] Ed Holt, personal communication.

several countries could share a registry. Registries must be operated by independent actors and confidentiality of the information maintained at all times.

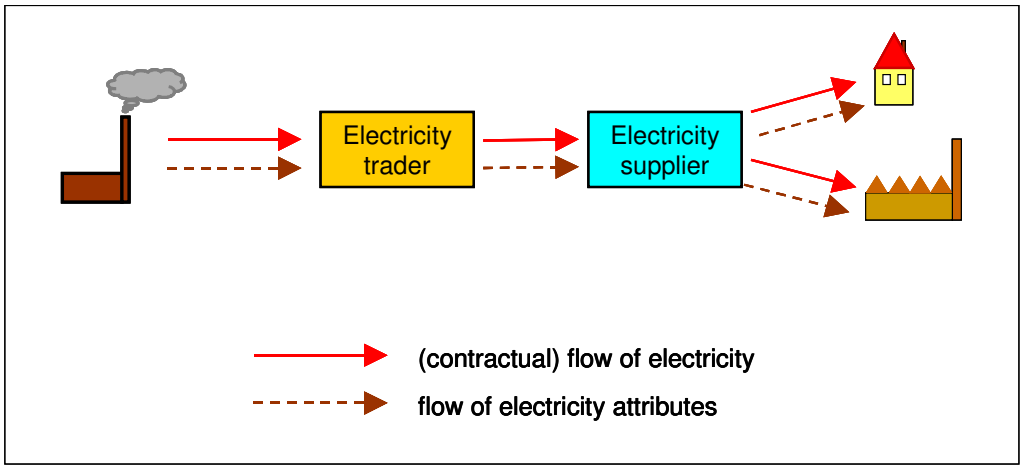

Figure 10 Contract based tracking

The first option would be easier to implement, because each market participant is able to choose the accounting system best suited to them, whereas under the tag system they would have to subscribe to a standardised central registry system for handling tags. The major shortfall of the first option is that it is very difficult to monitor and verify. In order to achieve an acceptable level of reliability, independent audits of each accounting system would be required which could be very costly. The central registry in the tag approach would facilitate relatively easy verification and could ensure that attributes are not double-counted. However, a central registry for tags may raise significant confidentiality concerns, because it reflects all activities on the electricity market. Further research would be required on how the mandatory transfer of tags together with electricity contracts could be enforced. It is likely that the overall cost of the tag system would be lower because transfers of attributes are performed on a uniform basis and verification is simplified through the central registry.

Neither alternative for contract based tracking would work easily with power exchanges due to the large number of trades involved and the lack of a direct relationship between buyer and seller within the exchange. One option would be to collect the attributes of electricity sold into the exchange over a certain period in time, e.g. a week or a month, and assign the average of these attributes to the electricity which has been purchased from the exchange during this period. Another option would be to use statistical averages, such as the UCTE mix, for the electricity traded through the exchange. However, as stated above, this leads to double-counting of attributes and should only be used if the market share of the exchange is low.

For consumers the main advantage of a tracking system based on electricity contracts compared with tradable certificates (see below) is that it reflects the actual trading of

electricity and so is conceptually straightforward. The disclosure information would show consumers which power plants their supplier bought electricity from and therefore to which generators their money is going, at least for the proportion of the market covered by bilateral contracts.

For the electricity industry, contract tracking requires the electricity attributes to be incorporated into each and every electricity contract. This could incur high transaction cost for traders. In addition, there could be a risk that competitors get a better insight into the market positions of other participants in the electricity market through the disclosure information.

5.4.3 Tracking based on tradable certificates

Tradable certificates are already used in renewable electricity support schemes with minimum quota obligations in several EU Member States and are also the basis of the Renewable Energy Certificate System (RECS), which is operated by more than 80 companies and organisations from the European electricity sector.

In the context of electricity disclosure, certificates could be issued for each kilowatt-hour delivered to the public grid. The certificates would detach the attributes of power generation from the electricity contracts and make them tradable on a separate market, thus avoiding some of the disadvantages of a contract-based mechanism. The 'grey' electricity (i.e. without attributes) is traded in the same way it is at present and a separate market would emerge for trading the attributes of the electricity (Figure 11). All suppliers would be required to acquire and redeem a sufficient number of certificates to cover their sales to final customers. The attributes of a supplier's portfolio would be determined from the certificates that it redeems.

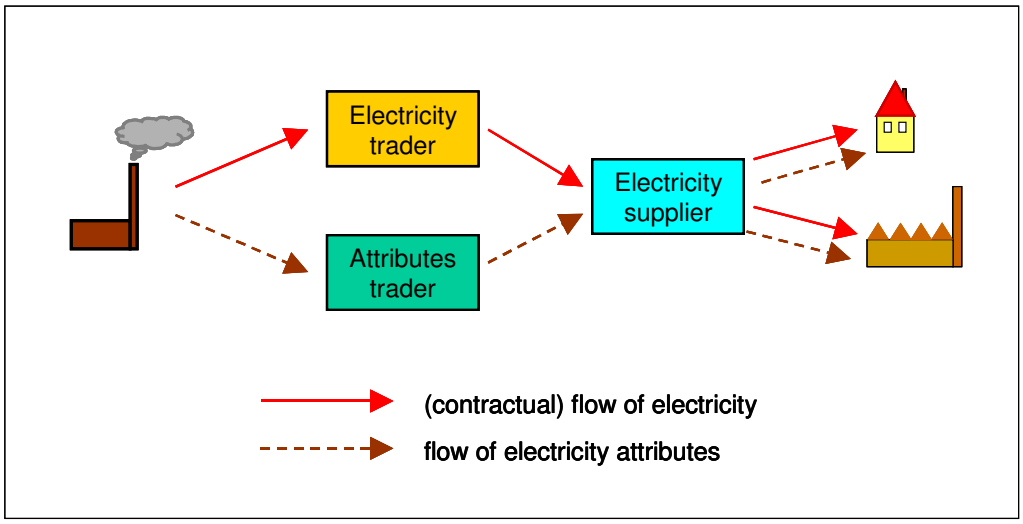

Figure 11 Tracking based on tradable certificates

The certificates would be kept as entries in a central registry database, similar to the tags discussed in Section 5.4.2. In fact, tags and certificates are identical, the only difference being that certificates may be traded separately from electricity. Trading of certificates could be based on long-term contracts or a spot market. Because of the separate markets for 'grey' electricity and attributes, the tracking mechanism would be independent from suppliers' ownership of power plants, bilateral trades, power exchanges and balancing power. A certificate system therefore allows for a large degree of flexibility for electricity market participants as well as a high accuracy of disclosure information.

This flexibility may also be a significant disadvantage from the point of view of consumers since the certificates bought by a supplier may not reflect the attributes of the power plants from which the supplier bought the electricity. This could undermine the credibility of the tracking system from the consumer perspective. For example, if a major supplier owning a large capacity of coal-fired generation sold the coal certificates to other suppliers and in exchange bought a large volume of hydropower certificates, it could then disclose a CO_2-free portfolio to its customers. Although this allocation of attributes would be correct under the certificate system, many customers of this supplier might not regard the information as credible, because it obviously contradicts the assumed portfolio on the electricity market (based on the ownership of generation).

In order to reduce the risk of such adverse effects, the free flow of certificates to the service areas of individual transmission system operators (TSOs) could be restricted. Exports and imports of certificates from these areas would only be allowed if there was proof of a corresponding electricity contract. This would ensure that no major swaps of attributes with other TSO service areas would take place without the corresponding electricity transactions.

In the US, several states that started out with a tracking system based on contracts have since decided to move towards a certificate-based system. However, it should be noted that the tracking systems in the US only cover individual states or several smaller states, such as the New England GIS scheme.[36] Nevertheless, the potential risk of loosing consumer's confidence through the use of certificates has also been recognised in the US (Herrmann/Roe 1998).

5.5 Mandatory vs optional use of the tracking mechanism

Both the contract-based and the certificate-based tracking schemes outlined in the previous sections would be fully mandatory, i.e. all electricity contracts must be associated with corresponding tags or, in the case of certificates, all suppliers must acquire sufficient attributes to match their electricity sales to final customers.

As an alternative to a mandatory tracking mechanism, the use of this mechanism could be made voluntary and a 'residual mix' could be introduced. This means that those elec-

[36] New England Power Pool Generation Information System http://www.nepoolgis.com.

tricity sales from suppliers to final consumers not covered by the redemption of tags or certificates are assigned an average mix of attributes.

For example, if the settlement period of electricity disclosure is the calendar year, at some point after the end of each year, all tags or certificates relating to power generation in the previous calendar year which have not been redeemed by a supplier would be collected from the registry. These tags or certificates represent the balance between the attributes which have been redeemed and the attributes of the total electricity sold in that year. These are then used to form the attributes of the residual mix, thus ensuring that the tracking system is comprehensive, i.e. all generation attributes are used for disclosure.

A residual mix can be used with either a tags or certificates based system, but requires a central registry which is able to determine all tags or certificates which have not yet been redeemed. The GIS system in New England, USA uses this approach in combination with tradable certificates.

The main advantage of using a residual mix is that only those market participants who want to actively steer the attributes of their portfolio (e.g. because a supplier offers specific products such as green electricity or because suppliers have set up company policies to meet certain fuel mix and/or emissions targets) have to deal with tracking, This can help to reduce the overall operating cost for the tracking system. On the other hand, the residual mix reduces the precision of the disclosed information. It may result in large parts of the market relying on the residual mix and only dedicated 'green' consumers receive differentiated products. This would limit consumer choice and represents no improvement in market transparency compared to the situation today. In order to minimise such risks, the use of the residual mix could be restricted to a certain share of each supplier's portfolio.

5.6 Imported electricity

The tracking mechanisms outlined above can easily handle cross-border transactions of electricity provided that the mechanisms used in both the importing and exporting countries are compatible. However, it is necessary to define rules for the situation where the exporting country has no tracking mechanism or where the schemes involved are not compatible. The Directive states that aggregate figures provided by the exporting undertaking for the previous year may be used. However, this may lead to double-counting of attributes if the exporting country has no system of Guarantees of Origin in place for the energy being exported. In this case, the average generation mix of the exporting country for the previous year could be used. This data is available from statistical sources.[37]

[37] More details on how to deal with imports and exports can be found in the Phase 1 report of the 4CE project.

5.7 Minimal compliance

This section outlines a minimal compliance approach to tracking of electricity based on the text of the Directive. The benefits and shortfalls of such an approach are also discussed.

5.7.1 Description of the minimal compliance approach

As stated in Section 5.4.1, the use of statistical data for determining the attributes of suppliers' portfolios is not sufficient in terms of providing precise information. Therefore, since the Directive requires reliability, tracking must either use a contract-based or certificate system. A minimal compliance approach could be based on electricity contracts, with attributes being accounted for by systems set up by market participants on an individual basis (Section 5.4.2).

In order to facilitate the European internal market for electricity, Member States would have to agree on general principles for these accounting systems, including interfaces for the transfer of attributes across borders. Reliability of the disclosed information must be ensured by verification of the accounting systems and their data, performed by independent auditors, e.g. on an annual basis.

However, due to the complexity of the electricity market, it is not possible for a contract-based tracking scheme to achieve 100% market coverage[38] and so it would be necessary to allow market participants to handle certain volumes of electricity as 'grey', i.e. without assigning any attributes. This 'grey' electricity should be disclosed to consumers as 'electricity with unknown origin'. An alternative would be to assign attributes based on statistical averages to the 'grey' electricity. However, this would result in double-counting of attributes and would suggest a higher degree of precision to the consumer than is actually achieved by the tracking mechanism. The introduction of this category would limit the accuracy of the disclosure system, e.g. if significant shares of electricity are traded via power exchanges. Therefore the total share of 'grey' electricity should be restricted to a reasonable level, e.g. around 10 % of the total (national, regional or European) market. If this share is exceeded, Member States would have to consider introducing a comprehensive, mandatory tracking system based on tags or certificates.

With regard to environmental indicators, either generic emission factors for each fuel source or plant-specific emission factors could be used. In both cases, only direct emissions from the plants would be accounted for, until agreement has been reached about how the life-cycle emissions should be calculated. Member States would need to choose one or other of these two options since co-existence of both is likely to lead to double-counting of those plants with low emissions. 'Grey' electricity should be excluded from

[38] For example, average attributes will usually be used under this approach for electricity which has been traded through power exchanges or which is used for balancing.

the calculation of environmental indicators because this could only be based on statistical averages, which would not be accurate or helpful to consumers.

Following the implementation of disclosure into Member State legislation, required by July 2004, market participants would need at least one year to set up and test their accounting systems. Hence the system is unlikely to begin operating any earlier than January 2006 and the earliest disclosure information could be made available to consumers would be mid 2007, based on data from the year 2006.

5.7.2 Evaluation

The minimal compliance approach requires a low level of regulation of the tracking system by Member States and allows high flexibility for market participants. Therefore this approach might be favoured by some Member States and parts of the electricity industry. However, it is still necessary for Member States (or the electricity industry) to agree on common standards for communication between the attribute accounting systems. The limited harmonisation of the tracking mechanism would be likely to result in barriers to cross-border trades, additional cost and loss of information.

In general, the reliability of the minimal compliance approach is heavily dependent on the level of verification. There is a high risk of error and fraud due to the lack of standardised procedures for data acquisition and data handling and there is no central registry to prevent double counting. Therefore, an acceptable level of reliability would require mandatory annual audits of all accounting systems in the market, performed by accredited technical auditors. This would incur significant additional costs.

The need to allow for ‘grey’ electricity in the market reduces the accuracy of the disclosure information. If Member States cannot agree to limit the market share of ‘grey’ electricity, this would undermine the reliability of the information provided to consumers.

A major drawback to the minimal compliance approach is that it requires electricity attributes to be tracked at every stage of trading. This could incur high transaction costs for electricity traders and can reduce liquidity in some parts of the market. It is likely that electricity traders would lobby Member States to increase the share of ‘grey’ electricity allowed in the system, further reducing the accuracy of disclosure information.

It is strongly recommended that Member States merge the Guarantees of Origin (GO) for electricity from renewable sources and the tracking mechanism into one single scheme. This means that the minimum compliance approach as set out in this section should not be used by Member States which have decided to base the GO on a system of tags or tradable certificates held in central registries.

5.8 Recommendations

The recommended approach to tracking requires to go beyond the minimum requirements of the Directive in order to facilitate reliable disclosure information.

5.8.1 Description of the recommended approach

A general principle of the recommended approach is that options for easy verification are incorporated into the system design. This requires a central registry for electricity attributes and common rules for the determination of plant data. It is recommended that Member States appoint independent bodies for the operation of central registries on a national or super-national level and that they agree on interfaces for communication between the different registries as well as standards and procedures for data acquisition. As far as possible, these should be based on existing data such as settlement data from the electricity market and emissions reporting from the intended EU Emissions Trading Scheme.

Since there is no clear overall preference for tags or certificates, it is recommended that the registries are set up in a way that can handle both options.[39] The decision as to whether attributes are transferred as tags together with electricity contracts or traded independently as certificates would be left to participants in the electricity market.

In order to allow for additional flexibility, the use of a residual mix should be allowed (Section 5.5). This means that the use of tags or certificates is voluntary for market participants and those suppliers who have not acquired a sufficient number of attributes to cover their electricity sales to final consumers will be assigned the average of all attributes which have not been used.

Environmental information can be determined using generic types of high- and low-emission tags or certificates.[40] These would provide plant-specific information on emissions to consumers, including the benefits of cogeneration, without significantly increasing the complexity of the attributes system. Similar to the minimal compliance approach, this would only relate to direct emissions from the plants for the time being.

If Member States allow for product disclosure in addition to the supplier portfolio disclosure required by the Directive, then the central registry should be used to provide the required data. Suppliers could maintain sub-accounts in the registry for each product. These sub-accounts would provide full transparency and would facilitate easy verification of suppliers' claims to consumers. However, the residual mix should not be used to create differentiated products because neither the consumer nor the supplier have any influence on the generation attributes of this mix. In particular, splitting up the residual mix into products, e.g. using the share of electricity from gas in the residual mix to create a gas product, should not be permitted.

The recommended approach requires no additional rules for power exchanges or balancing power. The registry would provide suppliers with the full set of information to dis-

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[39] As stated in section 5.4.3, tags and certificates are identical entries in the registry. The only difference is that certificates are traded freely while tags are linked to electricity contracts. The handling of tags will therefore require interfaces between the registries and trading software systems used by market participants.

[40] See section 7.4 of the Phase 1 report of the 4CE project for details.

close to their customers. As stated in the previous section, it is strongly recommended that Member States merge their systems of Guarantees of Origin for electricity from renewable energy sources and cogeneration and the tracking mechanism into one single scheme.

The timescale for implementation is similar to the minimal compliance approach. The development of the central registries could start in mid 2004 and would take at least one year.[41] The collection of data, issuing of tags and certificates and their transfer would be unlikely to begin earlier than January 2006 and the earliest disclosure information could be issued to consumers in mid 2007.

5.8.2 Evaluation

The implementation of common rules for data acquisition and central registries ensures a high level of reliability of the disclosure information and at the same time reduces the overall cost of verification. Participants in the electricity market have a high degree of flexibility being able to transfer attributes together with electricity contracts, use separate markets for certificates or rely on the residual mix. This minimises the impact of tracking on the wholesale market for electricity. Provided the residual mix is only used to a limited extend, this approach has the potential to provide a high degree of accuracy of disclosure information. Given these features, it is expected that this recommended approach would not incur a higher overall cost compared to the minimum compliance approach.

It will be necessary for Member States and the Commission to closely monitor the effects of the free flow of certificates and the use of the residual mix. If market participants use either of these options extensively, this could undermine the accuracy and credibility of the information provided to consumers. To minimise this risk, Member States could restrict the use of the residual mix, e.g. to a maximum share of 20 % of the portfolio of each supplier. Similarly, the use of certificates could be restricted by setting a minimum share of tags in each supplier's portfolio (which would be linked to electricity contracts). Alternatively, the free flow of certificates could be restricted to certain areas, e.g. the service areas of transmission system operators (Section 5.4.3). Such restrictions should only be implemented if they are necessary to ensure the reliability and credibility of the disclosure information.

5.9 Conclusions

It is possible to provide consumers with reliable electricity information by introducing a tracking mechanism. However, in order for such a system to be effective, it is necessary that Member States agree on principles of these mechanisms, joint definitions of the

[41] It might be possible to base the development of the registries on the experiences gained in the RECS initiative for a certificate system for electricity from renewable energy sources, which has been supported by the European Commission.

information to be provided, procedures for data calculations and interfaces for communication across borders. It is also essential that any mechanism which provides disclosure information must be verified independently and effectively to avoid errors and fraud.

The discussion of options has shown that any disclosure scheme based on statistical data does not generate sufficient precision and does not enable consumer choice. Because of the relevance of electricity trading, it is necessary to track market transactions properly. The minimal approach discussed above, based on individual accounting systems operated by market participants, could serve this purpose. However, its reliability is strongly dependent on the intensity and effectiveness of third-party verification and this is likely to incur relatively high cost.

The recommended approach, which features a central registry for electricity generation attributes, would enable market participants to track electricity in a reliable and relatively low-cost way. It offers considerable flexibility to market participants. However, extensive use of the residual mix would undermine the accuracy of disclosure information and therefore market participants should use this option with care.

The operation of the tracking mechanism should be monitored closely by Member States governments and the Commission. If necessary, the system should be adapted according to experiences made.

6 Costs and impacts

6.1 The cost of implementing disclosure

The cost of implementing a disclosure system will depend upon the chosen method of tracking information from generators to suppliers, the requirements set out for verifying data and the way in which the information is presented to consumers. Whilst the costs will be borne by generators, suppliers, traders and government appointed bodies, the majority of these costs will ultimately be passed on to electricity consumers.

The main supplier-related costs include:

- purchasing certificates (if appropriate);
- estimating portfolio qualities of total purchases;
- verification of purchases and sales;
- bill redesign and/or printing;
- any additional postage.

Generators will have costs associated with:

- registering and auditing plants;
- verification of plant data.

The regulator or appointed body will bear the cost of :

- the central register;
- verification of the system.

Within a certificates-based disclosure system, both generators and suppliers will incur some costs in gaining accreditation and obtaining certificates. Also, as described in Chapter 5, a common central register will need to be set up and run by a regulator (or similar appointed body). Costs borne by a regulator (or appointed body) can be passed onto the actors involved.

Within a contracts-based disclosure system costs associated with transferring data from generator to supplier will be incurred by generators, suppliers and traders. Use of a common central register, whilst not being required for a contracts-based system, would allow for simpler auditing, thereby reducing regulatory costs.

In addition to the costs suppliers will incur in acquiring the information on the attributes of their electricity (whether contracts or certificates), they are likely to incur some additional costs through changes to their billing procedures and any additional postage (if more pages are sent out) in order to incorporate the disclosure information in or with the bill (see Chapter 4 for a discussion of the various options).

Estimates for the cost of implementing disclosure in Germany, Hungary and the UK have been made. These three countries differ on a number of levels such as electricity

industry infrastructure, status of liberalisation and population, thus giving an indication of the range of potential costs throughout Europe. The costs for Hungary, as an Accession Country without a liberalised market, are most likely to change in the future. Estimates for Germany and the UK are more robust.

Estimates have been made for the front-side (changes to billing format and procedures and postage costs) and the back-side (the tracking mechanism)[42]. The cost estimates for the front-side focus on the electricity bill and do not include the cost of incorporating the disclosure information into the promotional materials. Under the costs for the back-side, three different options for the tracking mechanism (Section 5.4) have been considered: a contracts-based system which does not use a central registry, a contracts-based (tags) approach with a central registry, and a certificates-based approach using a central registry. Two different options for the front-side (Chapter 4) were considered:

1. Disclosure information displayed on the bill using some type of graphic e.g. pie chart or table, thus requiring bill redesign but using the suppliers' existing equipment;
2. Disclosure information displayed on a separate leaflet or insert, which is printed separately and sent out with the bill.

It is estimated that the total cost of implementing disclosure will be up to 0.01 €cent/kWh, based on cost estimates for Germany, Hungary and the UK. A certificates-based tracking approach is the lowest cost option in all three countries. Displaying disclosure information on the bill was the lower cost option in Germany and the UK whereas in Hungary, a separate leaflet is the cheaper solution.

Table 2 shows the costs of disclosure in Germany for three different approaches to tracking and two different options for presenting the information to consumers. The costs include both the initial cost of establishing the systems (one-off costs have been annualised over 5 years, using a zero interest rate) and running costs for all the players involved. As can be seen, it is anticipated that the cheapest system that could be developed in Germany would use a certificates-based approach with information being included on consumers' bills. The costs of providing information to consumers is a significant proportion of the overall cost (40%-60%).

[42] For full details see the 4CE Phase 3 Cost-benefit analysis report

Table 2 Estimates of the cost of disclosure in Germany

	Total costs of contracts (no central register)		Total costs of contracts (with central register)		Total costs of certificates (with central register) [43]	
	million Euros	€cent /MWh	million Euros	€cent /MWh	million Euros	€cent /MWh
Back-side	31.1	6.2	21.9	4.4	15.9	3.2
Front-side option 1	18.9	3.8	18.9	3.8	18.9	3.8
Front-side option 2	25.1	5.0	25.1	5.0	25.1	5.0
TOTAL (option 1)	**50. 0**	**10.0**	**40.8**	**8.1**	**34.8**	**7.0**
TOTAL (option 2)	**56.2**	**11.2**	**47.0**	**9.4**	**41.0**	**8.2**

In the UK and Hungary, however, the front-side costs are significantly lower than the cost of tracking (3%-14% and 13%-23% of total costs respectively), as can be seen in Table 3 and Table 4 which show estimates of the costs involved in establishing and running a disclosure system in these countries.

Table 3 Estimates of the cost of disclosure in the UK

	Total costs of contracts (no central register)		Total costs of contracts (with central register)		Total costs of certificates (with central register)	
	million Euros	€cent /MWh	million Euros	€cent /MWh	million Euros	€cent /MWh
Back-side	7.7	2.3	9.3	2.8	6.0	1.8
Front-side option 1	0.3	0.1	0.3	0.1	0.3	0.1
Front-side option 2	1.0	0.3	1.0	0.3	1.0	0.3
TOTAL (option 1)	**8.0**	**2.4**	**9.6**	**2.9**	**6.3**	**1.9**
TOTAL (option 2)	**8.7**	**2.6**	**10.3**	**3.1**	**7.0**	**2.1**

[43] It should also be noted that this estimate does not take into account the cost reduction that may result for market players through the synergies with the Guarantee of Origin for electricity from renewable energy sources and similar requirement for cogeneration, both of which could be facilitated by the tracking system as well.

The cost estimate for the UK is lower than that for Germany mainly because of the large number of suppliers (and therefore fewer customers per supplier) in Germany – 750 suppliers compared to around 22 in the UK. The high front-side costs in Germany are a consequence of higher postage rates compared to the UK and Hungary.

Table 4 Estimates of the cost of disclosure in Hungary

	Total costs of contracts (no central register)		Total costs of contracts (with central register)		Total costs of certificates (with central register)	
	million Euros	€cent /MWh	million Euros	€cent /MWh	million Euros	€cent /MWh
Back-side	1.1	2.8	1.1	2.8	0.9	2.4
Front-side option 1	0.3	0.7	0.3	0.7	0.3	0.7
Front-side option 2	0.2	0.4	0.2	0.4	0.2	0.4
TOTAL (option 1)	**1.4**	**3.5**	**1.4**	**3.5**	**1.2**	**3.1**
TOTAL (option 2)	**1.3**	**3.2**	**1.3**	**3.2**	**1.1**	**2.8**

Costs in Hungary are much lower than those in the UK and Germany, representing the lower range of the likely costs of disclosure within Europe. This is due to lower staff costs, a low number of generators and a non-liberalised market – all of which are likely to change once Hungary joins the EU in 2004.

Table 5 Summary of total costs of disclosure in Germany, UK and Hungary

Front-side	**Back-side**	**Germany**	**UK**	**Hungary**
		€cent /MWh	€cent /MWh	€cent /MWh
Bill redesign	Contracts (no central register)	10.0	2.4	3.5
	Contracts (with central register)	8.1	2.9	3.5
	Certificates (with central register)	7.0	1.9	3.1
Separate leaflet	Contracts (no central register)	11.2	2.6	3.2
	Contracts (with central register)	9.4	3.1	3.2
	Certificates (with central register)	8.2	2.1	2.8

Table 5 summarises and compares the total cost of each option for the disclosure system in the three countries. It is clear that, for all options, the cost of disclosure represents only a small percentage of the final price of electricity (average of the domestic and non-domestic selling price): between 0.1%-0.2% in Germany (assuming an average price of 6.5 €cent/kWh), between 0.03%-0.04% for the UK (assuming an average price of 7.5 €cent/kWh) and between 0.04%-0.05% for Hungary (assuming an average price of 7.4 €cent/kWh).

6.2 Benefits of implementing disclosure

The principal reason for implementing a system of disclosure is to support the functioning of the liberalised electricity market by providing consumers with information to help them to make informed choices in selecting their electricity supply. There are also additional benefits, including increased consumer awareness of the link between electricity consumption and emissions of environmental pollutants, and an increase in the demand for electricity generated from renewable energy sources.

Based on the 4CE consumer research, it appears likely that consumers, once given a choice, will choose electricity products that are generated from sources which result in low carbon emissions and low levels of nuclear waste. In the medium to long term this could lead to an increase in the quantity of electricity generated from renewable energy sources within the EU. This would result in consequential environmental benefits, increases in employment in the electricity sector and an improvement in security of supply, all of which are key EU objectives. Based on the outcome of the scenarios developed as part of the 4CE project[44], consumer demand could lead to up to an additional 25 TWh per annum being generated from renewable energy sources within the EU in the medium to long term[45]. Assuming this additional generation from renewables leads to less generation from gas-fired power plant (which has a high marginal cost of generation, and provides a conservative assumption for CO_2 emission reductions), this increase in renewables in the EU will avoid in the region of 10.4 million tonnes of CO_2 per year. Renewables also provide improved security of supply and an increase in employment in the electricity generation industry.

The actual increase in capacity due to disclosure will be affected by the range of policies chosen by governments to support renewable energy technologies, many of which will be complemented by disclosure and may account for some of the increase that would otherwise result from consumers voluntarily choosing renewables.

In the longer term, increased consumer awareness of the fuel mix and emissions resulting from electricity consumption could help to create political pressure for the introduction of further policy measures which support low carbon and low nuclear waste genera-

[44] For full details see the 4CE Phase 3 Scenarios report

[45] This figure is based on customers' willingness to pay (WTP) in each country and the cost curves for developing new capacity within these countries, taking into account that the actual WTP is likely to be only in the region of 20% of the stated WTP.

tion, which would have an additional positive environmental impact. These are discussed in more detail in Section 6.3.2.

6.3 Supporting and interacting policies

6.3.1 Making disclosure effective

A number of additional activities could be developed in order to ensure that disclosure is effective, both in terms of raising people's awareness of the impacts that their electricity consumption is having upon the environment and enabling consumers to make a properly informed choice of electricity supplier based upon their personal values.

An awareness raising campaign preparing people for disclosure, aimed at helping them to interpret and use the information presented to them with their electricity bills, would enhance the impact and effectiveness of the disclosure information. Campaigns both before and after the introduction of disclosure would provide a vital introduction and support for consumers. Other energy and environment related education campaigns could then build on this increased knowledge – the disclosure information could be a cost-effective way of communicating a message to all households and businesses.

Some suppliers will no doubt use the disclosed information as a marketing tool to promote themselves and their products. Therefore, in order for consumers to be able to make an informed choice, it is important that they are able to compare information from different suppliers. Disclosure information could be provided in an independent national catalogue, which is also displayed on a website, distributed in each Member State.

6.3.2 Building on disclosure

Disclosure can also be used as a foundation for developing policy instruments which help to achieve EU objectives that are over and above those for which disclosure is originally being implemented. There are a variety of policies that could be introduced to enhance the impact of disclosure, including:

- Fiscal measures;
- Carbon caps placed on suppliers and consumers (tradable domestic quotas);
- Minimum standards set on products (if applicable);
- Procurement specification;
- Mandatory disclosure in company reports.

Electricity disclosure would enable differentiated tax rates to be imposed on electricity consumption according to the carbon emissions and/or nuclear waste content resulting from its generation. Such an approach would be a step towards internalising the external costs of electricity production, with electricity which has been produced from RES being subject to a lower tax rate. This would provide an additional market based incentive for consumers to buy electricity which had a low environmental impact.

Carbon caps could be placed on each suppliers' portfolio, with, for example, each company having a limit set (per consumer) on the amount of carbon that it can sell. This limit could be reduced over time. Such an approach could be the cornerstone for a downstream emissions trading scheme[46]. Alternatively, if a market for individual electricity products is developed, minimum standards could be placed on electricity products. For example, suppliers could be required to limit the per kilowatt-hour carbon emissions or nuclear content of electricity sales. Again, these limits could then be reduced over time.

It is anticipated that the disclosure information on the environmental impacts of electricity could be incorporated into procurement specifications for goods and services by organisations in both the public and private sectors. Disclosed information could also simplify the procedures used by public authorities and private companies to obtain environmental indicators such as CO_2 emissions relating to their operations and energy purchases. An increasing number of organisations are publicly disclosing such non-financial information to highlight improvements in their environmental record (e.g. via EMAS, the voluntary Eco-Management and Audit Scheme, designed to highlight companies' environmental performance). Company reports could be required to include fuel mix information and associated environmental impacts of energy purchases, thus ensuring consumer demand for accurate and reliable disclosure information.

Increased consumer awareness of the link between electricity usage and sources of environmental impacts could encourage consumers to take actions to reduce energy consumption and also pave the way to the introduction of policies which support wider EU objectives. The effectiveness of such initiatives would in part be dependent upon the information that is provided to consumers via disclosure and the effectiveness of information campaigns which focus on the information being disclosed.

6.3.3 Interaction with other policies

It will be important to ensure that the disclosure scheme complements existing and planned policies and market-based instruments. Synergies or conflicts could arise with the systems established for Guarantees of Origin for renewable electricity (GO), proposed cogeneration guarantees of origin, the Renewable Energy Certificate Scheme (RECS), emissions trading schemes and renewable energy support mechanisms, such as feed-in laws and renewable energy obligations. In some cases, the way in which disclosure will interact with these other instruments will be dependent upon whether a contract-based (without a central registry) or a certificate-based (with a central registry using tags or certificates) approach is used for tracking.

The interaction of disclosure with GO (both for renewables and cogeneration) and RECS is of crucial importance. The EU Renewables Directive on the promotion of electricity from renewable energy sources in the internal electricity market (2001/77/CE)

[46] It would be difficult to avoid double counting if such an approach was used in conjunction with the forthcoming upstream EU Emissions Trading Scheme. However, in the long term a downstream emissions trading scheme may be considered to be more appropriate.

requires Member States to put a system in place for issuing a Guarantee of Origin for renewable electricity by October 2003. The revised draft of the EU Directive on cogeneration[47] contains a similar provision for a Guarantee of Origin for electricity from cogeneration. RECS is a voluntary trading system which aims to provide a cost effective and reliable certificate system for renewable energy in Europe and is now in operation after a two year test period in Europe. The RECs system can provide valuable information regarding the issue and administration of certificates, the operation of central registries and trading mechanisms.

The RECS management body is very keen to see the integration of Guarantees of Origin and RECS certificates so that the certificates are compatible. Whilst Guarantees of Origin have to be implemented in each Member State, it is not clear the extent to which the GO will be harmonised between Member States. On the other hand, although RECS is voluntary, where RECS systems are in use, these are harmonised. A single registry for all certificates could help to ensure that there is no double-counting. The RECS system could be easily adapted to a system of Guarantees of Origin and vice versa and these systems could also be extended to cover all forms of electricity generation for the purposes of a certificate-based disclosure scheme using a central registry. A contracts-based disclosure scheme without a central registry would be incompatible with GO and RECS and would lead to double counting of the electricity attributes. It is strongly recommended that Member States merge their systems for GO (and RECs where applicable) with the disclosure tracking mechanism.

In addition to certificates issued under GO or RECS, there may also be other certificates or tags used to represent the environmental benefits accruing from the same electricity produced under various different schemes e.g. Renewable Obligation Certificates and Climate Change Levy Certificates in the UK. This can result in duplication of information, infrastructure and costs and there is a considerable risk of double-counting the electricity attributes. Some rationalisation will be required to ensure consistent, fair and efficient policy, either through integrating all schemes into one certification system (as recommended for GO and RECS) or by viewing the different certificates as separate support mechanisms with clear rules regarding the role of each.

Feed-in tariffs, which provide a ‘market push’ for electricity generated by renewable energy sources, are another common policy at the national level, currently being used in Germany, Austria, Spain and France. This tariff usually covers the additional production cost for electricity generated by renewable energy sources compared to the market prices for electricity. In principle there is a distinction between renewable electricity sources which are covered by a feed in tariff scheme (financially supported sources) and those which are not (market mature sources). However, given that subsidies for other fuel sources are not likely to be covered under disclosure and that Guarantees of Origin do not make such distinction, it is suggested that there is no need to separately identify re-

[47] Amended proposal for a Directive of the European Parliament and of the Council on the promotion of cogeneration based on a useful heat demand in the internal energy market, COM(2003) 416 final.

newable sources supported by a feed-in tariff in the disclosure information. Such a distinction is more suited to the role of green 'quality' labels.

With regard to emissions trading, the European Commission is proposing to introduce a scheme for greenhouse gas emission trading from 2005.[48] This is an upstream system based on the use of primary energy i.e. it is the generators of electricity who are obliged to reduce emissions, not the consumers. As electricity disclosure refers to the information provided by electricity suppliers to consumers and the tracking of electricity in the wholesale market (i.e. downstream), there is no direct link between emissions trading and disclosure. However, much of the plant-specific data required for monitoring and reporting under the emissions trading scheme (e.g. on fuel input and emissions) overlaps with the information required for disclosure, therefore it would be sensible and cost-effective to use such reported data for the purposes of disclosure.

In the longer term, the introduction of electricity disclosure could even have an effect on the general design of the European Emissions Trading Scheme. One of the reasons for selecting an upstream approach for Emissions Trading in the electricity sector was that it was not clear how electricity consumers could prove the CO_2 intensity of the electricity they purchase. Following the introduction of a reliable system for electricity disclosure, including a tracking system for the fuels used and the associated greenhouse gas emissions, it could then be possible to change the Emissions Trading scheme from an upstream to a downstream system. In this case it would be the final electricity consumers who are responsible for the emission reductions. The tracking system would be used to assign power plants and their emissions to electricity consumers and to account for the emissions for each consumer.

6.4 Conclusions

Implementing disclosure will lead to some additional costs being incurred by generators, suppliers, traders, governments, which ultimately, in most cases, will be passed onto the electricity consumers. The extent of these costs depends upon the chosen disclosure system and its reliability, but are estimated to be up to a maximum of 0.01 €cent/kWh, representing not more than 0.2% of the average cost of electricity to consumers.

In addition to providing transparency for market actors, there are further benefits to disclosing the source of electricity to consumers. Perhaps the largest benefit will arise from an increased demand for electricity generated from renewable energy sources, resulting in an increase in electricity generation from renewable energy source in the order of up to 25 TWh/year within the EU. This increase in renewables would lead to a reduction in greenhouse gas emissions and an increase in employment and security of supply.

[48] Amended proposal for a Directive of the European Parliament and of the Council establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC, 27.11.2002, COM(2002) 680 final.

Disclosure could also support the introduction of a variety of other policies, including fiscal measures, carbon caps and minimum standards for electricity products. In addition, increased consumer awareness of the link between electricity usage and sources of environmental impacts could encourage consumers to take actions to reduce energy consumption and also pave the way to the introduction of policies which support wider EU objectives. The effectiveness of such initiatives would in part be dependent upon the information that is provided to consumers via disclosure and the effectiveness of information campaigns which focus on the information being disclosed.

There are a number of interactions and potential conflicts between disclosure and existing or planned policies and market-based instruments, both at a EU and Member State level. It is advisable to consider such interactions carefully in order to maximise any synergies that exist and minimise conflicts. Appropriate rationalisation would bring significant benefits in terms of time, cost and infrastructure savings and would avoid duplication of information and double-counting of electricity attributes.

7 Conclusions and recommendations

With the adoption of the Electricity Directive 2003/54/EC, there is a clear move towards a liberalised and harmonised European electricity market with increased cross-border trade and a stronger trans-European network. Electricity disclosure is an essential element in this liberalised market and it is vital that the disclosure scheme can deliver reliable and useful information to all consumers.

At present, electricity markets in the different Member States vary widely in terms of the market structures, extent of liberalisation, the fuel mix for generation and associated environmental impacts. These differences will increase when the Accession Countries join the EU in 2004.

This is the context into which electricity disclosure will be introduced when the Directive is implemented by Member States in July 2004. It is therefore a major challenge to introduce a disclosure system that is suitable and compatible for all countries. However, the research undertaken in the 4CE project demonstrates that it is possible and at relatively low cost.

Although electricity may be considered a 'low-interest' product, the purchase and use of electricity is something that is common to practically all households and businesses throughout Europe. It therefore represents an area of huge potential, with considerable savings to be made in terms of both fuel usage and environmental impacts.

7.1 Consumer Choice and Carbon Consciousness

Currently consumer choice and carbon consciousness regarding electricity is low. Consumer choice is, of course, limited in those markets which are not yet liberalised. However, even in those markets which are fully liberalised, price is almost the only factor available for people to base their choice of electricity supplier on. Within the liberalised markets, the percentage of consumers who have switched suppliers is still relatively low in many countries, indicating that market barriers still exist and price may not be a big enough incentive for people to move to a different supplier. In terms of carbon consciousness, whilst many consumers appear to understand that the generation of electricity has some impact on the environment, they do not necessarily understand the underlying mechanism or processes that result in the associated environmental impacts such as CO_2 emissions and radioactive waste.

In a liberalised market, consumers should be provided with comprehensive information on which to make their decisions. The 4CE consumer research has demonstrated that consumers want to be given information on the fuel mix of the electricity they buy and the associated environmental impacts with their electricity bills. Environmental concern and support for electricity generated from renewable sources amongst consumers is high – they want to buy, and therefore be able to choose, electricity with a low impact on the environment: 82% of householders and 85% of SMEs stated that they would prefer to buy electricity associated with a low impact on climate change and no nuclear waste.

Consumers want to be given this information in a standardised format, to allow easy comparison between suppliers, and to know that they can trust the information – hence independent verification is crucial.

Electricity disclosure can provide this information to consumers and therefore allow them a greater variety of choice. In addition to giving consumers the information that they want and need, electricity disclosure can raise general awareness amongst consumers about the sources of electricity and the impact of these on the environment. Since the information will be sent to practically every household and business in Europe, disclosure could be seen as a cheaper and potentially more effective way of raising awareness compared to a major educational campaign.

However, for a disclosure scheme to achieve such aims, it is important that it is designed appropriately.

7.2 Minimal compliance

The Directive specifies the minimum that a disclosure scheme must provide. The minimal compliance approach (as described in the previous chapters) uses a tracking mechanism based on electricity contracts with the electricity attributes accounted for by systems set up by market participants on an individual basis. Fuel mix information would be provided as a simple line of text somewhere on the bill and promotional materials. Environmental information would only be displayed as absolute figures on the supplier's website (or provided on request). Such a minimal compliance approach is not recommended for several reasons:

- It does not provide consumers with what they want – i.e. fuel mix and environmental information with their electricity bill. Minimal compliance does not require the environmental information to be included in or with the bill or promotional materials.
- Consumers also want to be given additional explanation of the disclosure information and reference values for comparison to help them understand it and put it into context. This would not be provided under minimal compliance.
- The fuel mix information would not necessarily be displayed in a format or location that would be noticed by the consumer, limiting the impact of this information.
- Displaying the environmental information on an existing reference source, such as a website, rather than in or with the bill (or promotional material) will limit the impact of this information and will be much less effective in raising awareness since the information will only reach a minority of the population.
- There would be little or no standardisation and harmonisation of the disclosure scheme, both in terms of the display format and tracking mechanism, at a country or EU level. This would cause problems for consumers in comparing between suppliers and for the electricity industry in terms of limiting cross-border trade.

- The cost and complexity of verification of the tracking system would be high due to the lack of harmonisation – there would be many different individual accounting systems to monitor and audit.
- If a minimal compliance approach is taken it will be difficult to then progress to a more advance system since this would require a major alteration to the accounting systems for tracking the electricity.

7.3 A European Disclosure System

The disclosure provision of the Directive is open to interpretation by the individual Member States who are free to go beyond the specified requirements. The following recommendations relate to the proposed approach for a European disclosure system based on the research conducted in the 4CE project:

- Member States agree on joint definitions of the information to be provided, procedures for data calculations and interfaces for communication across borders.
- The tracking mechanism is harmonised across Europe to facilitate cross-border trade and ensure efficiency.
- The tracking mechanism is based on a central registry approach. Member States should specify whether market participants trade the electricity on the basis of tags or certificates or both.
- Each Member State appoints an independent body to operate the registry.
- Additional flexibility is achieved by allowing suppliers the option to use a residual mix (to a limited extent e.g. 20% of a supplier's portfolio) instead of active tracking their electricity purchases.
- The collection of data on electricity production and environmental indicators of plants for disclosure is based, as far as possible, on data already collected for other purposes, such as the EU Emissions Trading Scheme.
- CO_2 emissions and radioactive waste are tracked using plant-specific emission factors which reflect the benefits of increased plant efficiency, higher fuel quality and cogeneration.
- The central registry provides the suppliers with the data to be disclosed to consumers, including data on differentiated electricity products, if applicable.
- The display of the disclosure information should be harmonised at least at the Member State level.
- The disclosure information display should be as eye-catching and informative as possible.
- The fuel mix and environmental information (both CO_2 emissions and radioactive waste) are provided together in a separate leaflet with the bill which is sent out at

least once a year but preferably twice a year provided this does not incur excessive additional costs.

- The disclosure information provided in the promotional material should be based on the display formats used in the separate leaflet, possibly integrated together as a stand-alone 'label'.
- The fuel mix information is displayed as a pie chart and table, which includes national reference figures and a detailed breakdown of renewable sources.
- The environmental information should be displayed as an indexed or ranked label – further research is required to determine the most appropriate display format.
- Absolute figures on CO_2 emissions and radioactive waste per kWh should be included as part of the environmental information display.
- All suppliers have to provide disclosure information on their portfolio but if they choose to also provide product information they must do so for all their customers.
- Independent verification of all aspects of the disclosure scheme is essential.
- It is likely to take around 4 years before a fully functioning disclosure scheme is in place, allowing for time to set up the tracking mechanism, collect data for the first year, verify the information and then incorporate the information with customers' electricity bills and promotional materials. The first disclosure information would be presented to consumers in July 2007.

Electricity disclosure is not expensive. A disclosure scheme based on the recommended approach is likely to cost at most 0.01 €cent/kWh, which represents around 0.2% of the final electricity price to consumers and is therefore negligible. This does not take into account any cost reduction for market players through synergies with the certification systems for Guarantee of Origin for electricity from renewable energy sources and co-generation and RECS.

7.4 Helping disclosure to work

There are a number of additional policies that could be put in place to help ensure the effectiveness of a disclosure scheme:

- National education campaigns would be necessary to raise awareness of the disclosure scheme and draw this to people's attention. This could take place in two stages: one campaign prior to the inclusion of disclosure information with electricity bills to prepare people so that they know what to look for and another campaign after people have started to receive the disclosure information to help them understand and use it.
- Compilation of an independent catalogue in each Member State based on the disclosure information provided by all suppliers to enable consumers to compare what is offered by different suppliers and therefore make a properly informed choice.

This would be available in hard copy as well as on the internet. Price information could also be included.

7.5 Policy interactions

Electricity disclosure is not taking place in a policy vacuum. There are other policies already in place which will interact and possibly conflict with a disclosure scheme.

In terms of EU policy, the most important interaction is with the Guarantees of Origin (GO) under the Renewables Directive 2001/77/EC and the draft Cogeneration Directive since both interface closely with the disclosure tracking mechanism if based on a central registry. It is strongly recommended that Member States merge their systems for GO for electricity from renewable energy sources and cogeneration and the tracking mechanism into one single scheme. As well as being cost-effective this minimises the risk of confusion and double-counting.

There is no direct link between electricity disclosure (downstream) and the EU Emissions Trading Scheme (upstream). However, the Emissions Trading Scheme could be of benefit to disclosure since information collected for the Emissions Trading Scheme could be used for the disclosure tracking mechanism, thus limiting costs. Disclosure could also support the Emissions Trading Scheme by providing the mechanism by which differences in generation cost resulting from Emissions Trading are passed on to electricity consumers. Ultimately, disclosure could allow a change from an upstream to a downstream Emissions Trading Scheme, more in line with carbon caps and tradable domestic quotas.

In terms of national policies, the main area of conflict is likely to be with existing renewable support schemes, many of which are based on certificates or tags (i.e. either traded with the electricity or separately). These interactions will vary between countries depending upon the nature of the various schemes in each country. However, for all Member States, the most crucial issue is to avoid double-counting of the electricity attributes through these schemes and establish clear rules regarding the role of each. If there are a number of different certification schemes, these should be combined so that only one type of certificate or tag is in use.

There are no direct synergies between feed-in tariffs and electricity disclosure, although both instruments may encourage the use of renewable electricity sources. It is not considered necessary to separately identify renewable sources supported by a feed-in tariff in the disclosure information.

Although disclosure requires information on the source of electricity is provided to consumers, award labels (e.g. for green electricity) will still have a role to play in identifying electricity from renewable sources which is truly additional i.e. new generation that is not supported or subsidised through other schemes, such as feed-in tariffs or renewable obligations.

Electricity disclosure also has the potential to work in synergy with existing policies which aim to increase the proportion of renewable electricity generation, helping these targets to be achieved.

7.6 Taking disclosure further

Through the provision of reliable information on the fuel mix and environmental attributes of electricity sold by suppliers, disclosure can provide a sound basis for further policies such as:

- Fiscal measures: differentiated tax rates to be imposed on electricity consumption according to the carbon emissions and/or nuclear waste content resulting from its generation.
- Carbon caps placed on suppliers: for example, each company has a limit set (per consumer), reduced over time, on the amount of carbon that it can sell.
- Disclosure could form the cornerstone of a downstream emissions trading scheme.
- Minimum standards set on products (if applicable): for example, suppliers could be required to limit the per kilowatt-hour carbon emissions or nuclear content of electricity sales.
- Procurement specification: the environmental impacts of electricity (based on disclosure information) could be incorporated into procurement specifications for goods and services.
- Mandatory disclosure of fuel mix information and associated environmental impacts of energy purchases in company reports would strengthen the demand for reliable and precise disclosure information.

Therefore disclosure is a useful building block for a wide range of other policies aiming to reduce environmental impacts and mitigate climate change.

7.7 Outcomes of disclosure

Electricity disclosure has a number of direct benefits in terms of a positive contribution to the environmental, social and economic developments of the national electricity sectors. At a fundamental level, disclosure is essentially an educational tool which aims to improve the availability of reliable information on electricity and thus increase awareness amongst consumers about electricity and its associated environmental impacts, within a liberalised market. A key outcome of this improved consumer information and awareness is likely to be an increased demand for electricity from renewable sources in the order of up to 25 TWh/year within the EU.

This main environmental benefit of this increase in renewables would be a reduction in the level of emissions, in the order of 10.4 million tonnes of CO_2 per year in the EU, and radioactive waste by replacing fossil and nuclear fuels. There would also be a corre-

sponding increase in employment within the renewables industry and increased security of supply with greater fuel diversity and less concentrated generation patterns.

Disclosure is an essential part of the liberalisation of the electricity market, allowing consumers to make an informed choice of electricity supplier. It will improve the functioning of the electricity markets, both at a national and European level and is likely to result in an increase in switching rates between suppliers. Such decisions will no longer be based on price alone – competition between suppliers based on the attributes of electricity will develop, thus ensuring a wider choice for the consumer.

7.8 Monitoring and evaluation

In order to determine the extent of the benefits resulting from disclosure and the level of understanding which disclosure brings, it is recommended that once disclosure is implemented Member States undertake a review to determine:

- The extent of consumer awareness of disclosure;
- Consumer understanding of the disclosure information they receive;
- The level of consumer confidence in the information;
- The effect of disclosure on consumers in choosing their supplier (and electricity product, if applicable);
- Changes in supplier offerings and sales.

There should also be continual monitoring and evaluation of the disclosure scheme itself to ensure that it is providing the required level of reliable information to consumers and is functioning in the most effective way possible.

7.9 Conclusions

Electricity disclosure has the potential to be an effective tool within a liberalised European electricity market in terms of providing consumers with reliable and useful information. It is expected that disclosure will also increase demand for electricity from renewable sources. This can be achieved for negligible cost in comparison to the current selling price of electricity. However, if a disclosure scheme is to be truly effective, then Member States need to go beyond the minimal requirements of the Directive to introduce a scheme that is harmonised and compatible within and between each Member State.

Disclosure is part of a wider trend within the energy world towards a greater devolution of responsibility and choice to consumers: sunshine can be used to heat water or create electricity in households; the ambient temperature of soil in peoples' gardens can be used as the source of heat for their homes. In these and other similar ways, people are becoming part of the national energy system. Enabling consumers to choose the way in which their electricity is generated, through disclosure, is another part of the same trend,

that is, crucially, going to be available to everyone. The ramifications of this devolutionary movement for the energy industry will be considerable, but it is accepted that consumers have the right to know, choose and influence.

With liberalisation so far, consumers have generally been limited to choosing an electricity supplier on the basis of price alone. Other factors, such as the environmental impacts, have been of minor importance or hidden. The European Directive on liberalisation of the European electricity markets beings the environment to the fore so that individual householders will be able to exercise their own priorities. The extent to which consumers use this additional information will become clearer with time, as liberalisation spreads across Europe and beings with it the opportunity to switch suppliers. The impact of disclosure also depends strongly on the way in which this enabling legislation is used: governments, generators, suppliers, consumer and environmental groups can all build on and enhance it, so that it becomes a truly powerful policy initiative. Disclosure can be an important educational tool, confirming for people the link between CO_2 emissions, radioactive waste and electricity consumption. Disclosure will provide consumers with information which will enable them to shape the generation mix of their own country and of Europe through their purchasing patterns. Bringing consumer choice and carbon consciousness together will be of potential benefit to the world through lessening the threat of climate change.

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Appendix A – Glossary

Bilateral contract - A direct contract between two market participants (e.g. power producer, supplier, trader) outside of a centralised power pool or power exchange.

Capacity - The maximum load a generating unit, generating station, or other electrical apparatus can actually carry under existing service conditions.

Certification – A process by which a company or product satisfies the criteria adopted by a regulating body for the control of specified requirements that need to be met. Certification provides a guarantee that a particular company or product have been tested and that they meet the specified requirements.

Cogeneration (or Combined heat and power - CHP) – A CHP plant is an installation where there is simultaneous generation of usable heat and power (usually electricity) in a single process. The term CHP is synonymous with 'co-generation' and 'total energy', which are terms often used in the United States or Member States of the European Community. Electricity generation from CHP plants with an inherent non-CHP component (e.g. many district heating plants with steam turbines are operated in condensing mode in summer time emitting a large portion of the residual thermal energy into the environment) need to be divided up into a CHP mode and a condensing mode.

Double counting - This is when the attributes of the electricity generated (e.g. benefits from renewable sources) are sold or accounted for more than once.

Electricity product – An electricity product has particular properties distinct from a supplier's overall supply mix and is often marketed and sold to consumers on the basis of these properties e.g. green electricity products, no nuclear content products, etc.

External Costs (or Externalities) - Costs resulting from a process which are not included in the monetary price of that process, e.g. damage from pollution associated with electricity generation.

Green Certificate - An standardised official record proving that a specified amount of green electricity has been generated. Green certificates represent the environmental value of renewable electricity production. The certificates can be traded separately from the energy produced.

Greenhouse effect -- The presence of trace atmospheric gases make the earth warmer than would direct sunlight alone. These gases (including carbon dioxide [CO_2], methane [CH_4], nitrous oxide [N_2O], tropospheric ozone [O_3], and water vapor [H_2O]) allow visible light and ultraviolet light (shortwave radiation) to pass through the atmosphere and heat the earth's surface. This heat is re-radiated from the earth in form of infrared energy (longwave radiation). The greenhouse gases absorb part of that energy before it escapes into space. This process of trapping the longwave radiation is known as the greenhouse effect. Scientists estimate that without the greenhouse effect, the earth's surface would be roughly 54 degrees Fahrenheit colder than it is today -- too cold to support life as we know it. See Global Climate Change.

Green Electricity Labels - Green electricity labels demonstrate that an electricity product or tariff meets certain independently assessed environmental criteria. Independent accreditation may be offered by official bodies (e.g. government agencies) or by non-governmental-organisations (e.g. environmental NGOs).

Green Electricity - Electricity generated from renewable energy sources such as the wind, sun, water etc. There are varying opinions about what type of electricity should count as green and the criteria can vary from country to country. (See definition for renewable energy below).

Green Tariffs/Products - Electricity tariffs/products that either guarantee to provide a certain percentage of electricity from renewable energy sources, or guarantee that a certain percentage of the money paid for the tariff/product will be invested in new renewable energy capacity.

Life cycle cost – The sum of all costs, both recurring and non-recurring, related to a product structure, system or service during its life span.

Portfolio - The collection of generation investments all owned by the same individual or supplier.

Power exchange - An entity providing a competitive spot market for electricity through e.g. day-and/or hour-ahead auction of generation and demand bids.

Registry - Electronic database containing details of all accounts and certificates/tags held in the disclosure system.

Renewable Energy - In general the term renewable energy refers to 'energy obtained from persistent and continuing flows of energy occurring in the environment'. EU countries have historically taken differing approaches to defining which technologies are classified as being renewable. This is an issue particularly regarding sources linked to wastes and to large hydro plant. Likewise categorisation of the many forms of agricultural 'biomass' and 'biofuels' may vary between countries. These decisions have partly been dependent on government policy objectives and public perceptions in each given country. Discussions concerning the possible implementation of an EU-Directive which would include a definition of renewables have focussed upon the following technologies and issues:

- ***Biogas*** - Agricultural, sewage, landfill and industrial organic wastes produce a methane gas that can be collected and burnt to produce electricity. Several EU countries exclude landfill gas and sewage gas from their renewable energy support programmes.
- ***Biomass*** - Forestry and agricultural residues can be used as a fuel to produce electricity and heat. In addition, energy crops are grown specifically to be used as a fuel. Use of biomass add little or no extra carbon dioxide into the atmosphere, as plants absorb carbon dioxide when they grow and this is then released when the plants are burnt. All EU countries consider biomass as being renewable, though several impose conditions before granting support.
- ***Geothermal*** - Geothermal energy, coming from hot underground rocks is accepted as being renewable in all EU countries. In some places steam comes to the surface naturally, whilst in others water can be pumped down and heated by the rocks to produce steam. Geothermal energy is most often used to provide hot water and heating for buildings.
- ***Hydro*** - Hydropower schemes can either use a dam or use the natural flow of water in a 'run of the river' system to generate electricity. It is widely recognised that large hydro schemes can have a significant impact on the local environment, and as such many countries do not permit hydropower schemes above a certain size, typically 10MW, to benefit from renewable energy support programmes. However, some countries only recognise old plants in order to discourage further hydro development. Most large hydro schemes have been in operation for many years, and do not need additional support to enable them to be financially viable. Even small hydropower schemes are often subject to a variety of conditions concerning their environmental impact.
- ***Municipal Waste*** - Municipal waste can be used as a fuel to produce electricity and heat. Few countries consider electricity generated from the burning of municipal waste to be renewable. However, the organic content of municipal waste is itself from a renewable resource, and in some countries the organic portion of the waste resource is eligible for support.

- ***Peat*** - Peat is included in the definition of renewables in some EU countries, under certain conditions.
- ***Solar*** - A solar photovoltaic (PV) panel generates electricity directly from light. PV panels can be integrated into buildings or used in a variety of other applications. All EU countries consider PV to be a renewable energy technology. Also, active and passive solar technologies that utilise the energy from the sun to produce heat are also widely supported in Europe.
- ***Wave and Tidal Energy*** - The energy in waves can be captured in a number of ways. One method is to funnel the waves into a vertical column, then the motion of the waves forces air back and forth over a bi-directional turbine to produce electricity. Several other types of wave energy device are currently under development. Tidal energy can either be captured by storing water behind a barrage at high tide and releasing it at low tide, or by using underwater turbines, which can also extract energy from other marine currents. Several EU countries have small support programmes to encourage the development of wave and tidal systems.
- ***Wind*** - Wind turbines, which capture the energy from the wind to produce electricity, have been developed for various purposes, from large groups of grid connected wind turbines, both on-shore and off-shore, to very small autonomous turbines used for battery charging. Currently all EU countries accept wind as being a renewable energy source worthy of support.

Settlement - The process of financial settlement for products and services purchased and sold. Each settlement involves a price and quantity.

Spot Market – Market where short-term imbalances between generation and consumption are evened out by material contracts.

Supplier - An entity that sells electricity to final customers.

Switching - The process of changing electricity supplier (i.e. electricity company) or to a different electricity product or tariff of the default supplier.

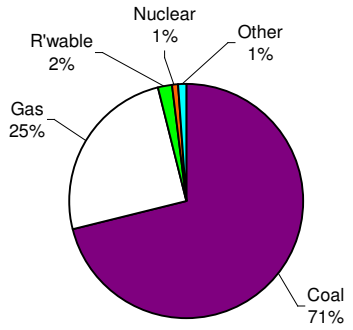
Tags – Information on the attributes of a certain volume of electricity (e.g. 1 MWh), presented in a standardised format that can be transferred in conjunction with electricity contracts. Tags differ from certificates in that tags follow the sale of electricity and are not designed to be traded separately.

Tariff - A tariff is the price or schedule of prices, contractual terms and conditions for a defined service or set of services.

Transmission System Operator (TSO) – Entity responsible for the secure an reliable operation of the transmission grid and taking care for the provision of system services (e.g. balancing power).

Appendix B – Example of disclosure information leaflet (A4 folded into three)

Electricity supplied by Supplier X in 2001



Fuel source	Supplier X %	National average consumption %
Gas	25	40
Coal	71	33
Nuclear	1	23
Other	1	1
Renewables (total)	2	3
Hydro-electric	*1.5*	*1.4*
Biomass	*0.0*	*1.2*
Wind	*0.5*	*0.3*
Solar	*0.0*	*0.0*
Other	*0.0*	*0.0*

15% of electricity sold by Supplier X was imported

Supplier X contact details

For an enquiry, please phone
0807 111 111

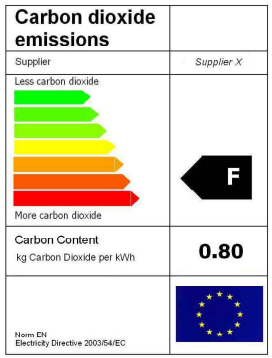
For further information on electricity and the environment, see
http://www.supplierx.com
or phone 0807 222 222

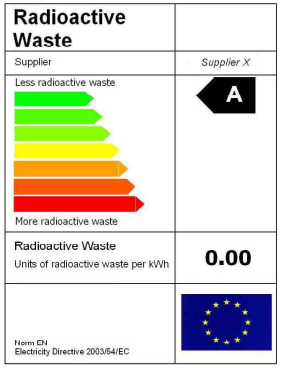
To compare the environmental impact of electricity offered by different electricity suppliers, see:
http://www.electricitycompare.com

Supplier X address

YOUR ELECTRICITY EXPLAINED

Environmental Impact Labels





How your electricity is generated

The electricity provided by Supplier X comes mostly from coal (71%) and natural gas (25%). Other energy sources such as nuclear, oil and renewables account for 4%. Renewable sources of energy include solar, wind and hydro-electric power.

15% of the electricity is imported. The rest is generated in country X.

You can use the information provided in this leaflet to compare the electricity sold by Supplier X to electricity sold by other suppliers.

What impact your electricity has on the environment

Each unit of electricity – a kilowatt hour (kWh) – supplied by Supplier X results in 0.0 micrograms of radioactive waste and 0.8 kilograms of carbon dioxide, a greenhouse gas.

The labels on the front of the leaflet give a rating for the environmental impact of your electricity in terms of carbon dioxide emissions and radioactive waste. The level of these environmental impacts depends on the power plants used to generate your electricity.

Carbon dioxide is released when certain fuels are burned. It is a greenhouse gas and a major contributor to climate change.

Radioactive waste is produced when electricity is generated by nuclear power stations.

On a scale of A to G, where A is the least damaging to the environment and G the most damaging, the electricity supplied by Supplier X has the label F for carbon dioxide and A for nuclear waste. This is because of the high proportion of coal and low proportion of nuclear energy in the fuel mix.

Where your electricity comes from

The actual electricity you use is indistinguishable from the electricity used by your friends and neighbours. There is no way to identify the actual power plant that produced the electricity consumed in your home because once it is fed into the distribution and transmission system it becomes a general pool of electricity.

However, it is possible to track the money you pay for your electricity. Your electricity Euros support electricity generation from various energy sources in the proportions listed in the table on the front of the leaflet. The national average column is provided as a comparison and represents the breakdown of sources used to generate all electricity that was sold in country X.

Appendix C – Example of a disclosure information insert (portfolio only)

ELECTRICITY LABEL

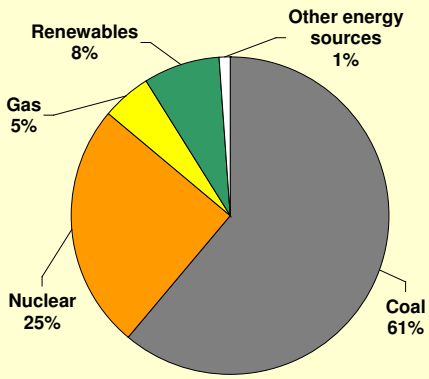
Supplier: Supplier X

Phone: 0800 - XXXXXXXXXX

Website: www.supplier-x.com

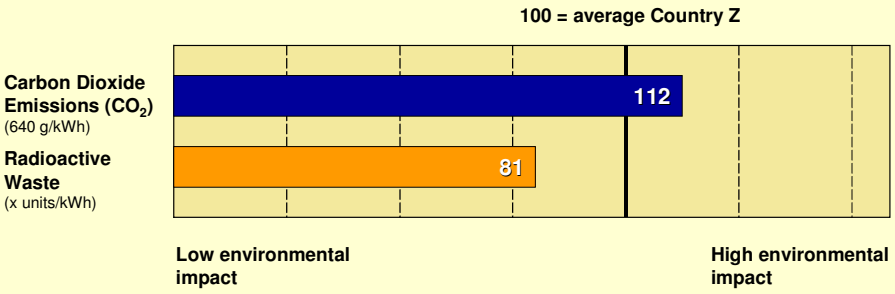
Electricity supplied by Supplier X, 2002

Electricity supplied by Supplier X was generated from the following fuel sources



Fuel source	Supplier X	for comparison average consumption Country Z
Coal	**61%**	**51%**
Nuclear	**25%**	**31%**
Gas	**5%**	**7%**
Other conventional energy sources	**1,0%**	**3,5%**
Renewables (total)	**8,0%**	**7,5%**
Hydro electric	4,5%	3,5%
Wind	3,2%	3,2%
Biomass	0,3%	0,8%
Solar	0,0%	0,0%
Other renewables	0,0%	0,0%
15% of electricity sold by Supplier X was imported		

Environmental Impact



To compare the environmental impact of electricity suppliers, see www.labelcompare.com

Norm EN - Electricity Directive 2003/54/EC

Appendix D – Example of a disclosure information insert (portfolio and product)

ELECTRICITY LABEL

Product: Product X

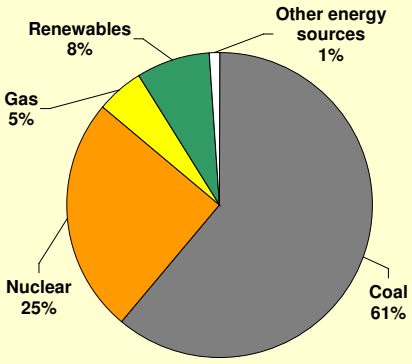
Supplier: Supplier Y

Phone: 0800 - XXXXXXXXXX

Website: www.supplier-y.com

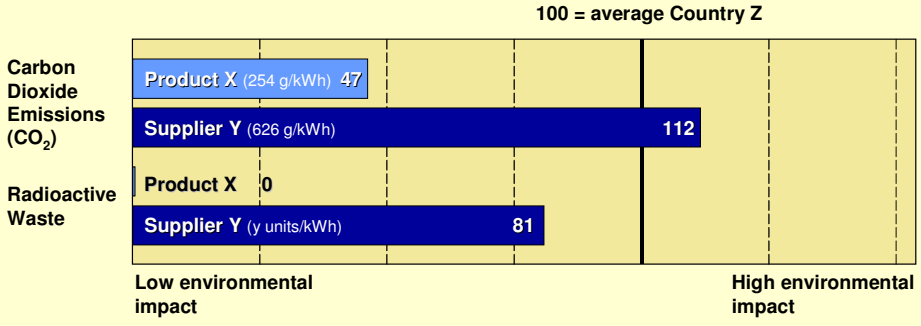
Electricity supplied by Supplier Y, 2002

Electricity supplied by Supplier Y was generated from the following fuel sources



Fuel source	Product X	Supplier Y	for comparison average consumption Country Z
Coal	**0%**	**61%**	**51%**
Nuclear	**0%**	**25%**	**31%**
Gas	**65%**	**5%**	**7%**
Other conventional energy sources	**0,0%**	**1,0%**	**3,5%**
Renewables (total)	**35,0%**	**8,0%**	**7,5%**
Hydro electric	24,5%	4,5%	3,5%
Wind	10,0%	3,2%	3,2%
Biomass	0,0%	0,3%	0,8%
Solar	0,5%	0,0%	0,0%
Other renewables	0,0%	0,0%	0,0%
15% of electricity sold by Supplier Y was imported			

Environmental Impact



To compare the environmental impact of electricity suppliers, see www. labelcompare.com

Norm EN - Electricity Directive 2003/54/EC

Appendix E – 4CE Programme of work

January 2002	Project commences
January – September 2002	**Phase 1**
Task 1.1	The European electricity market
Task 1.2	Supplier-generator interface
Task 1.3	Supplier-consumer interface
Task 1.4	How a label fits into the market
Task 1.5	Interviews with electricity industries
Task 1.6	Workshop 1 (11 September, Berlin)
Task 1.7	Phase 1 report
May 2002 – April 2003	**Phase 2**
Task 2.1	Consumer habits at present
Task 2.2	Draft labels for Focus Groups
Task 2.3	Focus groups
Task 2.4	Telephone survey
Task 2.5	Projection of expected results
Task 2.6	Phase 2 report
April – September 2003	**Phase 3**
Task 3.1	Proposed label design
Task 3.2	Policy considerations
Task 3.3	Cost benefit analysis
Task 3.4	Scenarios: impact on renewables
Task 3.5	Workshop 2 (19 May, London)
Task 3.6	Phase 3 report & final project report
January 2002 – September 2003	**Phase 4**
Task 4.1	Website
Task 4.2	Presentation to the EC (9 September 2002)
January 2002 – September 2003	**Phase 5**
Task 5.1	Project meetings
Task 5.2	Performance indicators

The 4CE project consortium

Environmental Change Institute, Oxford University (www.eci.ox.ac.uk) - Project Leader

The Environmental Change Institute (ECI) is Oxford University's multidisciplinary centre for the organisation and promotion of research and teaching on the environment. The ECI has co-ordinated and participated in a number of large EC contracts. Lower Carbon Futures (LCF) is the group dedicated to research on the rational use of energy and carbon reduction, with ten years experience in the provision of information, analysis and policy options to reduce the environmental impacts of energy use. Major areas of expertise are: consumer behaviour and energy use, market transformation policy, labelling and renewable energy.

Central European University (www.ceu.hu/envsci/)

The CEU was established in 1991 as a pan-regional university committed to promoting educational and academic development throughout the former socialist block of Central and Eastern Europe and the former Soviet Union (CEE). It seeks to contribute to the advancement of open societies in CEE by offering a system of postgraduate education in which ideas are creatively, critically, and comparatively examined. The CEU serves as an advanced centre of research and policy analysis and facilitates academic dialogue. The Department of Environmental Sciences and Policy of CEU is a centre of excellence for environmental scholarship, post-graduate education and training in CEE and has played a key role in addressing the CEE region's environmental legacies on an academic and professional level.

EVA (www.eva.ac.at)

Energieverwertungsagentur, the Austrian Energy Agency (EVA) was established in 1977 as a non-profit organisation. It is the Austrian energy research and policy institution in which the federal and the provincial administration and some thirty important institutions and corporations from a variety of economic sectors co-operate. EVA is the principal partner of the federal government in its effort to attain its energy policy objectives, which aim mainly at a stimulation of renewable energy sources, at a macro-economically efficient production and a rational use of energy, and innovative technologies. EVA is the Austrian Member of the European Energy Network EnR, leader of the Austrian OPET consortium and member of the AFB-nett.

IT Power (www.itpower.co.uk)

IT Power is a leading renewable energy consultancy company based in the UK with 20 years experience in the management and implementation of international projects. The company has key expertise in market studies, energy policy and economics, dissemination activities, organisation of seminars, as well as R&D, engineering design and project management. IT Power is part of the 'ELGREEN' project team, who are developing trading rules for green electricity in Europe and creating a Green Electricity Exchange model. IT Power has been particularly involved in the work concerned with the labelling of green electricity in the EU.

Öko-Institut (www.oeko.de/indexb.html)

The Öko-Institut (Institute for Applied Ecology) is one of the leading independent environmental research organisations in Germany. The Öko-Institut mission is to analyse and evaluate current and future environmental problems, and to develop and implement strategies and models for sustainable solutions. At present, the Institute's staff comprises about 80 scientists and engineers working at its Central Office in Freiburg and at the Berlin and Darmstadt offices. The Institute's Energy & Climate Division is working on problems of energy planning (systems analysis, scenario design), renewable and energy-efficiency technologies, utility regulation and implementation of sustainable energy strategies in liberalised markets and national and international climate policy.

Stockholm Environment Institute (www.sei.se/)

The Stockholm Environment Institute (SEI) is an independent, non-profit international research institute specialising in sustainable development and environment issues. SEI was established by the Swedish government in 1989. Its research programme aims to clarify the requirements, strategies and policies for a transition to sustainability. SEI's mission is to support decision-making and induce change towards sustainable development around the world by providing integrative knowledge that bridges science & policy in the field of environment & development.

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4CE

Consumer Choice and Carbon Consciousness for Electricity