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Towards sustainable energy systems
The role of deregulated electricity markets

MEMÒRIA

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Resumen

Durante los últimos 20 años los gobiernos de muchos países han empezado un proceso de liberalización de sectores clave como los de telecomunicaciones, transportes y energía.
Tradicionalmente, estos sectores eran considerados monopolios naturales, pero a finales de los setenta los principios bases del modelo de monopolio fueron criticados por muchos economistas.

El 19 de diciembre de 1996, la directiva europea 96/92/CE fue el comienzo de un proceso de reforma estructural de enormes dimensiones. La directiva introdujo una nueva tipología de mercado eléctrico europeo basada en la desregulación del sector.

El siguiente trabajo, en la primera parte, trata de analizar la reforma del mercado eléctrico mediante un estudio y una crítica de las directivas europeas y del estado de progreso de los países europeos en la satisfacción de los requerimientos de la reforma.
La segunda parte es una elucubración del autor sobre los resultados que la reforma puede lograr con respecto al desarrollo sostenible.
El propósito del siguiente proyecto es encontrar una respuesta a la siguiente pregunta:

"*Are the deregulated energy markets suitable to facilitate a development towards sustainable energy systems?*"

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Abstract

Since 1996 the EU15 countries have been restructuring the electricity sector.

The electricity market reform should make possible to achieve potential benefits in terms of improved efficiency in the electricity sector and in the economy through lower prices for customers, lower costs for producers and competitiveness.

The following work intends to explain how the reform works, to show the improvements of the electricity sector in the European countries and to analyze the new market from the point of view of the sustainable development.

1. Introduction

Over the last twenty years, governments in many countries have dealt with the liberalization process of network industries like telecommunications, postal services, transports and energy.

Traditionally, network industries were organized as State monopolies. This attitude was supported principally by the following reasons:

- There was a belief that such industries were natural monopolies and so it could be only one undertaking in the market.
- Monopolies were entrusted to the monopolist to provide a public service of general economic interest.
- The importance of these industries was very high and governments believed that it was fundamental to consolidate them in one firm which they could control.

In the late 1970s, the basic principles of the monopoly model were queried by the economists. They commenced to argue that while some market segments in network industries have natural monopoly attitudes, others do not.

The industrial sector started feeling largely penalized by the high costs of essential production inputs, like electricity, gas, transports, telecommunications…, which were provided by public monopolies.

Eventually, in the 1980s, the European Community commenced to put forward several directives with the aim to liberalize the various network industries.

On 19th of December 1996 European Directive 96/92/EC gave the go-ahead to a structural reform process of big dimensions. This directive introduced a new conception of market for electricity in Europe mainly based on the deregulation of the sector.

In the current political and economic background, the energy sources have to be considered the lifeblood of a country. The European Commission has decided to change

totally the traditional structure of the electricity market with the aim of achieving a new market more efficient from the economic, energetic and environmental point of view.

Traditionally, in the European countries, the electricity market was owned and managed by the State, which exercised the control of the whole supply chain from the electricity generation until the distribution to the final customer.
Both, household and large customers have been constrained to a monopoly supplier to obtain electricity.
The European Union has phased in open markets for energy supplies, lowering the barriers to suppliers and promoting choice for customers. As with goods which can now be moved and traded freely throughout the European Union, energy supply services can now be offered in a common European market. (European Commission, 2004, [13])

The reform commenced ten years ago, but, unfortunately, there is still a strong heterogeneity among the European countries. Despite the efforts, the European Community cannot yet reach a purely European market for electricity.

There are several documents that intend to analyze the electricity market reform.
The documentation can be divided into two main categories:

- Documents from sources correlated to the European Commission
- Documents from sources not involved in the European Commission

In the first category there is a large variety of information: analysis about very specific themes like the unbundling, and also global analysis that intend to give a less deep but wider view of the electricity market.
In the second category it is much more common specific information and there are not overall studies.

There is an important consideration. After a careful reading of documents from the first category the impression is that most of the time the information can no more be considered objective information, but it seems a defence of the decisions taken by the European Commission.

The criticisms that can be figured out from these documents are only about the policies of the individual countries or about the state of application of the directives by the countries. But it has never been put in doubt the efficiency of the community directives and the new market for electricity.

The documents that can be considered fundamental for the development of the work are:

- European Union, 1996. Directive 96/92/EC of the European Parliament and of the Council of 19 December 1996 concerning common rules for the internal market in electricity.
- European Union, 2003. Directive 2003/54/EC of the European Parliament and of the Council of 26 June 2003 concerning common rules for the internal market in electricity and repealing Directive 96/92/EC
- European Commission, 2005. Report on progress in creating the internal gas and electricity market.
- European Commission, 2004. Third benchmarking report on the implementation of the internal electricity and gas market.
- European Commission, 2004. The share of renewable energy in the EU. Country profiles. Overview of renewable energy sources in the enlarged European Union.

As stated before, in the second category the information is more specific and not always very useful for the development of the thesis. Anyway, some articles have been very helpful:

- Meeus, L., Purchala, K., Belmans, R., 2005. Development of the internal electricity market in Europe. Energy Policies, Vol. 18, Issue 6, pp. 25-35.
- Polo, M., Scarpa, C., 2002. The liberalization of energy markets in Europe and Italy. Conference "Monitoring Italy", Rome, Italy.
- Serralles, Robert J., 2004. Electric energy restructuring in the European Union: integration, subsidiarity and the challenge of harmonization. Energy Policies 34, pp 2542-2551.

The following work thesis is a contribution to a long-term project called *"Pathways to*

sustainable European energy systems" - an AGS[1] project funded by industry.

The overall aim is to study and evaluate pathways towards a sustainable energy system with respect to environmental, technical, economic and social issues. The focus is on the stationary energy system in the European setting. Evaluations will be based on a detailed description of the present energy system and follow how this can be developed into the future under a range of environmental, economic and infrastructure constraints. The proposed project is a response to the need for a large and long-term research project on European energy pathways, which can produce independent results to support decision makers in industry and in governmental organizations.

The overall question to be answered by the project is:

"How can pathways to a sustainable energy system be characterized and visualized and what are the consequences of these pathways with respect to the characteristics of the energy system as such (types of technologies, technical and economic barriers) and for society in general (security of supply, competitiveness and required policies)?"

This means to study how possible and different pathways can contribute to achieve a sustainable energy system. (Johnsson, Rydén, 2005, [25])

Regarding the project *"Pathways to sustainable European energy systems"*, the main goal of the following work is to intent to analyze the electricity market reform in Europe from the point of view of the sustainable development of the energy systems.

This means to analyze the electricity market reform and to make a point of its effectiveness.

The thesis intends to find an answer to the following question: "*Are the deregulated energy markets suitable to facilitate a development towards sustainable energy systems?*"

This work is divided in two main areas.

The first is a general analysis about the European electricity market with the purpose of giving an idea of the European Directives, the degree of deregulation, the instruments and

[1] AGS is the Alliance for Global Sustainability. See www.ags.chalmers.se

the policies of the market in Europe.
The second part intends to find out the problems and the opportunities with respect to the sustainable development of the energy systems which the electricity market reform is generating.

Through the general analysis of the European market it wants to map the current situation of the reform, explaining the key concepts and highlighting the degree of liberalization of the single countries in the EU15.
From the studies of the first part, the second section intends to make a critical analysis of the reform with respect to the sustainable development of the energy systems.
The objective is to explain what sustainable development of an energy system means, and, once cleared the concept, to study what the problems and the opportunities, which the policy instruments provided by the reform, are.

This master thesis wants to be a reflection instrument about which should be the main objectives of the energy policies in Europe. The report wants to question the *forma mentis* of the modern world according to which the economic growth is the main, and maybe the only way to improve the well-being level of the population.

2. The evolution of the electricity sector

In the following paragraphs we consider the gradual development of the power sector during its whole existence for over 100 years described by the International Energy Agency.

During these years, it has changed in structure and regulatory approach influenced by technical and economic developments.

2.1 1870s – 1945

In the first years, the developing industry was very fragmented, more than it is now, and it was largely privately owned, and, in many European countries, not particularly controlled. The grid kept on developing only in major cities or industrial areas. There was a great competition among suppliers who had to provide the infrastructure as well as supply.

The first attempts by national or local governments to guide the market came in the 1920s and 1930s. Governments were beginning to view electric power less as a luxury and more as an everyday necessity.

In the 1920s and 1930s, national and local governments started to try to control the market. The electric power was beginning to become part of the day life and was stopping to be considered only as a luxury.

In the first 1930s there was a large development of hydroelectric infrastructures that grew the grid until the rural areas. The industry developed also a lot of private and public companies owning and operating distribution facilities. By the way, transmission remained fragmented, because there was not an efficient network control. (International Energy Agency, 1999, [22])

2.2 1945 – 1960s

In this period things dramatically changed because new economic concepts began to be applied universally to deal with the negative economic behaviour which then characterised the most part of the industry: price wars, cartels and other anticompetitive behaviour. At the same time, technical progress was changing the economics of power generation and transmission.

The minimum efficient plant size increased dramatically, and the increasing economies of scale caused many of the old, small power companies to become uneconomic. Many European governments decided that the entire sector was a natural monopoly. So all small producers had to be merged in a single nation-wide monopoly, or some large regional monopolies. They thought that the best way to avoid monopolistic behaviour was public ownership.

France created EdF in 1946. Italy was the last European country to follow this trend by creating the state-owned monopoly ENEL in 1962.

The industry for electricity was considered to be a natural monopoly, so many governments brought into effect legislation that either explicitly forbade new entry into the power sector or exempted it from general competition law. One of the few notable exceptions to this rule in Europe is Spain, where they have never created any statutory entry barriers, and where there continued to be some competition. (International Energy Agency, 1999, [22])

2.3 1970s

The first doubt about the regulated monopoly utility emerged in the United States.

The 1970s were the years of the oil shocks, which raised the price of what was at that time the key input fuel to electric power. So a number of countries was encouraged to step up the pace of existing nuclear programmes, and others to start such programmes for the first time.

The United States, Europe and Japan simultaneously tried to substitute coal for oil, and near prohibition of the use of gas and oil-fired power generation.

During this period, other changes were occurring in the sector.

First, the real cost of nuclear generation grew, substantially due to inflationary expectations. At the same time, citizens in many countries expressed increased concern about the safety of nuclear plant operation and disposal of spent fuel. This resulted in the adoption of additional safety measures, the expectation of increased future costs associated with existing plants, and an increased perception of the risk of such operations.

Second, the price of natural gas in the United States fell substantially with the regulatory reform of that sector. This further reduced minimum efficient scale for generation.

Third, the petroleum cost increases caused much greater cost consciousness and prompted further research into power generating cost. This research figured out that, depending on the country; the era of large efficient scales for fossil generation was over.
Other research suggested that the generation side of the power business was perhaps not a natural monopoly anymore, and raised the question whether it ever had been. (International Energy Agency, 1999, [22])

2.4 1980s – 1990

Since the early 1980s a variety of new political, environmental and technological ideas commenced to exercise considerable pressure on the centralized, static and monopolistic European electric energy industry.
Leaders of this ideology were Margaret Thatcher in the United Kingdom and Ronald Reagan in the USA. The neo-liberal economic aims of liberalization of markets, which are to be reached through the opening of the market to the competition, the privatization of the own-state industries and the deregulation of key industrial sectors, offered a new alternative to what was commonly seen as a highly regulated and centralized electric energy sector. (Serrallés, 2004, [33])

2.5 1990s

During the last twenty years, the electricity demand in the current EU15 Member States has increased at an average rate of 1.1%. And demand will continue to grow with an average growth rate of 1.1% to 1.4% in the period until 2020. Demand for electricity is rising more rapidly than for any other type of energy and it is expected to continue to rise. (European commission, 2005, [15])
Moreover, it has to be considered the high energetic dependence of Europe from the countries which produce oil and gas, the strong political tensions that exist in the Middle East, and the environmental problem that by now can be considered a real emergency.
The cluster of these factors have led to the need of a structural reform of the electricity market with aims of economic and energy efficiency and environmental performances.

Consequently it has been growing the importance of as clean as possible and alternative energy systems like renewable and low consumption systems. The reform of the new electricity market should gear the whole Europe to complain these goals through lower prices for customers, lower costs for producers and competitiveness.

3. Electricity market reform

3.1 Electricity market and its problems

The analysis of theoretical issues and options tied to the design of the electricity sector reform must commence from the consideration of some characteristics that depend on the nature of the technology and the demand, which distinguish the electricity sector.

Steve Thomas summarized the special factors for electricity as follows:

- **Inability to store power**: unlike other products, it is not possible, under normal operating conditions, to keep in stock, ration it or have customers queue for it.
- **Need for supply and demand to match all times**: energy demand is for its nature aleatory and fluctuant and for a good operation of the energy system, demand for electricity has to be satisfied just in time.
- **Lack of substitutes**: electricity is the most diffuse form of energy and mostly is not possible to replace it with other kinds of energy.
- **Vital role in modern society**: a failure of the electricity system will lead to immediate and serious welfare and economic impacts.
- **Electricity is a standard product**: there is no better or worse electricity, and it means that the electricity market is purely price driven.
- **Environmental impacts**: electricity generation is one of the most important causes of green house gas pollutions.

3.2 The main goals of the electricity market reform

The energy market reform for electricity should produce, progressively, a liberalized and competitive electricity market across the European Union.

It should contribute to European energy policy objectives of increased competitiveness through better service for energy consumers, improved environmental protection, and greater security of energy supplies, while ensuring the continued achievement of basic public service requirements. (European Commission, 1999, [22])

Directive 96/92/EC and Directive 2003/54/EC have been defined to create a single and a competitive market for electricity for an enlarged European Union, where customers have choice of supplier, and where all unnecessary impediments to cross border exchanges are removed.

Substantially, the directives would have to provide the way (the European single market for electricity) thanks to which is possible to achieve potential benefits in terms of improved efficiency in the electricity sector and in the economy through lower prices for customers, lower costs for producers and competitiveness.

EU Directive 96/92/EC says: *"Establishment of the internal market in electricity is particularly important in order to increase efficiency in the production, transmission and distribution of this product, while reinforcing security of supply and the competitiveness of the European economy and respecting environmental protection."* (EU, Directive 96/92/EC, Preamble 4, [17])

The International Energy Agency divided the different main goals in categories.
The first category consists of objectives which are not being met effectively in the pre-reform situation; the main is the economic efficiency of the electricity sector and, hence, its contribution to the wider performance of economies.
The second category includes objectives that are being met in the pre-reform situation but probably at disproportionate cost, the main is: security of supply.
Finally there is a third category that includes the objectives, which straddle the two previous categories: environmental performances.

To summarise, the main goals of the energy market reform, which can be identified, are:

1. Economic efficiency
2. Security of supply

3. Environmental performances

European Commission assure that the single market for electricity has been creating to guarantee:

- Increased efficiency by introducing competitive forces into the electricity market.
- To settle electricity price levels those vary enormously between Member States.
- Increasing efficiency to lead to lower prices.
- To provide essential public services such as ensuring electricity supply to all customers, protecting the old and disadvantaged, and protecting the environment.
- To require less reserve capacity.
- By the introduction of competition electricity producers should have to make better use of resources in the electricity production process to avoid wastes, and consequently should generate less pollution.
- By the introduction of competition, customers acquire the right to choose their supplier of electricity.
- Savings in investment costs
- Higher labour productivity
- Development of new energy services

3.2.1 Economic efficiency

In the market environment nobody does anything if he is not sure about possible incomes. Economic efficiency is a *conditio sine qua non*: it means that it is not possible to achieve security of supply goals or environmental performances without assuring economic efficiency.

Not until the new market provides economic benefits can the other objectives be achieved. Electricity market reform is a strategic operation which involves different markets, different countries and different policies; it must be economic reliable because it deals with the whole European market.

The energy market can be defined economically efficient when it guarantees the following sub-objectives:

- Improved efficiency in the production
- Improved efficiency in the transmission
- Improved efficiency in the distribution
- Lower costs
- Lower prices
- Better allocation of resources
- Improved risk allocation

3.2.2 Security of supply

Electricity is the lifeblood of our modern economy.

Due to its usefulness and the fact that it is practically a not substitutable good for many end-users, the importance of electricity continues to grow for the increasing number of essential appliances in the home, for the expanding health and services sectors, for the information and communications technologies, for energy efficient industry applications. (EURELECTRIC, 2003, [5])

The International Energy Agency defines three different types of security of supply:

- **Short term security of supply** (system reliability): it refers to the short term capability of the power industry to cover demand at all times
- **Long term security of supply** (adequate capacity investment): it refers to the power sector's capacity for generating electricity
- **Security of input energy supply** (fuel diversification): it refers to the degree of diversity of primary energy sources

A good level of Security of supply has to guarantee:

- Electricity supply to all costumers
- Improved maintenance services and networks
- Perfect balance between demand and supply
- Measures to cover pick demand
- Measures to deal with shortfalls of one or more suppliers
- Less blackouts
- Less brownouts

3.2.3 Environmental performances

During the last three decades the environmental challenge has gained increasing importance: a will of protection of the environment and a strong criticism towards the not environment-friendly technologies like nuclear and fossil energy are being disseminating very quickly in the European society.
With electric energy currently responsible for almost 35% of global CO2 emissions (IPCC, 2001, [21]), the EU and the member states have established ambitious emission-reduction goals to comply with Kyoto protocol.

With such premised, it is clear that the new energy market reform for the electricity in Europe cannot omit absolutely the environmental theme.
The most difficult challenge is to conciliate economic goals with ecological goals because, generally, whichever type of environmental policy is not economically feasible or attractive.

Good environmental performances require:

- Less green house gas emissions
- Lower consumption of energy
- Development of renewable
- Lower waste of energy

- Global cooperation

3.3 Key issues

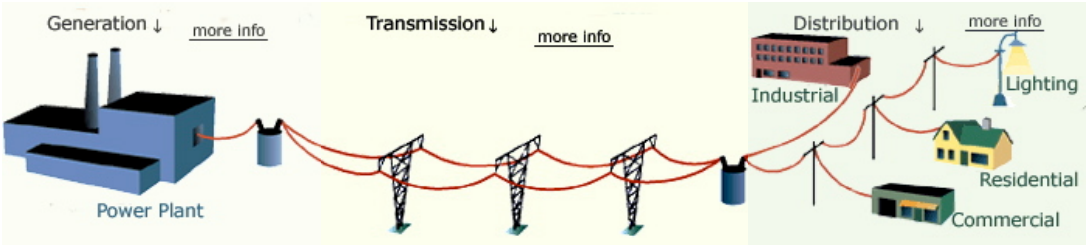
The European Directives and the national plans have designed a common pathway for energy markets to complete the transition from an highly regulated, centralized monopoly to a transparent competitive market in electricity built on the principle of the Third Party Access, unbundling of the incumbent activities and consumer choice.

Some key points must be addressed in the implementation of the liberalization process, which poses both theoretical and political challenges.

3.3.1 The electricity supply chain

In order to arrive to the final customer, electricity energy has to be produced by the central, and then it has to be transmitted through the grid and distributed in the places of use.

Four main activities can be distinguished:



- **Generation:** is the transformation of some other form of energy into electric energy, either chemically through the combustion of fossil fuel such as coal, oil or gas, or physically through the use of nuclear fission, or kinetic energy from the wind or water motion.

- **Transmission:** is the high-voltage transport of electricity, it refers to transportation over an interconnected network, which is shared by all end users.

- **Distribution:** is the low-voltage transport of electricity, generally from the transmission system to the end user, or between generator and end user

- **Supply:** is the final process in the delivery of electricity to the consumer, it is contracting for, and selling of electricity to the end user, and includes all the services related to these activities.

3.3.2 Unbundling

Unbundling means separation. This is one of the key principles of the reform; it is considered an unavoidable step to approach the goals of the new electricity market.
There are two different types of disaggregation that countries have to achieve: vertical and horizontal.
Big companies are motivated to achieve high degrees of conglomerate to develop significant economies of scope, of scale, or of coordination. But this pursuit of efficiency can be at the expense of competition, because this is the way to acquire strong or dominant market position.

Vertical disaggregation has to break up the supply chain, through the separation of generation, transmission, distribution, and supply.
Horizontal disaggregation has to increase the number of entities active at the same level of the industry.

Vertical unbundling

Vertical unbundling is the separation of potentially competitive generation and supply from the natural monopoly activities of transmission and distribution networks.
The effective separation of generation and transmission activities prevents non-competitive behaviour by incumbent generators and assures non-discriminatory network access to others. Similarly, unbundling supply from distribution is to prevent discriminatory behaviours at the supply level.

The main reason is to avoid any kind of discrimination.
The International Energy Agency summarizes three different forms of discriminations:

- **Discrimination between generation and transmission**: a transmission owner who also owns generation capacity has the incentive to discriminate against the other

generators and to favour himself. To limit the access to the grid to the other generators which want to distribute their electricity, the transmission owner has the possibility to discriminate by setting high access prices, reserving transmission capacity for its own generation units, providing unequal access to technical information, or imposing abusive technical requirements.

- **Discrimination between generation and distribution:** the owner of distribution assets may favour his own generation and discriminate against other competing generators.
- **Discrimination between distribution and end user supplier:** the owner of the distribution grid has the incentive to discriminate the end user suppliers; competitors in the end-user supply market can be discriminated through abusive distribution pricing, cross subsidisation, unnecessary technical requirements and procedural and implementation delays.

Unbundling can take the form of functional, accounting, legal or ownership separation.

- Functional unbundling: investors are allowed to enjoy revenue streams from generation and transmission, but the operations of the grid are in the hands of strictly separate hands.
- Accounting unbundling: the accounts of the different businesses, which make up the company, are ring-fenced.
- Legal unbundling: there is a full legal separation between the two different entities.
- Ownership unbundling: is the strongest form of separation, it implies the full structural separation.

Horizontal structure

The aim of horizontal separation is to create sufficient competition and so, utopisticly, to achieve an atomistic market in which there are a large number of small producers and consumers, each so small that its actions have no significant impact on others; and the market sets the price that they must choose.

According with Polo and Scarpa, to facilitate competition and to encourage new entries in the long term there are two alternative ways:

- To force the incumbent to divest capacity until a sufficiently competitive structure has been achieved.
- To block the incumbent's expansion, relying on entry as the force, which will reduce prices.

The first approach assures the most immediate results. Under a fragmented structure, prices are, supposed to be set near the competitive benchmark.
On the other hand, the second one is more gradual and accepts that in the short run prices will be high, and because of the higher prices new competitors will be attracted in the market.

3.3.3 Third party access

"*Member states shall ensure the implementation of a system of third party access to the transmission and distribution systems based on published tariffs, applicable to all eligible consumers and applied objectively and without discrimination between system users.*" (EU, Directive 2003/54/EC, Article 20, [19])

Equal access to the transmission and distribution networks constitutes one of the more challenging aspects of transition to a liberalized electricity energy market.
To provide a non-discriminatory third party access is a key element to obtain a free and competitive market, especially to have no discrimination in the access to transmission and distribution grids.

According with Polo and Scarpa, the first crucial issue is the redesign of the proprietary and industrial structure of the industry, in order to eliminate the incentive of the network owner to distort competition downstream.
Hence, it is studied that the basic externality comes from the fact that the access to the network increases the competition in the retail supply market, modifying the distribution of market shares and profits.
If the owner of the network is involved also in the final market, giving access to a competitor implies a reduction in the income. Hence, the natural solution is, refusing the

access, to keep the final market monopolized through excessively high access prices or a simple refusal to supply.

3.3.4 Customer choice

A key element to open up the market to competition for the electricity market reform is choice.

All consumers have to be able to choose their electricity supplier.

This will be achieved in a step-by-step approach, commenced from large consumers in 1999 until reaching household customers in 2007.

European Directives established the dates for a gradually opening market:

- From February 1999, about 26% of the market had to be open
- From February 2000, about 28% of the market had to be open
- From February 2003, about 33% of the market had to be open
- From July 2004, all non-household were allowed to choose the supplier
- From July 2007, all customers will be allowed to choose the supplier

3.3.5 Market architecture

A market is an environment designed to help buyers and sellers interact and agree on transactions.

To fulfil the requirements of a liberalised market is necessary that also electricity buying and selling mechanism is as much liberalized as possible.

Liberalized market means a market where the prices are basically set by the intersection of the demand curve with the offer curve.

Unfortunately, due to the particular nature of this good, the participation of a "*super partes"* actor is unavoidable to take some measures for assuring total equilibrium between energy generation and energy demand.

In the following paragraphs the three principal types of market are analyzed:

- Bilateral trading
- Power exchange platform

- Managed spot market

Bilateral trading

Buyers and sellers can buy and sell electricity through bilateral contracts without involving any external authority or organization.
There are two different forms of bilateral trading:

- **Forward and long term trading**: this kind of contracts is flexible because private parties manage them, and permits to satisfy their needs. Normally this trading is done to cover the forecast consumption portfolio in advance and over long period of time.
- **Over the counter trading**: as real consumption is not completely predictable and electricity cannot be stored, there is often the need of additional capacity in very short-term. These transactions involve smaller amounts of energy, the costs are higher and there is the problem of non-anonymity.

Power exchange platforms

The transaction costs of fine-tuning a portfolio via an over the counter type of spot market are high, hence a mixture of private and public initiatives of generators, suppliers, and transmission system operators has led to the creation of trading platforms operating day-ahead and facilitating anonymous trade (Meeus, Purchala, Belmans, 2005, [28]).

A trading platform basically operates as follows.
Generators make bids to supply a certain amount of electrical energy at a certain price for every hour of the day.
Then the trading platform operators for every hour rank these offers in order of increasing price and a curve can be drawn to represent the supplier function for the market.

In the same way consumers declare their availability to buy electricity in terms of quantity and price per hour and the demand curve of the market is built ranking their offers in decreasing order of price.

The intersection of the supply and demand curves represents the market equilibrium point. All the bids submitted at a price lower or equal to the market equilibrium price are satisfied and generators can produce the amount of energy that corresponds to their accepted bids. Therefore, all the offers submitted by the consumers at a price higher or equal to the market equilibrium price are satisfied and in this way the trading platform guarantees minimum possible cost for the consumers.

Managed spot market

While a large proportion of the electrical energy can be bought and sold through an unmanaged open market, there is a smaller part that has to be managed by system operators.
Electrical system is subject to tightening technical constraints.
The most important is the need of a continuous and instantaneous balance between the amount of energy filled into the grid and the amount of energy taken from the grid.

Unbalances are frequently in the electricity market: mostly, buyers need a quantity of energy higher than they forecasted, and sellers have to provide more electricity than they predicted.
A managed spot market is able to fix quickly the production to the demand of electricity by adjusting the production of flexible generators.

4. European directives

The Council of Ministers adopted a Directive concerning common rules of the internal market in electricity on 19th December 1996, 96/92/EC.
This was replaced by Directive 2003/54/EC of 26th June 2003.

At the same time European Commission established others directives, which have relation with the reform of electricity market in Europe, to improve its effectiveness:

- Directive 2001/77/EC
- Directive 2005/89/EC

4.1 Directive 96/92/CE

The 1996 Directive established rules in four areas:

- Generation
- Transmission and distribution
- Retail supply
- Unbundling

4.1.1 Generation

There were two procedures that Member States could adopt for the construction of new power plants:

- Tendering procedure
- Authorisation procedure

With tendering, the power system continued to be centrally designed. There was an official body in charge that established how much capacity that would need to be built and the specifications bidders that would need to be met. It invited tenders for this, and the best bid won.

With authorisation, the timing and the location of generating capacity investments was the responsibility of individual investors. Member States laid down the criteria that the producer had to comply, in terms of factors such as safety and the commercial credentials of the company.
From the point of view of competition, authorisation was clearly the Commission's preferred option because a free market requires free entry and exit.

4.1.2 Transmission and distribution

Generators and retailers need to be guaranteed they have free access to the electricity market, and so there were measures to allow all competitors would be able to get non-discriminatory access to the network.
There were three possible choices:

- Negotiated third party access model
- Regulated third party access model
- The single buyer model

In the negotiated third party access model, prices for access to the network were negotiated with the network owners. The network owner could refuse access in case of lack of capacity.
The explanatory notes established that the network operators would not be obliged to build new capacity in response to a request for access if there was insufficient capacity.

In the regulated third party access, tariffs for access to the network were published. As with negotiated third party access, the network owner could refuse access on grounds of lack of capacity, but the explanatory notes did not make it clear whether the network owner had to build new capacity to satisfy a request for access that could not immediately be complied with. (Thomas, 2005, [34])

The single buyer model required the creation of a public body that was responsible for the purchasing and the sale of the country's electricity.
The Single Buyer option was not very clear and the provisions were muddled and it is not clear how the Single Buyer option would have worked in practice. (Thomas, 2005, [34])

4.1.3 Retail supply

The Directive required Member States to open their retail market for large users and distributors:

- By February 1999, 26% of the demand had to have choice (i.e. minimum consumption: 40GWh/year)
- By February 2000, 28% of the demand had to have choice (i.e. minimum consumption: 20GWh/year)
- By February 2003, 33% of the demand had to have choice (i.e. minimum consumption: 9GWh/year).

4.1.4 Unbundling

Aside from avoiding a discriminatory access and conflicts of interests, European legislation provided a separation of competitive from non-competitive segments.
Basically, a separation of accounts was required.
Therefore, the transmission and distribution system operators could be part of companies with other interests in the electricity sector, for example as generators or retailers but had to operate on objective and non-discriminatory procedures that did not favour, for example, power plants owned by them.
Network companies had to prepare separate accounts for their generation or retail activities to demonstrate that it was not being any kind of unfairly subsidised by their network activities.

4.1.5 The lacks of the directive 96/92/CE

Directive did not require a sector regulator, and without an official body that supervised and regulated constantly the electricity sector, it seemed very hard that unfair behaviours were avoided.

The following three areas were where the most important lacks were present:

- Market concentration
- Creation of a wholesale market
- Retail market opening

Market concentration

Excluding Luxembourg, because of its size, the market situation among Member States was:

- 6 were effectively monopolies: Belgium, France, Greece, Ireland, Italy and Portugal.
- 4 were effectively duopolies: Germany, Spain, Denmark and the UK.
- Only 4 had potentially competitive structure: Austria, Finland, the Netherlands and Sweden

Creation of a wholesale market

The directive established provisions to try to ensure producers had access to the network, but there were no provisions to ensure that competitive producers had a sensible possibility of finding a market for their power.
It means that mostly new generators, which could enter in the market, did not find anybody to sell their electricity power to.

The separation of accounts and the negotiated third party access were not sufficient: the problem was the possibility for the integrated companies to get around the rules for the non-discriminatory access to the networks and in this way to avoid a market opening to the competence. (Thomas, 2005, [34])

Retail market opening

No more than a few thousands of the very largest consumers would be given choice even six years after the Directive was passed and countries could meet the requirements partly by allowing distribution companies to shop around for their energy supplies. (Thomas, 2005, [34])

4.2 Directive 2003/54/EC

In June 2003, European Commission decided to introduce a new Directive to accelerate market opening, to deal with the criticism on network access and regulation and to eliminate the less liberal options.

The Directive established rules in the following areas:

- Generation
- Transmission and distribution
- Retail supply
- Unbundling

4.2.1 Generation

Since this Directive, there is only an option that Member States can adopt for the construction of new power plants: authorisation procedure.

Tendering procedure would be allowed only according to some special criteria.

4.2.2 Transmission and distribution

The negotiated third party access option and the single buyer option were eliminated.

The only possible option is the regulated third party access, but it is important to underline that the other options have not almost been used.

4.2.3 Retail supply

The new Directive accelerated the process:

- By July 1, 2004 all non-household customers were allowed to choose the supplier
- By July 1, 2007 all consumers will be allowed to choose the supplier.

4.2.4 Unbundling

New directive has strengthened the unbundling rule.

The basic elements of the new unbundling regime are the following:

- Legal unbundling of the transmission system operator and distribution system operator from other activities not related to transmission and distribution.
- Functional unbundling of the transmission system operator and distribution system operator, in order to ensure its independence within the vertically integrated undertaking
- Possibility of exemptions from the requirements of legal and functional unbundling for distribution system operators
- Accounting unbundling is a requirement to keep separate accounts for transmission system operator and distribution system operator activities.

APPLICATION OF UNBUNDLING RULES TO TSOS AND DSOS

	Legal Unbundling	Functional Unbundling	Accounting Unbundling
TSO	+	+	+
DSO above 100.000 customers	Exemption possible until 1.7.2007	+	+
DSO below 100.000 customers	Exemption possible	Exemption possible	+

4.3 Directive 2001/77/EC

On 27th September 2001, European Commission introduced Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources in the internal electricity market: "*The purpose of this Directive is to promote an increase in the contribution of renewable energy sources to electricity production in the internal market for electricity and to create a basis for a future Community framework thereof."*(EU, Directive 2001/77/EC, Article 1, [18])

The renewable electricity directive introduced an overall target for renewable electricity of 22% indicative share of electricity produced from renewable energy sources in total Community (EU15) electricity consumption by 2010.
From this 22%, targets for each country have been defined.

4.4 Directive 2005/89/EC

The challenge of security of supply was faced in little determined way in Directive 2003/54/CE. Security of supply does not have the status of a priority aim of the Directive.

On 18th January 2006 European Commission introduced Directive 2005/89/EC, "*this Directive establishes measures aimed at safeguarding security of electricity supply so as to ensure the proper functioning of the internal market for electricity and to ensure:*

- *An adequate level of generation capacity*
- *An adequate balance between supply and demand*
- *An appropriate level of interconnection between Member States for the development of the internal market"*(EU, Directive 2005/89/EC, Article 1, [20])

Basically Directive says that governments are responsible for guaranteeing an adequate level of security of supply in their own country: "*Member States shall ensure a high level of security of electricity supply by taking the necessary measures to facilitate a stable investment climate and by defining the roles and responsibilities of competent authorities, including regulatory authorities where relevant, and all relevant market actors and publishing information thereon..."*(EU, Directive 2005/89/EC, Article 3, [20])

It is Member States' responsibility to assign the rules and tasks to the different actors, like generators, transmission system operators and distribution system operators to ensure security of supply.

5. About Directives

5.1 About Directive 96/92/EC and Directive 2003/54/EC

The process of market electricity reform for Europe officially begun 10 years ago; during these years several directives, whose impact has not been quite convincing, have been put forward.

Perhaps it is a little premature to define the new European market for electricity as a failure, mainly, due to the fact that it has not yet concluded the market opening stage, though it is clear that all of the initial objectives have not been reached.

There are three main goals that can be extrapolated from the official releases, the Directives, the green and white papers of the European Commission. They are economic efficiency, security of supply and environmental performances. However the ocean that separates Europe from these objectives is still very wide.
As stated in chapter 3, it is not possible to steer the whole market toward no lucrative scope if economic security is not guaranteed, and this would seem to be the way undertaken by European Union.
Directives 96/92/EC and 2003/54/EC are evidently geared toward an economic efficient and liberalized market.

This is, probably, the right strategy to achieve general consent and cooperation from a market whose main actors are not longer exclusively state bodies, but now includes private investors.

From a classical economic and theoretical point of view, Directives are faultless: a liberalized and European market, based on competitiveness should reduce the costs, diminish the prices and increase technical and economic efficiency…

The problem is that this does not appear to be happening: prices continue to vary among the different countries and there is no a EU wide convergent trend. Fragmentation at the

different levels of the supply chain is not always present (especially at the generation level). There is strong heterogeneity in progress towards the choice for customers, though there is not great enthusiasm for the construction of infrastructure necessary for cross-border exchanges in electricity. This is probably because some countries prefer to safeguard their own market from foreign competition.

One of the indicators of inertias within individual member states is the fact that some countries opened their market well before Commission deadlines whereas others opened at the last possible moment.

As such the decision taken with Directive 2003/54/EC to bring forward the opening deadlines would not have been a good idea, because it would have forced some countries to accelerate their process, and this might not have brought about satisfactory results.

Finally there is a deficit of authority emanating from the commission resulting in a lack of implementation and binding directives.
Generally the European Commission gives countries total freedom on what level to apply the directives and this makes the situation worse with respect to coordination and homogeneity in the European market for electricity.

5.2 About Directive 2001/77/EC

This directive could be a good point of departure to spread the production of energy from renewable sources; however two main lacks can be identified:

- There is no connection between this directive and the electricity market reform
- The targets, which have been fixed, are only indicative

Among the electricity market reform goals, there is also the task of environmental performances. It was clear the deficiency of Directive 96/92/EC on this topic, and it was clear the growing awareness of the environmental challenge by society.
So, Directive 2001/77/EC has been created to stimulate energy production from renewable sources. Unfortunately, there is no any refer to the new dynamics produced by the

liberalized market, but only some advice about the implementation of the use of renewable sources.

The second criticism is about the lacks of authority from European Commission. Only indicative targets have been defined, and so countries may not comply with the targets, because they are not mandatory.

Analyzing the progress that have been got until now by individual countries, it is obvious that the new market for electricity is not collaborating on the spread of the use of clean energy sources; such results can be seen in the summary table.

5.3 About Directive 2005/89/EC

Probably, the main lacks of Directive are two:

- The excessive action freedom left to the individual countries
- To consider that a liberalized market can achieve by nature a high level of security of supply

Scope of this Directive should be supporting Directive 2003/54/CE safeguarding security of electricity supply, defining rules and parameters to achieve a minimal level of security in the whole continent.
Unfortunately, Directive limits itself to give qualitative advice based on unexceptionable concepts like security, transparency, no-discrimination, etc… neglecting quantitative parameters that would homogenize security of supply in Europe.
Certainly, this criticism is still more valid considering that we are trying to reach the goal of the single European market for electricity, actually, if the single market was achieved, it would develop strong interdependences between different countries, it means some countries would import electricity from abroad and some other would export it abroad. Consequently, security of supply would not be a simply national affair, but the ability of a single country to cope with emergencies also would depend on other countries.

During the last years, the symptoms of this problem have been seen in United States and in Europe where some security of supply emergencies happened, causing, through chain reactions, huge and long blackouts.
For these reasons it is absolutely important to try to face the problem of security of supply from a global point of view, and so looking for a European solution.

The second criticism is about the consideration that a liberalized market by nature can assure security of supply.
In a competitive market, decisions on investments are taken by private investors with no explicit care about system security, but only with a view of profitability.
In the competitive parts of the market, no one is explicitly charged with responsibility for overall system security: it is assumed that a number of private firms, interested only in private profit, will collectively act to ensure adequate security levels.
Under the old monopoly systems there was generally an in-built bias toward "excessive" security-levels of security.
Under a competitive system the level of security could fall because private investors will be unwilling to maintain excess level of capacity, with the effect of depressing prices in a competitive market. (Lieb-Dòczy, Borner, MacKerron, 2003, [1])

5.4 Summary tables

Table 5.1 Directive 96/92/EC and directive 2003/54/EC

	Directive 96/92/EC	**Directive 2003/54/EC**
Generation	Tendering procedure Authorisation procedure	Authorisation procedure

Transmission and distribution	Negotiated third party access model Regulated third party access model The single buyer model	Regulated third party access
Retail supply	By February 1999, 26% of the demand had to have choice (40GWh/year) By February 2000, 28% of the demand had to have choice (20GWh/year) By February 2003, 33% of the demand had to have choice (9GWh/year).	By July 1, 2004 all non-household customers were allowed to choose the supplier By July 1, 2007 all consumers will be allowed to choose the supplier
Unbundling	Accounting unbundling	Legal unbundling Functional unbundling Accounting unbundling

Table 5.2 Renewable targets for each country

COUNTRY	RES-E % 1997	RES-E % 2010
Belgium	1,1	6,0
Denmark	8,7	29,0
Germany	4,5	12,5
Greece	8,6	20,1
Spain	19,9	29,4
France	15,0	21,0
Ireland	0,84	3,6
Italy	16,0	25,0
Luxembourg	2,1	5,7
Netherlands	3,5	9,0

Austria	70,0	78,1
Portugal	38,5	39,0
Finland	24,7	31,5
Sweden	49,1	60,0
United Kingdom	1,7	10,0
Community	13,9	22,0

6. Map of the European electricity market

The liberalization reform, started through the communitarian directives for the electricity sector, is not yet successful in producing a completely convergence process in terms of competitiveness, electricity costs and opening degree among the Member States.

The following paragraphs intend to explain quantitatively the degree of development of the new market for the electricity.
Analyzing the following figures it can be noted the lack of homogeneity presents in the process of the electricity market reform.
Mainly, this is due to the strong differences of the productive characteristics present in the Member States, the different opening policies of the market, the different interpretation of the communitarian directives and to the strong constraints of the infrastructure that prevent an efficient integration of the national markets.
Although it is appropriate to underline that the reform, which the European Commission has started, is based on a gradual advance, and so this deficit of coordination could be partly justified.

The following study consists of the analysis of the parameters relating to 6 key aspects of the reform:

- Competitiveness
- Vertical unbundling
- Prices
- Cross-border exchanges
- Security of supply
- Environmental performances

6.1 Competitiveness

Table 6.1 reports the percentage of opening market of the individual Member States.
10 countries out of 15 have a totally open market, and 14 countries out of 15 have at least opened the market to all the non-household users.

In theory, from the 1st July 2007 all Member States should open completely their electricity market, and it is possible that the objective get reached. Although this does not mean that the reform is successfully concluded, because the degree of opening market is only a small step toward the complete electricity market reform.

Table 6.1 Degree of market opening (European Commission, 2005)

	% of market opening	Size of open market (TWh)	Eligibility threshold
Austria	100%	59	-
Belgium	90%	77	[2]
Denmark	100%	34	-
Finland	100%	87	-
France	70%	330	Non HH
Germany	100%	524	-
Greece	70%	36	Non HH[3]
Ireland	100%	24	
Italy	79%	245	Non HH
Luxembourg	57%	3	20GWh
Netherlands	100%	114	-
Portugal	100%	48	-
Spain	100%	242	-
Sweden	100%	138	-
UK	100%	361	-

The number of clients that change supplier is a natural indicator of the efficiency of competitiveness.

If the customers have difficulties to change supplier, especially the large users that are very motivated for saving as money as possible, probably there is a problem in the market.

[2] Full market opening in the Flanders region. Non-household in other regions
[3] All customers in non-interconnected islands are non-eligible

This does not mean that every customer has to change supplier, but in a competitive market there should be some switching.

The customers, who have changed supplier, in most of the cases, are less then 50%.
It means that there is not a regular negotiation between customers and suppliers, and frequently there is a dominant player.
Experts think that at least one every two customers should change supplier to identify a good level of competition in the market.

Generally, when there is a change of supplier, customers switch from the old supplier to another national supplier. The penetration by foreign companies is very low and this lack proves the deficit of integration in the European market.
Mostly, the foreign suppliers represent less than 20% of the market. The only exceptions are the markets in regions quite well integrated and countries where suppliers have been acquired by foreign companies.

The states with a good level of switching are Finland, Sweden and UK, where also a high percentage of small consumers has changed supplier.
It is important to underline that in several countries, the new market has not yet been totally opened; therefore it would be right to analyze only the situation of the large consumers, because the market for them is open in every Member State.
Considering only this part of the market, the results which have been reached are better: Denmark, Finland, Ireland, Italy, Sweden and UK have overcome the threshold of 50% of switching, and in Austria 100% of large and very large users have renegotiated with their supplier.
On the other hand, the countries that have not yet reached an adequate level of switching are France, Greece and Portugal.

Table 6.2 Volume of electricity consumption having switched by group - cumulative since market opening (European Commission, 2005)

	USER		
	Large and very large industrial	**Small-medium industrial and business**	**Very small and household**
Austria	29%[4]	29%	4%
Belgium	20%	10%	
Denmark	>50%	15%	
Finland	>50%	82%	30%
France	15%		0%
Germany	41%[5]	7%	5%[6]
Greece	2%	0%	0%
Ireland	>50%	15%	9%
Italy	60%		0%
Luxembourg	25%	3%	0%
Netherlands	n.d.	n.d.	11%
Portugal	16%		
Spain	25%	22%	19%
Sweden	>50%	n.d.	29%
UK	>50%	>50%	48%

High level of concentration characterizes the electricity generation sector.

It is not yet possible to talk about concentration at European level, because the national markets, as stated before, are too much isolated and so a country where the market is very fragmentized cannot make up for the high concentration in another country (the only exceptions are the Scandinavian and Britannic markets where not even a problem of national concentration is present).

[4] 100% have renegotiated with their existing supplier
[5] The remaining approximately 65% have renegotiated with their existing supplier
[6] A further approximately 25-50% have renegotiated with their existing supplier

Hence, the countries that should improve their situation are Belgium, France, Greece and Ireland where the number of companies with at least 5% share of production capacity is small and the share of largest three producers is higher than 90%. Therefore in these states there is oligopoly or including monopoly.

Table 6.3 Wholesale market position (European Commission, 2004)

	Number of companies with at least 5% share of production capacity	**Share of largest 3 producers**
Austria	5	54%
Belgium	2	95%
Denmark	2	40%
Finland	10	40%
France	1	96%
Germany	5	72%
Greece	1	97%
Ireland	2	93%
Italy	5	60%
Luxembourg	1	88%
Netherlands	4	69%
Portugal	3	76%
Spain	3	74%
Sweden	10	40%
UK	8	39%

In some countries the number of supply companies is very high, but, mostly, these companies are affiliated to distribution companies, and frequently these suppliers have relationships with certain generation companies. (European Commission, 2005, [16])
Therefore the market is not totally free, and several times, these relationships at the different levels of the supply chain drive it.

In theory it would be possible to enter the market for the companies which wanted to be pure suppliers, easily buying the energy in the wholesale market and selling it to the clients. But in practice this type of supplier has to be a price taker in the wholesale market and could find it difficult to maintain an own and independent price policy for the final customers because the price depends on the price negotiated with the principal generators. (European Commission, 2005, [16])

In the following table it can be noted that in terms of market share and biggest actors the situation is quite similar between generation and retail market.
Summarizing, Belgium, France, Greece, Ireland and Portugal are the countries which should "atomize" their retail market.

Table 6.4 Retail market position (European Commission, 2004)

	Companies with market share over 5%	Number of fully independent suppliers (no network affiliates)	Market share of largest 3 companies large industrial users	Market share of largest 3 companies small/medium businesses	Market share of largest 3 companies very small commercial/household
Austria	5	4	60%		
Belgium[7]	3/2	14/6	100%/92%	100%/99%	94%/100%
Denmark	-	3	-	-	-
Finland	5	<5	-	35-40%	
France	1	20	91%	97%	96%
Germany	4	13	-	-	-
Greece	1	10	97%	97%	100%
Ireland	3	7	99%	99%	99%
Italy	6	119	33%	12%	93%
Luxembourg	4	4	94%		95%
Netherlands	3	18	-	-	83%

[7] Belgium data Flanders/Wallonia

Portugal	2	4	98%		
Spain	5	20	82%	86%	85%
Sweden	3	-	50%		
UK	6	3	65%	66%	59%

6.2 Vertical unbundling

As stated in chapter 3, the unbundling is a principle of the reform, because vertical separation should assure non-discriminatory behaviours.

As far as unbundling at transmission level is concerned, the situation is quite good because most of Member States satisfy the minimum requirements of the Directives.

Some countries have adopted also the ownership unbundling assuring a stronger fair behaviour.

Table 6.5 Unbundling of network operators: electricity transmission (European Commission, 2006)

	Legal unbundling implemented?	Functional unbundling implemented?	Accounting unbundling implemented?	Ownership unbundling implemented?
Austria	Y	Y	Y	N
Belgium	Y	Y	N	N
Denmark	Y	Y	Y	Y
Finland	Y	N	Partly	Y
France	Y	Y	Y	N
Germany	Y	Y	Y	N
Greece	N	N	N	N
Ireland	N	Y	Y	N
Italy	Y	N	N	Y
Luxembourg	Y	N	N	N
Netherlands	Y	Y	Y	Y
Portugal	Y	N	N	Y
Spain	Y	Y	Y	Y

Sweden	Y	Y	Y	Y
UK	Y	Y	N	Partly

At distribution level, the unbundling process is slower with respect to transmission level, probably due to less close deadlines and to the presence of more players. In fact, the distribution market is characterized by a higher number of participant companies then the generation market.

Table 6.6 Unbundling of network operators: electricity distribution (European Commission, 2006)

	Legal unbundling implemented?	**Functional unbundling implemented?**	**Accounting unbundling implemented?**	**Ownership unbundling implemented?**
Austria	Partly	Partly	Partly	N
Belgium	Y	Y	N	N
Denmark	Y	Y	Y	N
Finland	Partly	Partly	Y	N
France	N	Y	Y	N
Germany	Y	Y	Y	N
Greece	N	N	N	N
Ireland	N	Y	Y	N
Italy	Partly	N	Y	N
Luxembourg	N	N	Partly	N
Netherlands	Y	Y	Y	N
Portugal	N	N	Y	N
Spain	Y	Y	Y	N
Sweden	Y	Y	Y	N
UK	Y	Y	N	N

In the table 6.7 it can be figured out the number of transmission system operators in the EU15 countries. In most of them there is only one operator. It means that in these countries, the transmission system operator is the only player at the transmission level and its role is fundamental for the good working of the market. So, in order to avoid unfair behaviours a solution could be the mandatory ownership unbundling in that countries where there is only one transmission system operator.
In France, legal, functional and accounting separation are guaranteed, hence, the unbundling requirements are satisfied. But RTE, the electricity transmission system, is owned by *Electricité de France* that is the most important electricity generator and supplier in France. Consequently, some anti-competitive behaviour could happen.

In the table 6.7 there are also the number of distribution system operators for each country, the number of distribution system operators with less than 100.000 customers and in the last column it can be figured out if a country has applied the 100.000 customer exemption rule. This rule, from the European directives, allows the exemption from the unbundling directives for that distribution system operators which have less than 100.000 customers.
Hence, there are countries like France, Germany and Sweden that satisfy the unbundling requirements, but they also apply the 100.000 customers exemption rule. It means that most of the distribution system operators of these countries are not required to satisfy the unbundling requirements. In France, only 5/10 out of 160/170 distribution system operators are subject to the unbundling rules; in Germany only 120 out of 900; and in Sweden only 6 out of 175.

In the table 6.8, written up by the European Commission, it can be seen that several countries have not yet satisfied the unbundling requirements, and moreover, for the previous reasoning, in the other countries the efficacy of the unbundling is not always guaranteed.

Table 6.7 Number of TSOs and DSOs in EU15 (European Commission, 2006)

	Number of TSOs	Number of DSOs	Number of DSOs < 100.000 customers	100.000 customer exemption rules?
Austria	3	133	122	Y
Belgium	1	27	-	N
Denmark	11	115	107	Y[8]
Finland	1	91	85	Y (Modified)[9]
France	1	160/170	155/165	Y
Germany	4	900	780	Y
Greece	1	1	-	-
Ireland	1	1	-	-
Italy	1+11[10]	> 39	n.a.	N
Luxembourg	2	n.a.	-	N
Netherlands	1	11	5	N
Portugal	1	1+10[11]	10	n.a.
Spain	1	320	n.a.	N
Sweden	1	175	169	Y
UK	1	14	0	N

Table 6.8 Satisfaction of unbundling requirements

	Have the unbundling provisions of the Directives on electricity been satisfied?
Austria	Federal legislator: Yes Provincial legislator: No
Belgium	Yes
Denmark	Yes
Finland	Partially
France	Yes
Germany	Yes

[8] The 100.000 customers exemption only applies to the requirement of management separation
[9] According to the Energy market authority, 59 DSOs are exempted from the legal unbundling provision
[10] In Italy there is one TSO (Terna) for more than 90% of the network
[11] In Portugal there is only one big DSO than 10 very small DSO with less than 10.000 customers

Greece	Yes but not completely. Legal unbundling have been transposed but not fully implemented.
Ireland	Partly
Italy	No
Luxembourg	n.a.
Netherlands	Yes
Portugal	No
Spain	No, because the Spanish legislation establishes the separate accounting bur not the full legal and functional unbundling for distributors.
Sweden	Yes
UK	Yes

6.3 Prices

As stated before, prices in the new market should diminish and converge in the whole Europe.

Actually, at the beginning, there was a drop in prices, but during the last years an increase is present.

It is possible that this trend is not due to the new market reform, but only to market fluctuations.

Generally increases in energy prices are not blamed on inefficiencies in the market, but to increases in oil, gas or general raw materials prices. Hence, for the same reason, it is not sure that a drop in prices is caused by the good work of the reform, but it could be caused by other factors that do not have absolutely anything to do with the reform.

It is not true that prices are lowest where market is more liberalized, because electricity is cheap where it has always been cheap.

For instance, in Greece electricity is cheap with respect to European average, though the reform has just commenced. In France the prices are low and carry on diminishing, though the liberalization is catching on laboriously.

Undoubtedly in Sweden, Denmark, Finland and UK, where the markets are very open, the prices are lower, but this has always been and moreover, in Scandinavian countries, during the last years, electricity prices are rising.

Table 6.9 Eurostat electricity retail prices before taxes (Euro/MWh) (EUROSTAT, 2006)

INDUSTRIAL IG
(24000 MWh/year)

	Jan 2000	July 2000	Jan 2001	July 2001	Jan 2002	July 2002	Jan 2003	July 2003	Jan 2004	July 2004	Jan 2005	July 2005	Jan 2006	July 2006
AT								37	41	42	47	47	52	55
BE	55	58	57	59	58	58	58	56	58	57	53	62	72	80
DE	50	52	53	53	53	52	56	60	62	63	68	71	77	78
DK														
ES	54	54	49	49	47	47	48	48	49	49	58	58	61	64
FI	34	34	33	34	36	37	52	50	51	49	50	47	49	51
FR	49	47	48	48	49	49	45	45	46	45		46	46	46
GR	48	47	48	50	50	50	52	52	53	53	54	54	56	56
IR	53	53	53	53	65	65	64	64	67	67	77	77	90	90
IT	60	69	79	71	71	74	76	77	71	73	83	82	93	95
LX	45	43	38	38	39	38	40	40	42	42				
NL											56	56	56	56
PT	53	53	53	53	56	56	56	56	61	61	64	66	73	72
SW	28	30	31	31	26	26	62	37	45	47	38	47	51	63
UK	54	54	48	48	47	46	44	43	40	41	43	52	70	67

INDUSTRIAL IB
(50 MWh/year)

	Jan 2000	July 2000	Jan 2001	July 2001	Jan 2002	July 2002	Jan 2003	July 2003	Jan 2004	July 2004	Jan 2005	July 2005	Jan 2006	July 2006
AT	157	126	112	102	96	97	98	89	95	96	103	109	116	125
BE	143	146	125	128	129	130	131	122	126	120	111	115	114	114
DE	139	134	133	133	131	126	131	134	142	149	152	155	162	165
DK	56	55	64	65	69	67	74	65	70	71	72	73	76	82
ES	98	98	98	98	99	99	95	95	97	97	104	104	109	109
FI	55	54	53	54	56	57	65	68	69	66	66	64	67	68
FR	87	85	85	85	86	86	83	83	84	84		84	84	84
GR	84	83	84	87	87	87	90	90	93	93	95	95	98	98
IR	126	126	126	126	127	127	128	128	131	131	143	143	154	154
IT	119	128	87	78	98	101	103	104	100	116	114	120	124	140
LX	133	131	119	121	122	122	127	127	130	147				
NL	78	101	104	106							108	109	116	125
PT	104	104	105	105	100	100	101	101	103	103	107	109	123	121
SW	56	53	40	41	36	36	71	46	70	72	68	71	80	93
UK	107	101	94	93	92	84	79	78	79	80	93	96	106	116

DOMESTIC DC
(3500 kWh/year)

	Jan 2000	July 2000	Jan 2001	July 2001	Jan 2002	July 2002	Jan 2003	July 2003	Jan 2004	July 2004	Jan 2005	July 2005	Jan 2006	July 2006
AT	95	95	95	95	93	93	93	92	98	98	96	95	89	98
BE	117	117	118	118	114	111	112	112	115	114	112	110	112	114
DE	119	120	122	123	126	125	127	125	126	128	133	135	137	141
DK	72	72	78	82	87	84	95	87	92	91	93	96	100	107
ES	90	90	86	86	86	86	87	87	89	89	90	90	94	95
FI	65	64	64	67	70	70	74	80	81	79	79	78	81	83
FR	93	91	91	91	92	92	89	89	91	91	91	91	91	91
GR	56	55	57	58	58	58	61	61	62	62	64	64	64	64
IR	80	80	80	80	88	88	101	101	106	106	120	120	129	129
IT	150	160	157	146	139	142	145	147	143	141	144	151	155	155
LX	106	105	112	114	115	115	119	119	122	122	129	131	139	139
NL	94	108	98	89	91	98	97	109	103		110	111	121	124
PT	119	119	120	120	122	122	126	126	128	128	131	131	134	134
SW	64	65	63	68	70	69	84	86	90	84	85	81	88	98
UK	99	97	96	97	97	95	96	95	88	85	84	88	97	110

The graphs set out below show the price developments in individual Member States, firstly, for very large users (24000 MWh/year), and then for other smaller consumer category (50 MWh/year) and finally for domestic users (3500 kWh/year).

Figure 6.1 Eurostat electricity prices (Industrial IG) (Euro/MWh)

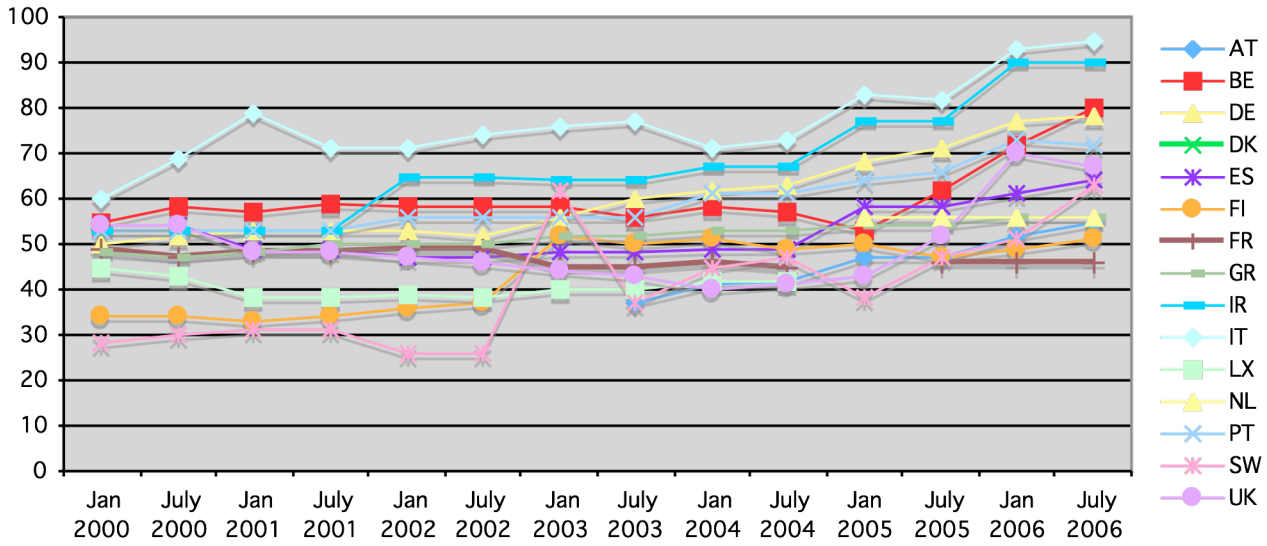


Figure 6.2 Eurostat electricity prices (Industrial IB) (Euro/MWh)

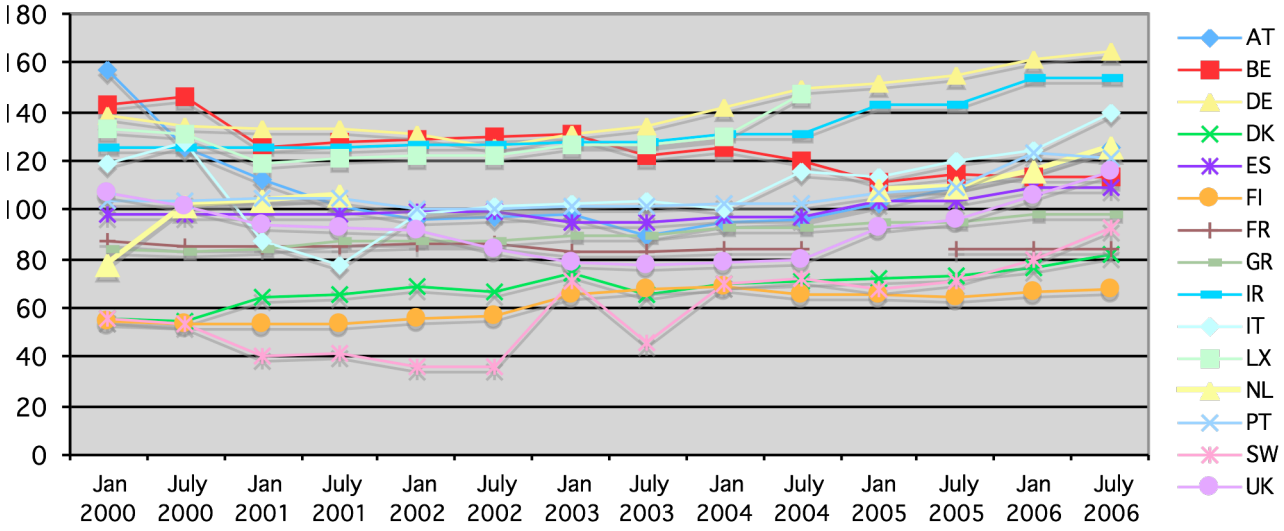
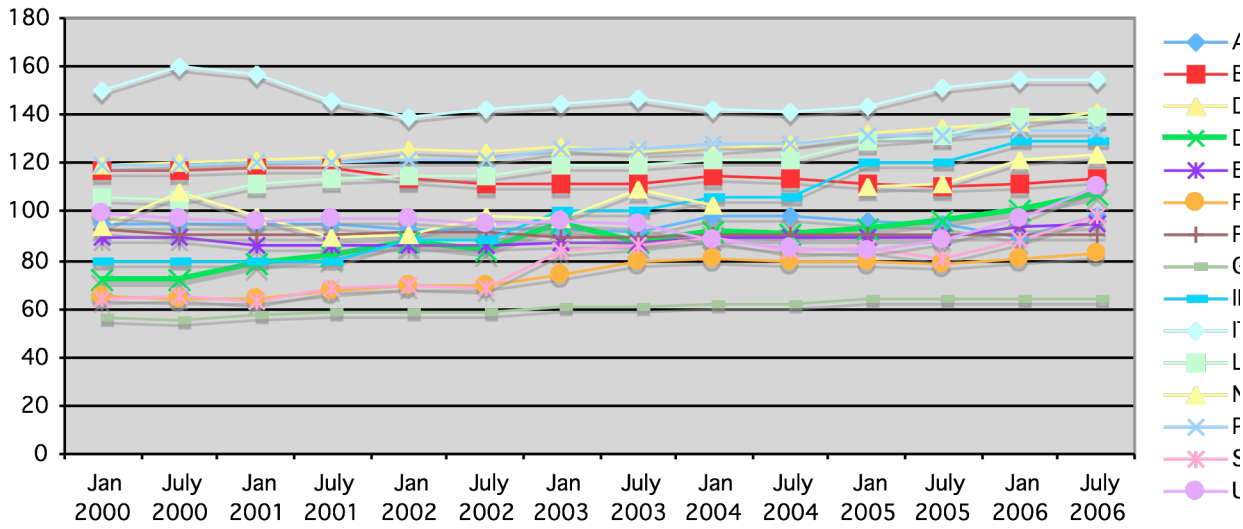


Figure 6.3 Eurostat electricity prices (Domestic DC) (Euro/MWh)



From the three graphs it can be seen that there is no convergence, and it keeps a big gap price between the countries with the cheapest electricity and the countries with the most expensive electricity.

This difference of price can come up to more than 100%:

- In the very large industrial consumer market (24 GWh/year) a MWh in Italy is sold for 95 Euros and in France it is sold for 46 Euros. The difference is 106%.
- In the small commercial consumers (50 MWh/year) a MWh in Germany is sold for 165 Euros, and in Finland it is sold for 68 Euros. The difference is 143%.
- In the domestic consumer market (3,5 MWh/year) a MWh in Italy is sold for 155 Euros, and in Greece it is sold for 64 Euros. The difference is 142%.

6.4 Cross-border exchanges

Another important aspect is the lack of integration of the energy offer at European level.

It is very important to try to improve cross-border exchanges of electricity and to do this, it is essential to improve the electricity infrastructure among Member States. Actually, the lack of integration is principally due to insufficient interconnection capacity among most

of the Member States, and frequently in the cross-border exchanges there are congestion problems.

The European countries are not doing all that is necessary to allow foreign companies to enjoy the electricity national market. In most of the states the market is dominated by one or two big companies and mostly there are inadequate policies for cross-border competitiveness.

In table 6.10 it can be figured out that during the last 10 years, the transmission grid has been developing just a bit: from 1995 cross-border flows have only had a growth of 3,7%.

Table 6.10 Extent of cross border electricity flows (European Commission, 2005)

	Cross border flows – actual as % of consumption
1995	7%
2000	8%
2005	10,7%

The present interconnections are insufficient to ensure a properly functioning internal market in electricity and also to guarantee security of supply.
A few critical bottlenecks have been identified in the electricity sector, in particular:

- The borders between France and Spain
- The borders between Italy and France, Switzerland and Italy and Austria and Italy
- The borders between Belgium and Netherlands
- The borders West-Denmark and Germany
- Ireland
- The interconnection between the UK and continental Europe
- Greece

6.5 Security of supply

The important indicator in the following table is the figure for "remaining capacity" that sets out the extent to which reliably available capacity exceeds a forecast for maximum load.

Some Member States show negative figures, it means that they do not have sufficient spare capacity. Generally, there are neighbouring Member States that can provide the electricity in case of emergency, but not always it is possible because of the lacks of cross-border infrastructures.

Table 6.11 Security of supply (European commission, 2005)

	Peak demand recorded (MW) / (date)	Season	Total generation capacity (MW)	Remaining capacity
Austria	9500 (16/12/05)	W	18300	55%
Belgium	13708 (20/12/04)	W	14600	-5%
Denmark	6480 (?)	W	12710	-
Finland	14040 (02/01/03)	W	16488	-
France	86000 (21/02/05)	W	112900	13%
Germany	77200 (16/12/05)	W	114800	10%
Greece	9510 (02/08/05)	S	11000	-3%
Ireland	4528 (20/12/04)	W	6400	-
Italy	54100 (28/06/05)	S	90800	13%
Luxembourg	994 (18/11/04)	W	1700	75%
Netherlands	15601 (21/12/04)	W	21100	5%
Portugal	8261 (09/12/05)	W	11800	17%
Spain	43708 (21/07/05)	S	64800	18%
Sweden	27000 (22/01/04)	W	33551	-
UK	54100 (13/12/04)	W	75700	-

The performance of the network is a key factor that affects the quality of service that is perceived by the final customer and has to be a high priority.

In the following table it can be seen the average duration of interruption per customer per year, performances are quite different, varying between 27 minutes per customer per year on average in the Netherlands, to 5 hours per customer per year on average in Portugal. The level of interruption that can be tolerated is a decision of individual Member States.

Table 6.12 Interruption from the distribution network (European Commission, 2005)

	Average duration of interruption per customer per year (minutes)
Austria	30
Belgium	-
Denmark	30
Finland	103
France	-
Germany	-
Greece	-
Ireland	162
Italy	180
Luxembourg	-
Netherlands	27
Portugal	300
Spain	-
Sweden	123
UK	68

6.6 Environmental performances

The following table indicates the ratio between the electricity produced from renewable energy sources and the gross national electricity consumption.

It measures the contribution of electricity produced from renewable energy sources to the national electricity consumption.

Electricity produced from renewable energy sources comprises the electricity generation from hydro plants, wind, solar, geothermal and electricity from biomass and wastes.

Gross national electricity consumption comprises the total gross national electricity generation from all fuels, plus electricity imports, minus exports.

In the last column the targets for each country, introduced by the European Commission in Directive 2001/77/CE in September 2001, are indicated.

During the last years, Europe is making progress, but it is clear that most of the Member States will not reach the 2010 targets.

This is probably the case of Belgium, France, Greece, Ireland, Italy, Portugal, and UK.

Finally, it is very strange and dramatic that Austria, France, Ireland, Italy and Portugal in 2004 (these are the most recent data that is possible to get) had a share of electricity from renewable energy to gross electricity consumption lower than that they had 10 years before.

Table 6.13 Share of electricity from renewable energy to gross electricity consumption (EUROSTAT, 2005)

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2010
Austria	70.1	70.6	63.9	67.2	67.9	71.9	72.0	67.3	66.0	53.4	58.7	78.1
Belgium	1.1	1.2	1.1	1.0	1.1	1.4	1.5	1.6	1.8	1.8	2.1	6.0
Denmark	5.6	5.8	6.3	8.8	11.7	13.3	16.4	17.4	19.9	23.2	27.0	29.0
Finland	24.8	27.6	25.5	25.3	27.4	26.3	28.5	25.7	23.7	21.8	28.3	31.5
France	19.7	17.8	15.3	15.2	14.4	16.5	15.1	16.3	13.7	13.0	14.2	21.0
Germany	4.3	4.7	4.7	4.3	4.9	5.5	6.8	6.5	8.1	8.2	9.7	12.5
Greece	6.4	8.4	10.0	8.6	7.9	10.0	7.7	5.2	6.2	9.7	9.5	20.1
Ireland	5.5	4.1	4.0	3.8	5.5	5.0	4.9	4.2	5.4	4.3	5.1	13.2
Italy	18.0	14.9	16.5	16.0	15.6	16.9	16.0	16.8	14.3	13.7	15.9	25.0
Luxembourg	3.0	2.2	1.7	2.0	2.5	2.5	2.9	1.6	2.8	2.3	3.2	5.7
Netherlands	1.9	2.1	2.8	3.5	3.8	3.4	3.9	4.0	3.6	4.7	5.7	9.0
Portugal	36.1	27.5	44.3	38.3	36.1	20.5	29.4	34.2	20.8	36.4	24.4	39.0
Spain	17.7	14.3	23.5	19.7	18.6	12.8	15.7	20.7	13.8	21.7	18.2	29.4

Sweden	42.7	48.2	36.8	49.1	52.4	50.6	55.4	54.1	46.9	39.9	46.1	60.0
UK	2.1	2.0	1.6	1.9	2.4	2.7	2.7	2.5	2.9	2.8	3.7	10.0
EU15	14.2	13.7	13.4	13.8	14.0	14.0	14.7	15.2	13.5	13.7	14.9	22.0

In the following table, the electricity energy consumption *pro capite* of the individual Member States can be seen. In all of the European countries, except Belgium, the electricity consumption has growth with respect to 1999.

From the data, three Member States figure out because of their very high consumption with respect to the European average.

Table 6.14 Final electricity consumption (EUROSTAT, 2006)

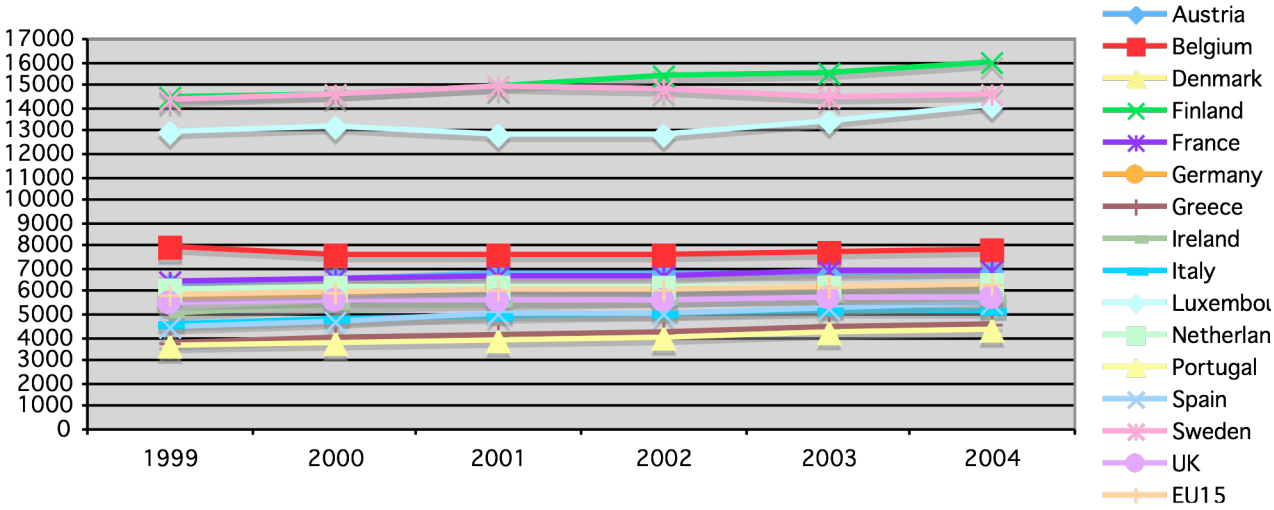
Final electricity consumption per capita (kWh/capita)						
	1999	**2000**	**2001**	**2002**	**2003**	**2004**
Austria	6326	6473	6720	6811	6811	6925
Belgium	7925	7573	7613	7609	7694	7753
Denmark	6065	6090	6086	6054	6010	6109
Finland	14381	14589	14919	15338	15530	15928
France	6405	6550	6687	6609	6821	6908
Germany	5698	5874	6143	6051	6170	6220
Greece	3764	3957	4074	4245	4415	4503
Ireland	5038	5347	5460	5598	5684	5718
Italy	4586	4787	4868	4953	5076	5097
Luxembourg	12892	13183	12831	12774	13417	14121
Netherlands	6010	6174	6219	6193	6208	6343
Portugal	3559	3764	3894	4015	4147	4264
Spain	4453	4706	4965	5042	5280	5447
Sweden	14296	14526	14936	14735	14478	14524
UK	5510	5606	5644	5629	5677	5696
EU15	5764	5938	6093	6090	6208	6279

In the following graph the curves of the electricity energy consumption *pro capite* of the individual Member States are drawn. Finland, Sweden and Luxembourg curves are the

highest ones: in 2004 the citizens of these 3 countries has used 154%, 131% and 124% more electricity than the average consumption in EU15.

A part of this gap in consumption could be due to the strong climate of these countries, but the gap is too high and it is obvious that there is a consumption excess, especially if it is compared with consumptions of countries with a similar climate like Netherlands and Denmark.

Figure 6.4 Electricity energy consumption *pro capite* (EUROSTAT, 2005)



7. Sustainable development in the European electricity market

7.1 Introduction

In 1972, during the Stockholm Conference, for the first time international countries admitted the need to protect and improve the environment.
After this conference it was founded the United Nations Environment Program (UNEP) that, currently, with the United Nations Development Programme (UNDP), the Food and Agriculture Organization (FAO), the United Nations Educational, Scientific and Cultural Organization (UNESCO), and the International Union for the Conservation of Nature (IUCN) is one of the most important organizations in the world about sustainability.

In 1987 the World Commission on Environment and Development (The Brundtland Commission) commenced talking about sustainable development and defined it as it follows:

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (Brundtland report, 1987)

Some years later, in 1992, in Rio de Janeiro, there was the United Nations Conference about Environment and Development (Earth Summit). For the first time non-governmental organizations (NGO) were involved.
This was one of the most important international meetings about sustainability. They set up the first approaches, which nowadays are still essential to design sustainable strategies.
The participating countries signed three agreements:

- Agenda 21
- The Rio Declaration on Environment and Development
- Statement of Forest Principles

And they signed also two legally binding conventions:

- Framework Convention on Climate Change

- Convention on Biological Diversity

In December 1993, in Brussels there was the first environment conference of regional ministers and politic leaders in the European Union. They established the real intention to implement the Agenda 21 in the European Union.
In November 1995, in Valencia, there was the second environment conference of regional ministers and politic leaders in the European Union. There have been defined instruments and goals of the environmental polices.
And in June 1997, in Gothenburg, there was the third environment conference of regional ministers and politic leaders in the European Union where there was developed proposals in three particular areas:

- The implementation and further development of Community environmental law
- Regional Agenda 21
- Sustainable development and the Structural Funds.

In December 1997, the Kyoto protocol was negotiated in Kyoto and it came into force on 16th February 2005 with the ratification by Russia.
They put forward an amendment to the international treaty on climate change, assigning mandatory targets for the reduction of greenhouse gas emissions to signatory countries.

During the last years, international conferences, congresses and meetings have taken place periodically, dealing with the problem of sustainable development widely and deeply, and producing a big (maybe too much big) amount of information, studies and strategies.

The definition of sustainable development since the early stages gave rise to several arguments about its real meaning.
Many people, actually, thought that the term sustainable development contained deep down an intrinsic contradiction, and so such expression was not so useful because of its "no-meaning".
In Robert B. Gibson's book "Sustainability assessment: criteria and processes" a series of original definitions of sustainable development is listed. They clarify the argument about Bruntland's definition.

Sustainable development is:

- A redundancy, since unsustainable activities cannot provide true development.
- An oxymoron (a self-contradiction) that amounts to believing that you can have your cake and eat it too.
- A case of developers getting the noun and environmentalists being left with the adjective.
- A dangerous delusion, promoted by those who are unwilling to recognize that we are already overstraining our planet's capacity to withstand our impositions.
- One of the landmark steps in human history, following opposable thumbs, the discovery of fire and the invention of progress
- An exceptionally popular term, invoked favourably by all manner of otherwise incompatible individual.
- A term that everyone can support, largely because no one knows what sustainability means and/or no one agrees on what development means.
- A term that offers an accommodation of opposing forces — suggesting that responsible stewardship of nature and continuing gains in human material well-being are compatible.

With the time the term became so popular that it would be impossible to change it.

This debate about the definition of sustainable development is not only a semantic argument, but it highlights the contradictions and the innovation which are at the heart of the concept of sustainable development and that, at the beginning, were not immediately accepted.

In general terms, it can be affirmed that sustainable development focuses on improving the well-being of every citizen of the whole world, without increasing the use of natural resources and respecting the ties set from the ability to regeneration of the environment.

So, it is fundamental to understand that the concept of sustainable development includes environmental aims and, social and economic aims as well.

7.2 Three dimensional model

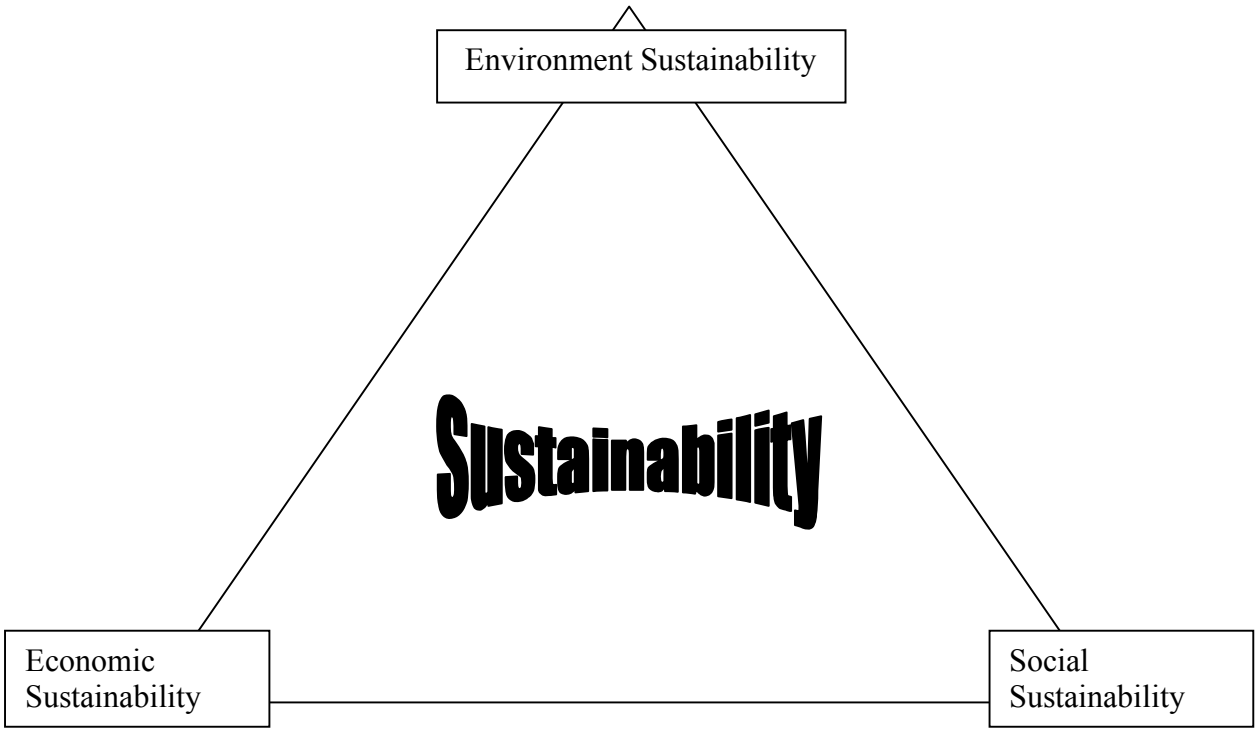
The most asserted model to describe sustainable development is the three dimensional model.

Sustainable development has three components:

Environmental sustainability: the use of natural resources for being considered sustainable must respect the ties set from the ability to regeneration and absorption of the environment.

Economic sustainability: it encompasses the requirements for strong and durable economic growth, such as preserving financial stability and a low and stable inflationary environment. (IEA, 2001, [23])

Social sustainability: it emphasises the importance of well functioning labour markets and high employment, of adaptability to major demographic changes, of stability and cultural systems, of equity and of democratic participation in decision-making. (IEA, 2001, [23])



So the model says that its three dimensions has the same importance.
A development geared to only environmental goals, or social goals, or economic goals cannot be considered sustainable.
Neither the attainment of 2 goals out of 3 is admitted by the model. Actually it pretends a three dimensional development.
The challenge consists of satisfying the three apexes of the triangle although they are geometrically opposite among them.

Most of the time, environmental sustainability goes in the opposite direction with respect to economic sustainability, which goes in the opposite direction with respect to social sustainability.
Eventually, the solution is to reach a trade off which permit to achieve the general goal of sustainability.
The economic, social and environmental processes cannot be considered separately, although, several times, the players only belong to one dimension out of 3 and so it is difficult for them to interact on the three dimensions at the same time. However they have to consider the externalities that whatever action generates.

Moreover, it is important to consider the variable time. Actually, an action in the present time can produce effects in the future. Although the future can be very far it has to be considered as well. The present needs are as important as the needs of the future generations.

In 1987, when sustainable development was defined, for the first time they questioned the model of development adopted by the industrialized countries. This model is based on the no ending growth, the maximisation of the product, consumptions with no control, squandering of the natural resources, above all the energetic ones. (Palea, 2006, [31])
According to sustainable development, the economic growth implies an exploitation of non-renewable sources (oil, coal, gas, etc…) totally uncoupled by the environmental pace according to the natural heritage is able to regenerate itself.

It is important to highlight that the sustainable development model does not want to question the need of economic growth, but it expects that also the other directions of development are considered as well.
If the unit of measurement was not the money, and it was possible to quantify the well-being of people of the present and future generations, it would be easier to implement with successful whatever sustainable development model.

7.3 Are the deregulated energy markets suitable to facilitate a development towards sustainable energy systems?

Mostly, when people talk about sustainable energy systems, they think that an energy system, which guarantees low emissions of CO_2, or low emissions of other gases like CO or NOx, is sustainable.
But the contribution to sustainable development by an energy system is something more complex.
So, as stated before, an energy system geared to the attainment of sustainable development should contribute positively to the as large as possible amount of social, environmental and economic aspects.

This thesis, as final goal, intends to answer the question "are the deregulated markets suitable to facilitate a development towards sustainable energy systems?"

In order to answer this question the three dimensional model has been used, weighing up for each dimension the effects which the new market reform has brought.

7.3.1 Economic sustainability

The main goal of the reform for the new electricity market is to guarantee a better economic efficiency.
As stated in chapter 3, in order to achieve this goal, it has to be guaranteed:

- Improved efficiency in the production
- Improved efficiency in the transmission

- Improved efficiency in the distribution
- Lower costs
- Lower prices
- Better allocation of resources
- Improved risk allocation

Currently, it can be asserted that the economic goals have not yet been reached.
Actually, the reform is late in guaranteeing all of that benefits which theoretically should gush from a market based on competitiveness.
But the process of the reform has not yet been completed and probably, sometime it will work better. A guarantee is due to the widespread presence of private investors in the supply chain; actually, no private investors would enjoy the market if it were not chance of profit.

A problem could be, when the market starts working, how much it affects the other two dimensions.

Currently, the most critical factors from the economic point of view are:

- High prices
- The lack of price convergence
- The competitiveness that is not yet working
- The lack of integration among the markets of the different countries

7.3.2 Environmental sustainability

The environmental sustainability, theoretically, is a primary importance challenge. At institutional level, international associations and agencies meet periodically to discuss about environment, but from a practical point of view the efforts and the results are not as good as they should be.
The attainment of environmental performances is another main goal of the electricity market reform. As stated in chapter 3, the new market should assure:

- Less green house gas emissions
- Lower consumption of energy
- Development of renewable
- Lower waste of energy
- Global cooperation

But actually, the results reached are low and it does not seem that they are improving.
The tables 6.13 and 6.14 from chapter 6 show terrible data.
The targets introduced by the European Commission in Directive 2001/77/CE, which indicate the ratio between the electricity produced from renewable energy sources and the gross national electricity consumption, do not seem that they can be reached by most of the EU15 countries.
Moreover, the electricity consumptions have been growing for the last years.

The European Commission, in the report "Measuring progress towards a more sustainable Europe. Sustainable development indicators for the European Union (1990-2005)", in order to monitor and measure the progress towards a sustainable Europe, assessed the list of sustainable development indicators proposed by the United nations in the European context.
So, the "climate change and energy" indicators in figure 7.1 and the diagram in figure 7.2 confirm what stated in the lines before:

Figure 7.1 Climate change indicators (European Commission, 2005)

	EU-25	EU-15
Greenhouse gas emissions	:	⛈
Gross inland energy consumption	⛈	⛈
Climate change		
CO_2 intensity of energy consumption	⛅	⛅
Energy		
Energy intensity of the economy	⛅	⛅
Final energy consumption	⛈	⛈
Gross electricity generation	⛈	⛈
Renewable energy	⛈	⛈
Consumption of biofuels	☀	☀

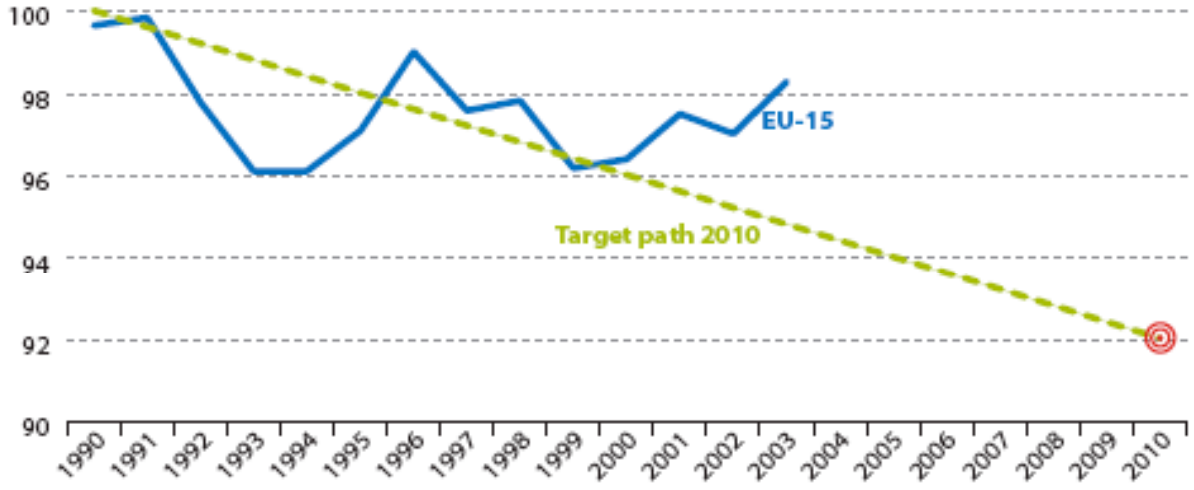
☀ *favourable change*

⛅ *no or little change*

⛈ *unfavourable change*

: *insufficient data to evaluate change*

Figure 7.2 EU15 total greenhouse gas missions and target according to Kyoto protocol as a percentage of base year emissions (European Commission, 2005)



NB: *The dotted line shows the linear path of the reduction target for the first commitment period, 2008–12.*

"Both greenhouse gas emission and energy consumption have increased since 2000. While the 1990s saw a decrease in the CO2 intensity of energy use and in the energy intensity of the economy, this has clearly slowed down since 2000. The share of renewable energy for electricity production has decreased due to a stabilisation in renewable energy use relative to a growth in overall energy consumption."(European Commission, 2005, [15])

7.3.3 Social sustainability

The social sustainability in the new market for electricity is very difficult to assess because it is mainly based on qualitative parameters.

The social variables identified, which are influenced by the new market, concern the following areas:

- Security of supply
- Employment

Security of supply in the social sector is the guarantee of connection to the network for all the European citizens, included those who live in isolated zones.

But, for sure, it depends on the economical assessment, because if the state does not bear the investment on infrastructures which are not economic feasible, certainly, there is no private investor who is prepared to lose money for "charity". This means that the new market does not guarantee improvements in this direction, but it depends on the social policies undertaken by the individual countries.

As far as employment is concerned, the report called "EPSU Contribution to the progress report on the internal market for electricity and gas. State of play" affirms that the internal market for electricity and gas has:

- Destroyed 300.000 jobs in 10 years (some figures indicate 330.000). While this job loss has contributed to an apparent increase in labour productivity, this was a one-off effect and it has brought no long-term dynamic efficiency gains, undermining a central tenet of the competition theory.
- Reduced labour costs through income cuts of workers and their families. It is foreseen this will continue through outsourcing amongst others.
- Introduced more flexibility and insecurity for workers.

7.4 Final discussion

From the previous analysis of the three dimensions, it can be figured out that the new market is not improving Europe with respect to sustainability, although it is hoped that things will change.

Maybe the scenario just described is a little bit exaggerated, but probably it is not so far away from the reality.

The European governments has a fundamental role, because they will have to monitor and assure the fair play of all the players and the good working of the market that theoretically would work perfectly, but practically it is not producing good results.

Actually, just the market cannot achieve good results, but the collaboration among the individual countries and the European Commission (with stronger authority) could cause a synergy, which could generate strong improvements.

European Union constitutes a huge market, which is composed of 450 millions consumers, and an economically and technologically developed area. Theoretically, Europe could bear

the inevitable transition costs to go past to a sustainable economic model.

It is fundamental considering sustainable development at European level, because no country can face isolated and effectively the global problems of sustainability.
Actually, if a country reached, locally, a sustainable model, which worked well, it could not bear, for a long time, a market totally open, the hardness of the international competitiveness, the challenge with others economies which continued developing with no sustainability constraints.

Hence, the efforts that the member states are doing to achieve a single European market for electricity could return good results in the long term. But it is essential an active collaboration among all the European countries, and not only participation geared to satisfy the minimum requirements in order to not have to pay any sanction.
The French case is the most obvious. The European Commission cannot impose sanctions on the French government because the minimum requirements are satisfied, but it is evident that the French market is not competitive and probably it will not be competitive for a long time.

So, an overall improvement of the European energy system, the development of renewable sources, the progressive abandon of the nuclear, the reduction of the greenhouse gas emissions are goals that can be achieved by Europe. These efforts can lead to high benefits not only for the environment, but also for a stronger and, above all, lasting economy and also for improving the sanitary conditions of the population and the well-being. Summarizing, it is possible, through a general effort by the European Union, to improve the three parameters of the triangle of the three dimensional model of sustainable development.

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Appendix A

A.1 Map of the European electricity market country by country

A.1.1 Introduction

In the following paragraphs, it has been analyzed the electricity market situation for every EU15 country.

For each country the key aspects of the electricity market reform are described:

- Unbundling
- Cross-border exchanges
- Security of supply
- Customer service
- Switching
- Competition
- Prices
- Environment

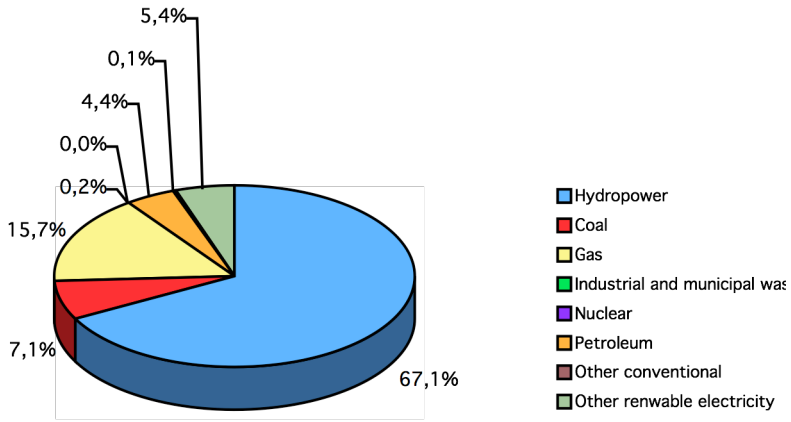
The main sources have been the following:

- European Commission, 2004. The unbundling regime. Country overview.
- European Commission, 2004. The share of renewable energy in the EU. Country profiles. Overview of renewable energy sources in the enlarged European Union.
- European Commission, 2005. Report on progress in creating the internal gas and electricity market.
- Nordel, 2005. Annual statistic, 2005.
- UCTE, 2004. Statistical Yearbook 2004.
- ERGEG National Reports by Country
- EUROSTAT webpage

A.1.2 Austria

Background

- Population: 8.265.900
- Size: 83858 Km^2
- GDP (2005): 245.102.800 Euros
- Growth rate of GDP volume (2005): 2,0%
- Final electricity consumption per capita (2004): 6.925 kWh/capita
- Degree of liberalization: 100%
- Primary production:



Unbundling

There are 3 transmission system operators, and they are legal, functional and accounting separated.

Legal, functional and accounting separation of distribution system operators for electricity is partly assured. There are 133 distribution system operators and 122 of these have less than 100.000 customers and they are subject to the exemption rules.

Cross-border exchanges

The electricity interconnector capacity of Austria with neighbouring countries amounts to 14000MVA line rating. Apart from the connections with Germany and Switzerland, congestion occurs frequently. Austria is an important transit country for electricity.

Physical exchanges in interconnected operation [1]

Austria | GWh

MM_YY	AT→CH	AT→CZ	AT→DE	AT→HU	AT→IT	AT→SI	AT_UCTE_EXP	AT_III_EXP	CH→AT	CZ→AT	DE→AT	HU→AT	IT→AT	SI→AT	AT_UCTE_IMP	AT_III_IMP	AT_UCTE_SLD	AT_III_SLD
	Export (-)								Import (+)								Balance	
I.99	400	1	289	0	133	311	1134	0	1	339	631	224	0	0	1195	0	61	0
II.99	278	3	299	0	117	279	976	0	6	296	551	211	0	0	1064	0	88	0
III.99	324	7	343	9	132	267	1082	0	2	281	669	169	0	0	1121	0	39	0
IV.99	370	11	265	7	135	351	1139	0	8	240	662	168	0	0	1078	0	-61	0
V.99	200	17	580	13	141	382	1333	0	28	216	300	52	0	0	596	0	-737	0
VI.99	185	18	672	20	163	303	1361	0	16	167	286	77	0	0	546	0	-815	0
VII.99	200	5	676	7	160	358	1406	0	17	274	211	150	0	1	653	0	-753	0
VIII.99	145	4	549	5	78	215	996	0	66	165	178	223	0	0	632	0	-364	0
IX.99	203	2	519	2	167	313	1206	0	99	357	273	192	0	0	921	0	-285	0
X.99	217	0	489	0	158	348	1212	0	69	436	299	218	0	0	1022	0	-190	0
XI.99	288	0	380	0	155	288	1111	0	38	409	586	202	0	0	1235	0	124	0
XII.99	335	0	282	2	148	140	907	0	25	456	864	132	0	4	1481	0	574	0
1999	**3145**	**68**	**5343**	**65**	**1687**	**3555**	**13863**	**0**	**375**	**3636**	**5510**	**2018**	**0**	**5**	**11544**	**0**	**-2319**	**0**
I.03	453	1	431	21	150	231	1287	0	8	452	832	79	0	20	1391	0	104	0
II.03	330	0	297	27	132	197	983	0	11	391	706	21	0	32	1161	0	178	0
III.03	376	1	265	35	141	240	1058	0	27	489	1047	25	0	34	1622	0	564	0
IV.03	431	0	191	11	145	272	1050	0	6	636	934	81	0	5	1662	0	612	0
V.03	220	0	391	23	151	344	1129	0	46	622	466	97	0	0	1231	0	102	0
VI.03	226	0	383	17	137	392	1155	0	78	692	515	68	0	0	1353	0	198	0
VII.03	171	0	352	16	138	323	1000	0	90	742	560	67	0	9	1468	0	468	0
VIII.03	287	0	223	21	74	219	824	0	37	694	833	64	0	26	1654	0	830	0
IX.03	421	0	147	55	157	180	960	0	22	723	980	11	0	28	1764	0	804	0
X.03	469	0	237	192	157	299	1354	0	10	738	914	6	0	3	1671	0	317	0
XI.03	273	0	221	38	138	184	854	0	21	649	870	43	0	31	1614	0	760	0
XII.03	405	0	195	12	144	185	941	0	15	800	1249	76	0	11	2151	0	1210	0
2003	**4062**	**2**	**3333**	**468**	**1664**	**3066**	**12595**	**0**	**371**	**7628**	**9906**	**638**	**0**	**199**	**18742**	**0**	**6147**	**0**
I.04	445	0	254	23	137	136	995	0	2	661	1296	59	0	13	2031	0	1036	0
II.04	537	0	297	29	126	161	1150	0	0	564	1152	38	0	12	1766	0	616	0
III.04	518	1	326	22	139	165	1171	0	1	443	1000	50	0	67	1561	0	390	0
IV.04	469	0	324	64	145	168	1170	0	3	533	757	37	0	13	1343	0	173	0
V.04	276	0	401	21	132	158	988	0	37	183	407	188	0	24	839	0	-149	0
VI.04	315	8	542	102	141	206	1314	0	23	268	296	17	0	5	609	0	-705	0
VII.04	181	0	674	40	152	210	1257	0	101	482	256	27	0	2	868	0	-389	0
VIII.04	177	0	427	34	112	145	895	0	59	655	328	65	0	18	1125	0	230	0
IX.04	311	0	333	49	125	224	1042	0	13	588	568	75	0	2	1246	0	204	0
X.04	283	0	288	30	136	139	876	0	38	626	730	68	0	14	1476	0	600	0
XI.04	379	0	292	48	136	174	1029	0	31	541	892	36	0	16	1516	0	487	0
XII.04	528	0	307	16	140	116	1107	0	1	704	1240	80	0	48	2073	0	966	0
2004	**4419**	**9**	**4465**	**478**	**1621**	**2002**	**12994**	**0**	**309**	**6248**	**8922**	**740**	**0**	**234**	**16453**	**0**	**3459**	**0**

[1] These physical energy flows were measured on the cross-frontier transmission lines (≥110 kV). These values may differ from the official statistics and the total physical balance in the table "Monthly values: Operation".

Security of supply

- Installed capacity: 18700 MW
- Peak demand: 9500 MW
- Total electricity generation (2004): 60.600 GWh
- Total electricity consumption (2004): 62.100 GWh

New project amounting to in total around 2000 MW are in the pipeline and supposed to be implemented by 2010. In addiction, around 1300 MW from renewable sources of energy is supposed to be added by 2010.

Customer service

There are 5,12 million electricity customers in Austria. The electricity market was opened 100% in October 2001. General consumer protection legislation applies to electricity. In addition, specific consumer protection rules for electricity are under preparation.
In Austria there is no regulation of end-consumer prices. There is no supplier of last resort.

	2005
Not eligible customers	0
Eligible customers	5.120.000
Not eligible customers (GWh)	0
Eligible customers (GWh)	59.000

Switching

Customers can change supplier without any charge, there are standard rules a standard process of changing. Around 29% of large consumers, 29% of Small-medium industrial and business users and around 4% of household have changed supplier since market opening.

Competition

The wholesale market is currently based on bilateral trading (largest part) and trading in the Austrian electricity exchange (EXAA).
Five companies have a share in overall production capacity of more than 5%.

The share of largest three companies is around 54% of total production capacity.

Prices

Electricity end consumers prices in Austria are characterised by a relatively low component for energy and a relatively high component for network access charges.

Euro/MWh	IG (24000 MWh/year)	IB (50 MWh/year)	DC (3500 KWh/year)
Austria price (July 2006)	55	125	98
EU15 average	70	122	109

Environment

The RES-E target to be achieved by Austria in 2010 is 78% of gross electricity consumption.

Currently they have achieved 58,7% of gross electricity consumption.

The production of electricity by renewable energies in Austria is dominated by large hydropower.

There is wide variety of policy measures for the support of renewable energies in Austria, stimulated by the new feed-in tariffs steady growth is also expected in the sector of wind energy, biomass electricity as well as small hydro installations.

Feed-in tariffs:

- Small hydro: 3,15 – 6,25 Eurocents/kWh
- PV systems: 60 Eurocents/kWh for plants < 20 kWp, 47 Eurocents/kWh for plants > 20 kWp
- Wind systems: 7,8 Eurocents/kWh for new plants
- Geothermal energy: 7,0 Eurocents/kWh for electricity fed into the grid
- Solid biomass and waste with large biogenic fraction: 10,2 – 16,0 Eurocents/kWh (10 – 2 MW), 6,5 Eurocents/kWh (hybrid plants)
- Fuels including biogenic wastes: 6,6 – 12,8 Eurocents/kWh (10 – 2 MW), 4,0 – 5,0 Eurocents/kWh (hybrid plants)

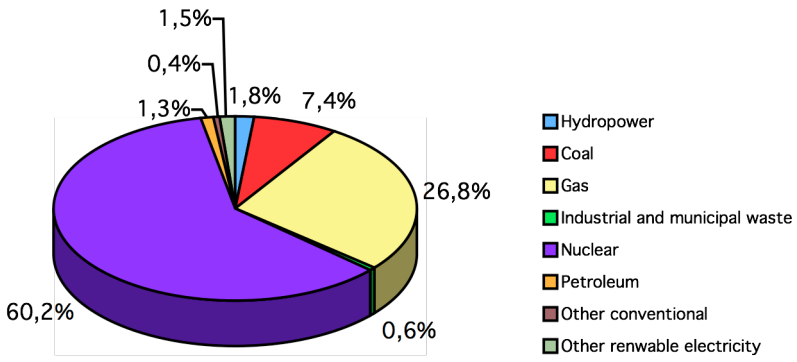
- Liquid biomass: < 200 kW 13,0 Eurocents/kWh; > 200kW 10,0 Eurocents/kWh
- Biogas: 10,3 – 16,5 Eurocents/kWh
- Sewage and landfill gas: 3,0 – 6,0 Eurocents/kWh

Investment subsidy: subsidy of about 30% of the investment cost for solar thermal, biomass, geothermal, wind, hydropower on project basis.

A.1.3 Belgium

Background

- Population: 10.511.400
- Size: 30.510 Km^2
- GDP (2005): 298.540.900 Euros
- Growth rate of GDP volume (2005): 1,1%
- Final electricity consumption per capita (2004): 7.753 kWh/capita
- Degree of liberalization: 90%
- Primary production:



Unbundling

There is only one transmission system operator.

In Flanders there are 15 distribution system operators, in Wallonia 14 and in the Brussels-Capital region 1.

Legal and functional separation of both transmission and distribution system operators for electricity is assured.

Cross-border exchanges

New electricity interconnection projects have recently been completed between France and Belgium.

Physical exchanges in interconnected operation [1]

Belgium | GWh

MM_YY	BE→FR	BE→LU	BE→NL	BE_UCTE_EXP	BE_IIL_EXP	FR→BE	LU→BE	NL→BE	BE_UCTE_IMP	BE_IIL_IMP	BE_UCTE_SLD	BE_IIL_SLD
	Export (-)					Import (+)					Balance	
I.99	336	167	197	700	0	163	0	407	570	0	-130	0
II.99	233	166	263	662	0	203	0	290	493	0	-169	0
III.99	190	178	381	749	0	271	0	318	589	0	-160	0
IV.99	23	163	459	645	0	359	0	293	652	0	7	0
V.99	31	154	475	660	0	431	0	272	703	0	43	0
VI.99	24	164	395	583	0	505	0	274	779	0	196	0
VII.99	7	178	532	717	0	694	0	163	857	0	140	0
VIII.99	0	109	707	816	0	1018	0	134	1152	0	336	0
IX.99	0	162	511	673	0	916	0	149	1065	0	392	0
X.99	10	179	419	608	0	589	0	235	824	0	216	0
XI.99	84	181	477	742	0	344	0	274	618	0	-124	0
XII.99	72	145	432	649	0	337	0	279	616	0	-33	0
1999	**1010**	**1946**	**5248**	**8204**	**0**	**5830**	**0**	**3088**	**8918**	**0**	**714**	**0**
I.03	50	135	448	633	0	868	176	406	1450	0	817	0
II.03	63	123	496	682	0	844	202	249	1295	0	613	0
III.03	41	167	462	670	0	1022	88	301	1411	0	741	0
IV.03	63	142	408	613	0	763	162	269	1194	0	581	0
V.03	56	128	443	627	0	843	213	239	1295	0	668	0
VI.03	85	124	742	951	0	1059	193	167	1419	0	468	0
VII.03	52	154	685	891	0	845	73	133	1051	0	160	0
VIII.03	52	100	702	854	0	619	33	104	756	0	-98	0
IX.03	126	120	508	754	0	651	188	198	1037	0	283	0
X.03	135	139	226	500	0	484	218	435	1137	0	637	0
XI.03	37	148	358	543	0	875	232	302	1409	0	866	0
XII.03	112	122	301	535	0	527	181	409	1117	0	582	0
2003	**872**	**1602**	**5779**	**8253**	**0**	**9400**	**1959**	**3212**	**14571**	**0**	**6318**	**0**
I.04	130	110	374	614	0	728	229	406	1363	0	749	0
II.04	134	140	131	405	0	518	215	602	1335	0	930	0
III.04	144	153	134	431	0	505	213	598	1316	0	885	0
IV.04	124	122	239	485	0	561	195	480	1236	0	751	0
V.04	48	152	372	572	0	624	109	219	952	0	380	0
VI.04	31	139	625	795	0	870	196	180	1246	0	451	0
VII.04	144	148	527	819	0	352	204	171	727	0	-92	0
VIII.04	78	98	585	761	0	856	215	186	1257	0	496	0
IX.04	99	135	285	519	0	623	226	398	1247	0	728	0
X.04	23	150	251	424	0	802	222	351	1375	0	951	0
XI.04	91	105	352	548	0	683	192	461	1336	0	788	0
XII.04	133	120	178	431	0	475	166	581	1222	0	791	0
2004	**1179**	**1572**	**4053**	**6804**	**0**	**7597**	**2382**	**4633**	**14612**	**0**	**7808**	**0**

[1] These physical energy flows were measuredon the cross-frontier transmission lines (≥110 kV). These values may differ from the official statistics and the total physical balance in the table "Monthly values: Operation".

Security of supply

- Installed capacity: 15.700 MW
- Peak demand: 13.800 MW
- Total electricity generation (2005): 85.441 GWh
- Total electricity consumption (2005): 80.900 GWh

Customer service

In the Flemish region, all end customers are able to choose their supplier. In the other regions, non-household consumers are able to choose their supplier in Bruxelles-Capitale and in Wallonia, customers connected to the distribution network are able to choose supplier on request of the distribution company.

	2005
Not eligible customers	657.700
Eligible customers	4.401.300
Not eligible customers (GWh)	11.500
Eligible customers (GWh)	77.100

Switching

53% of all electricity clients in the Flemish region have changed supplier with around 20% moving to totally new company. There is no data available for the other regions.

Competition

Only 2 producers Electrabel and SPE have market share above 5%. But Electrabel itself owns over 70% of production capacity.

The wholesale market is based on bilateral contracts between producers and suppliers. A power exchange platform (Belpex) is going to be created in 2006.

Prices

Euro/MWh	**IG (24000**	**IB (50**	**DC (3500**

	MWh/year)	MWh/year)	KWh/year)
Belgium price (July 2006)	55	125	98
EU15 average	70	122	109

Environment

The RES-E target to be achieved by Belgium in 2010 is 6% of gross electricity consumption.

Currently they have achieved 2,1% of gross electricity consumption.

There are three different green certificate markets in Belgium: one in Flanders, one in the Walloon region and one in the Brussels region.

These three different systems have complicated the implementation of RES-E market.

The main promotion schemes for renewable energy sources in Belgium are Green certificate system with mandatory demand or minimum feed-in tariff.

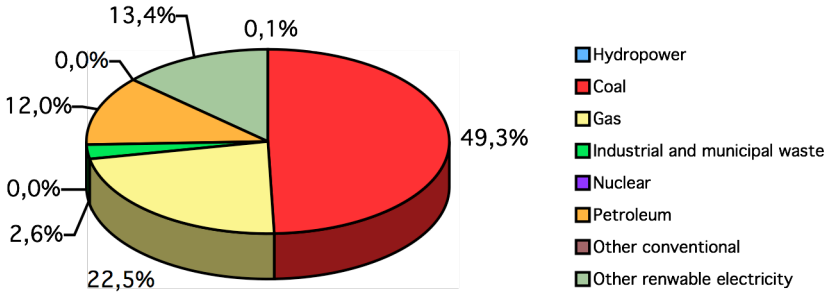
Minimum prices are:

- Wind offshore: 9 Eurocents/kWh
- Wind onshore: 5 Eurocents/kWh
- Solar: 15 Eurocents/kWh
- Biomass and other RE: 2 Eurocents/kWh
- Hydro: 5 Eurocents/kWh

A.1.4 Denmark

Background

- Population: 5.427.500
- Size: 45.000 Km^2
- GDP (2005): 208.546.100 Euros
- Growth rate of GDP volume (2005): 3,0%
- Final electricity consumption per capita (2004): 6.109 kWh/capita
- Degree of liberalization: 100%
- Primary production:



Unbundling

In Denmark there is one transmission system operator (Energinet.dk), operating the 400 kV grid, that is ownership unbundled (state owned) since its establishment as of 1st January 2005. Furthermore, 9 regional transmission system operators that operate the lower voltage transmission grid and that are legal and functional unbundled.

Legal, functional and accounting separation of both transmission and distribution system operators for electricity is assured.

Cross-border exchanges

Interconnection capacity of Denmark is about 5.200 MW with Norway, Sweden and Germany. A further increase of 600 – 800 MW with Norway has been planned.
Invetsments in interconnectors between the Nordic countries as well as internal links having impact on the cross border trade is planned.

Figure 1 Nordpool exchange for electricity 2005 (GWh) (Nordel,2005)

From: To:	Denmark	Finland	Norway	Sweden	Other countries[1]	∑ From
Denmark	-	-	470	759	10,394	11,623
Finland	-	-	131	1,394	.	1,525
Norway	4,712	164	.	10,816	.	15,692
Sweden	7,692	7,193	2,836	.	4,251	21,972
Other countries [1]	594	11,312	215	1,606	.	13,727
∑ To	12,998	18,669	3,652	14,575	14,645	64,539
						Nordel
Total to	12,998	18,669	3,652	14,575		49,894
Total from	11,623	1,525	15,692	21,972		50,812
Net imports	1,375	17,144	-12,040	-7,397		-918
Net imports/total consumption	3.8 %	20.2 %	-9.6 %	-5.0 %		-0.2 %

[1] Germany, Russia and Poland.

Security of supply

Following the blackout in Eastern Denmark and southern Sweden on 23rd September 2003, the Danish government decided to prepare an energy infrastructure plan. The scope of the plan was to provide an overview of the necessary investments in new major transmission network in order to ensure security of supply, incorporation of renewable energy, and efficient electricity market function.

- Installed capacity: 12.600 MW
- Peak demand: 6.300 MW
- Total electricity generation (2005): 36.200 GWh
- Total electricity consumption (2005): 35.400 GWh

Customer service

The electricity market was fully opened in 2003.

	2005
Not eligible customers	0
Eligible customers	3.000.000
Not eligible customers (GWh)	0
Eligible customers (GWh)	33.900

Switching

There are no available figures about switching.

The household market has been opened since 2004.

Competition

The wholesale market is integrated to the Nordic power market.

It consists of a bilateral trading market between generators on one hand and suppliers and industrial companies on the other hand, and of a voluntary Nordic power exchange Nordpool which has a spot market and a forward market.

The market share of Nord Pool Spot AS in 2004 was 42% of the physical delivery in the Nordic countries. The wholesale market in Denmark has been largely dominated by two producers, Elsam and Energi E2. The competition authority is preparing two cases concerning Elsam's abuse of dominant position.

Prices

Euro/MWh	**IG (24000 MWh/year)**	**IB (50 MWh/year)**	**DC (3500 KWh/year)**
Denmark price (July 2006)	-	82	107
EU15 average	70	122	109

Environment

The RES-E target to be achieved by Denmark in 2010 is 29% of gross electricity consumption.

Currently they have achieved 27% of gross electricity consumption.

The main promotion schemes for renewable energy sources in Denmark are:

- Act on payment for green electricity
- Settlement price instead of formerly high feed-in tariff

Wind onshore: new installation receive spot price plus (on a monthly basis) an environmental premium (maximum of 1,3 Eurocents/kWh) plus a compensation for offsetting costs (0,3 Eurocents/kWh), in total limited to 4,8 Eurocents/kWh. Turbine owners are responsible for selling and balancing the power. The tariff is insufficient to attract new investments.

Wind offshore: new installations receive spot price plus (on a monthly basis) an environmental premium (maximum of 1,3 Eurocents/kWh) plus a compensation for offsetting costs (0,3 Eurocents/kWh), in total limited to 4,8 Eurocents/kWh. Turbine owners are responsible for selling and balancing the power. The tariff can be well below the 4,8 Eurocents/kWh in times of a low spot price.

Solid biomass: a settlement price of 4 Eurocents/kWh is guaranteed for a period of ten years. Additionally and as a guarantee these plants receive 1 Eurocent/kWh in compensation for a Renewable Energy certificate.

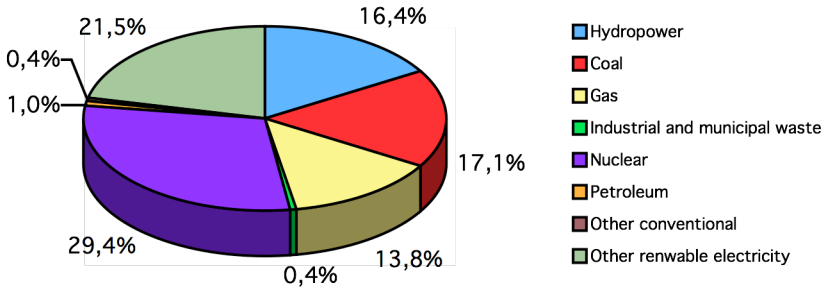
Biogas: a settlement price of 4 Eurocents/kWh is paid

Waste: a settlement price of 1 Eurocent/kWh is paid

A.1.5 Finland

Background

- Population: 5.255.600
- Size: 337.000 Km^2
- GDP (2005): 157.377.000 Euros
- Growth rate of GDP volume (2005): 2,9%
- Final electricity consumption per capita (2004): 15.928 kWh/capita
- Degree of liberalization: 100%
- Primary production:



Unbundling

In Finland there is only one transmission system operator (Fingrid Plc) that is ownership and accounting unbundled.

Legal and functional unbundling is required for distribution system operators in whose the annually transmitted quantity of electricity has been at least 200 GWh during the last three years.

Cross-border exchanges

Fingrid Plc and Svenska Kraftnät, the transmission system operators in Finland and Sweden respectively, have decide to construct a new cross-border transmission connection of 600 – 800 MW between the countries. An interconnector to Estonia of a 350 MW capacity will be built.

Figure 2 Nordpool exchange for electricity 2005 (GWh) (Nordel,2005)

From: To:	Denmark	Finland	Norway	Sweden	Other countries[1]	∑ From
Denmark	-	-	470	759	10,394	11,623
Finland	-	-	131	1,394	.	1,525
Norway	4,712	164	.	10,816	.	15,692
Sweden	7,692	7,193	2,836	.	4,251	21,972
Other countries [1]	594	11,312	215	1,606	.	13,727
∑ To	12,998	18,669	3,652	14,575	14,645	64,539
						Nordel
Total to	12,998	18,669	3,652	14,575		49,894
Total from	11,623	1,525	15,692	21,972		50,812
Net imports	1,375	17,144	-12,040	-7,397		-918
Net imports/total consumption	3.8 %	20.2 %	-9.6 %	-5.0 %		-0.2 %

[1] Germany, Russia and Poland.

Security of supply

Reserve margin is relatively low in Finland and in general in the Nordic market, but it is considered sufficient.

- Installed capacity: 16.488 MW
- Peak demand: 13.475 MW
- Total electricity generation (2005): 81.200 GWh
- Total electricity consumption (2005): 84.900 GWh

Customer service

The electricity market was fully opened in January 1997.

	2005
Not eligible customers	0
Eligible customers	3.120.000
Not eligible customers (GWh)	0
Eligible customers (GWh)	86.600

Switching

The network operator may not charge a customer for the change of supplier unless the time elapsed from the previous change of supplier is less than 12 months.

In the Finnish electricity market about 11% of household customers have changed the supplier by the year 2004.

Competition

The wholesale market in Finland is integrated to the Nordic power market.

It consists of a bilateral trading market between generators on one hand and suppliers and industrial companies on the other hand, and of a voluntary Nordic power exchange Nordpool which has a spot market and a forward market.

Prices

Euro/MWh	IG (24000 MWh/year)	IB (50 MWh/year)	DC (3500 KWh/year)
Finland price (July 2006)	51	68	83
EU15 average	70	122	109

Environment

The RES-E target to be achieved by Finland in 2010 is 28,3% of gross electricity consumption.

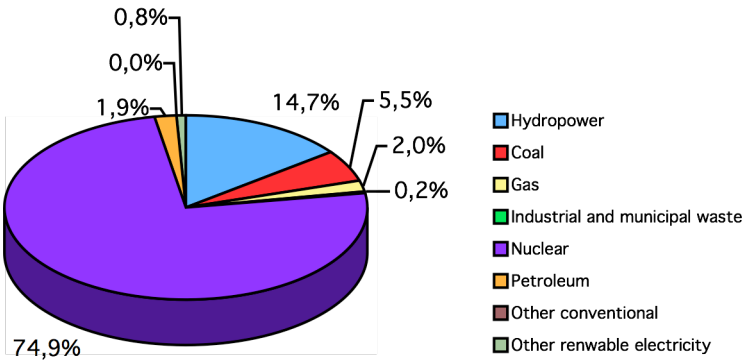
Currently they have achieved 31,5% of gross electricity consumption.

The main promotion scheme for renewable energy sources in Denmark is the exemption from energy taxes for renewable electricity. Unlike electricity from fossil or nuclear sources renewable electricity is exempted from the Finnish energy tax paid by end-users.

A.1.6 France

Background

- Population: 62.886.200
- Size: 547.030 Km^2
- GDP (2005): 1.710.023.600 Euros
- Growth rate of GDP volume (2005): 1,2%
- Final electricity consumption per capita (2004): 6.908 kWh/capita
- Degree of liberalization: 70%
- Primary production:



Unbundling

Legal, functional and accounting separation of the transmission system operator for electricity is assured. RTE is the only electricity transmission system operator in France and it is owned by Electricité de France that is the most important electricity generator and supplier in France.

Functional and accounting separation of distribution system operators for electricity is assured, and legal separation will be put forward by 1st July 2007. The 100.000 customers exemption is present, this means that only 5 out of 170 distribution system operators are subject to the unbundling rules.

Cross-border exchanges

The level of electricity interconnector capacity of France with neighbouring countries is quite high.

They decided to improve the interconnection grid between France and Belgium. The reinforcement structure started on 14th December 2005 and it has increased commercial capacity by at least 700 MW.

Commercial capacity of transits between France and Spain is currently around 1.600 MW. The Iberian Peninsula interconnection rate is one of the lowest in Europe. It is far from being in line with recommendations made by the European Summit held in Barcelona in 2002 (10% of domestic consumption, *id est* 4.000 MW).

The objective currently targeted by transmission system operators is to raise the capacity to 2.800 MW, and then to 4.000 MW at a later date

In 2004 it began to import significant quantities from both Germany and Switzerland. Two new interconnectors with Belgium have been undertaken and will be operational by 2007.

Physical exchanges in interconnected operation [1]

France | **GWh**

MM_YY	FR→BE	FR→CH	FR→DE	FR→ES	FR→IT	FR→GB	FR_UCTE_EXP	FR_III_EXP	BE→FR	CH→FR	DE→FR	ES→FR	IT→FR	GB→FR	FR_UCTE_IMP	FR_III_IMP	FR_UCTE_SLD	FR_III_SLD
	Export (-)								Import (+)								Balance	
I.99	163	1087	993	531	1407	1338	4181	1338	336	121	12	66	38	0	573	0	-3608	-1338
II.99	203	1079	1050	560	1386	1168	4278	1168	233	170	0	55	35	0	493	0	-3785	-1168
III.99	271	1106	1221	600	1528	1361	4726	1361	190	105	0	50	35	0	380	0	-4346	-1361
IV.99	359	876	1422	601	1281	1275	4539	1275	23	85	0	65	26	0	199	0	-4340	-1275
V.99	431	507	1030	521	1350	1351	3839	1351	31	105	8	38	16	0	198	0	-3641	-1351
VI.99	505	433	914	503	1232	1192	3587	1192	24	226	28	35	36	0	349	0	-3238	-1192
VII.99	694	392	1222	706	1190	1114	4204	1114	7	169	5	56	70	0	307	0	-3897	-1114
VIII.99	1018	411	1571	673	781	1318	4454	1318	0	276	1	25	87	0	389	0	-4065	-1318
IX.99	916	607	1375	648	1237	1076	4783	1076	0	411	3	47	33	0	494	0	-4289	-1076
X.99	589	722	1199	655	1422	1341	4587	1341	10	202	38	40	10	0	300	0	-4287	-1341
XI.99	344	783	909	729	1461	1158	4226	1158	84	174	42	47	20	0	367	0	-3859	-1158
XII.99	337	975	865	678	1495	1222	4350	1222	72	165	85	65	35	0	422	0	-3928	-1222
1999	**5830**	**8978**	**13771**	**7405**	**15770**	**14914**	**51754**	**14914**	**1010**	**2209**	**222**	**589**	**441**	**0**	**4471**	**0**	**-47283**	**-14914**
I.03	868	1154	1660	443	1749	650	5874	650	50	118	4	132	37	32	341	32	-5533	-618
II.03	844	1167	1824	356	1701	246	5892	246	63	120	0	61	33	285	277	285	-5615	39
III.03	1022	1402	1974	544	1888	371	6830	371	41	46	0	21	36	235	144	235	-6686	-136
IV.03	763	1065	1620	393	1666	362	5507	362	63	71	2	43	35	243	214	243	-5293	-119
V.03	843	796	1844	651	1600	561	5734	561	56	49	0	24	33	194	162	194	-5572	-367
VI.03	1059	605	1812	703	1327	354	5506	354	85	233	1	22	49	520	390	520	-5116	166
VII.03	845	631	1722	680	1334	292	5212	292	52	187	86	41	55	247	421	247	-4791	-45
VIII.03	619	598	1684	683	872	411	4456	411	52	249	22	14	60	112	397	112	-4059	-299
IX.03	651	776	1396	660	1601	47	5084	47	126	91	4	20	22	587	263	587	-4821	540
X.03	484	848	903	582	1373	296	4190	296	135	156	32	60	16	308	399	308	-3791	12
XI.03	875	1293	1877	378	1425	688	5848	688	37	51	0	62	28	178	178	178	-5670	-510
XII.03	527	1357	1911	316	1489	1023	5600	1023	112	92	1	102	30	34	337	34	-5263	-989
2003	**9400**	**11692**	**20227**	**6389**	**18025**	**5301**	**65733**	**5301**	**872**	**1463**	**152**	**602**	**434**	**2975**	**3523**	**2975**	**-62210**	**-2326**
I.04	728	1261	1519	400	1527	954	5435	954	130	126	5	99	32	78	392	78	-5043	-876
II.04	518	1035	746	374	1416	661	4089	661	134	125	79	84	34	92	456	92	-3633	-569
III.04	505	989	603	537	1635	465	4269	465	144	100	91	119	33	264	487	264	-3782	-201
IV.04	561	910	845	402	1479	751	4197	751	124	82	79	95	37	33	417	33	-3780	-718
V.04	624	734	1494	486	1353	829	4691	829	48	43	14	51	38	83	194	83	-4497	-746
VI.04	870	484	1416	469	1285	948	4524	948	31	286	62	42	45	39	466	39	-4058	-909
VII.04	352	452	1493	593	1376	928	4266	928	144	421	27	44	67	16	703	16	-3563	-912
VIII.04	856	655	1672	366	1162	896	4711	896	78	234	6	66	88	7	472	7	-4239	-889
IX.04	623	734	1443	528	1362	772	4690	772	99	231	4	15	50	24	399	24	-4291	-748
X.04	802	892	1453	498	1499	1271	5144	1271	23	227	4	67	19	0	340	0	-4804	-1271
XI.04	683	793	1544	561	1523	925	5104	925	91	216	7	60	53	117	427	117	-4677	-808
XII.04	475	881	1254	820	1508	924	4938	924	133	213	18	18	48	59	430	59	-4508	-865
2004	**7597**	**9820**	**15482**	**6034**	**17125**	**10324**	**56058**	**10324**	**1179**	**2304**	**396**	**760**	**544**	**812**	**5183**	**812**	**-50875**	**-9512**

[1] These physical energy flows were measured on the cross-frontier transmission lines (≥110 kV). These values may differ from the official statistics and the total physical balance in the table "Monthly values: Operation".

Security of supply

- Installed capacity: 116.000 MW
- Peak demand: 86.024 MW
- Total electricity generation (2005): 563.100 GWh
- Total electricity consumption (2005): 482.400 GWh

The government has started a pluri-annual investment project to improve the installed capacity of France:

- 232 MW of biomass and biogas generation facilities
- 500 MW of offshore wind power generation and 500 MW of onshore wind power generation.

Customer service

There are 32 millions electricity customers in France.

All business clients and *collectivités territoriales* are able to select their supplier.

Significant customer protection is assured, mainly for low-income customers. Many prices are still regulated.

	2005
Not eligible customers	31.600.000
Eligible customers	1.400.000
Not eligible customers (GWh)	140.000
Eligible customers (GWh)	330.000

Switching

59.200 consumers have changed supplier by June 2005, representing 13% of the total volume of eligible consumption and 1,3% of the number of clients. Many other have negotiated a new contract with the incumbent supplier while leaving the regulated tariff.

Competition

Electricité de France has around 90% of installed production capacity.

The power exchange (Powernext) traded volumes of 14,2 TWh for day-ahead exchange and 12,9 TWh of futures market in 2004, in total 5,6% of consumption in France.

Prices

Euro/MWh	IG (24000 MWh/year)	IB (50 MWh/year)	DC (3500 KWh/year)
France price (July 2006)	46	84	91
EU15 average	70	122	109

Environment

The RES-E target to be achieved by France in 2010 is 21% of gross electricity consumption.

Currently they have achieved 14,2% of gross electricity consumption.

The main promotion scheme for renewable energy sources in France is the feed-in tariff for renewable energy installation up to 12 MW, guaranteed for 15 or 20 years.

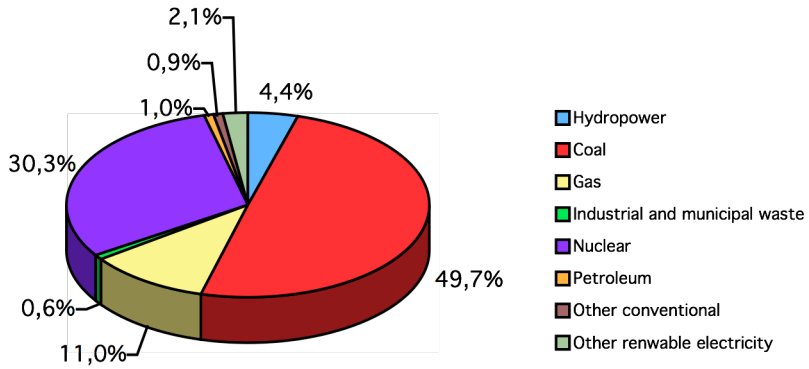
- PV-Systems: 15 Eurocents/kWh
- Biomass: standard rate of 4,9 Eurocents/kWh, premium up to 6 Eurocents/kWh
- Hydro: standard rate of 6 Eurocents/kWh, premium up to 7,5 Eurocents/kWh
- Sewage and landfill gas: standard rate of 3,5 Eurocents/kWh, premium up to 4 Eurocents/kWh
- Municipal solid waste: standard rate of 3,5 Eurocents/kWh, premium up to 4 Eurocents/kWh
- Wind: 8,5 Eurocents/kWh for the first 5 years after installation, then 6,5 Eurocents up to 10 years after installation and 3 Eurocents/kWh for a further 5 years

A tendering system is in place for renewable energy installation > 12 MW. Some projects have launched for biogas, wind on-shore and wind off-shore with a power capacity of 250 MW.

A.1.7 Germany

Background

- Population: 82.438.000
- Size: 357.022 Km^2
- GDP (2005): 2.241.000.000 Euros
- Growth rate of GDP volume (2005): 0,9%
- Final electricity consumption per capita (2004): 6.220 kWh/capita
- Degree of liberalization: 100%
- Primary production:



Unbundling

Legal, functional and accounting separation of transmission system operators for electricity is assured.

The process of unbundling of distribution system operators is not yet finalised. Germany has many small distribution system operators, of which the largest part will be exempted from legal and functional unbundling in application of the 100.000 customer rules.

Cross-border exchanges

The interconnection capacity in Germany amounts to 14,4% of installed electricity capacity.

Physical exchanges in interconnected operation [1]

Germany | **GWh**

MM_YY	DE→AT	DE→CH	DE→CZ	DE→FR	DE→LU	DE→NL	DE→PL	DE→DK_W	DE→DK[2]	DE→SE	DE_UCTE_EXP	DE_III_EXP	AT→DE	CH→DE	CZ→DE	FR→DE	LU→DE	NL→DE	PL→DE	DK_W→DE	DK[2]→DE	SE→DE	DE_UCTE_IMP	DE_III_IMP	DE_UCTE_SLD	DE_III_SLD
MM YY	Export (-)												Import (+)												Balance	
I.99	631	1250	126	12	361	1456	148	n.a.	18	18	3984	36	289	343	455	993	49	28	50	n.a.	536	112	2207	648	-1777	612
II.99	551	1010	98	0	326	1171	142	n.a.	21	20	3298	41	299	413	469	1050	45	18	30	n.a.	550	131	2324	681	-974	640
III.99	669	1031	110	0	342	1304	75	n.a.	0	1	3531	1	343	446	480	1221	41	17	20	n.a.	550	126	2568	676	-963	675
IV.99	662	1007	94	0	343	1400	193	n.a.	2	1	3699	3	265	346	327	1422	42	18	23	n.a.	441	140	2443	581	-1256	578
V.99	300	322	38	8	328	1648	156	n.a.	12	0	2800	12	580	714	350	1030	49	80	20	n.a.	371	152	2823	523	23	511
VI.99	286	296	34	28	334	1577	115	n.a.	24	0	2670	24	672	686	462	914	54	103	24	n.a.	300	136	2915	436	245	412
VII.99	211	569	48	5	330	1423	188	n.a.	45	0	2774	45	676	321	434	1222	43	101	17	n.a.	278	131	2814	409	40	364
VIII.99	178	385	5	1	321	1276	209	n.a.	203	15	2375	218	549	509	326	1571	53	151	24	n.a.	252	43	3183	295	808	77
IX.99	273	531	41	3	357	1451	186	n.a.	145	10	2842	155	519	509	388	1375	60	57	30	n.a.	237	65	2938	302	96	147
X.99	299	528	5	38	390	1598	201	n.a.	73	32	3059	105	489	688	644	1199	71	24	36	n.a.	474	94	3151	568	92	463
XI.99	586	756	0	42	400	1409	113	n.a.	13	2	3306	15	380	507	786	909	78	34	81	n.a.	676	142	2775	818	-531	803
XII.99	864	1000	13	85	397	1445	228	n.a.	42	1	4032	43	282	381	572	865	72	34	13	n.a.	454	15	2219	469	-1813	426
1999	**5510**	**8685**	**612**	**222**	**4229**	**17158**	**1954**	**n.a.**	**598**	**100**	**38370**	**698**	**5343**	**5863**	**5693**	**13771**	**657**	**665**	**368**	**n.a.**	**5119**	**1287**	**32360**	**6406**	**-6010**	**5708**
I.03	832	1132	1	4	433	1453	236	n.a.	385	285	4091	670	431	273	1231	1660	71	91	34	n.a.	102	5	3791	107	-300	-563
II.03	706	1110	0	0	388	899	169	n.a.	486	228	3272	714	297	252	1008	1824	55	101	43	n.a.	181	2	3580	183	308	-531
III.03	1047	1426	2	0	395	1178	196	n.a.	577	251	4244	828	265	283	1011	1974	52	13	47	n.a.	179	1	3645	180	-599	-648
IV.03	934	1322	4	2	388	1235	286	n.a.	489	223	4171	712	191	324	971	1620	59	20	17	n.a.	251	17	3202	268	-969	-444
V.03	466	456	0	0	396	1308	179	n.a.	687	233	2805	920	391	576	1148	1844	65	16	16	n.a.	224	25	4056	249	1251	-671
VI.03	515	787	0	1	395	1056	238	n.a.	437	150	2992	587	383	247	880	1812	67	63	31	n.a.	412	93	3483	505	491	-82
VII.03	560	758	3	86	421	698	227	n.a.	387	137	2753	524	352	463	982	1722	77	174	31	n.a.	518	107	3801	625	1048	101
VIII.03	833	1045	20	22	401	856	246	n.a.	523	184	3423	707	223	191	867	1684	78	66	8	n.a.	352	68	3117	420	-306	-287
IX.03	980	1086	0	4	408	1048	207	n.a.	357	88	3733	445	147	178	1014	1396	70	32	7	n.a.	316	19	2844	335	-889	-110
X.03	914	1280	1	32	445	1836	189	n.a.	358	140	4697	498	237	107	1227	903	79	4	32	n.a.	525	71	2589	596	-2108	98
XI.03	870	1394	0	0	444	1652	191	n.a.	401	165	4551	566	221	109	1312	1877	81	3	16	n.a.	457	57	3619	514	-932	-52
XII.03	1249	1552	21	1	442	1819	397	n.a.	282	157	5481	439	195	125	1143	1911	80	18	3	n.a.	482	92	3475	574	-2006	135
2003	**9906**	**13348**	**52**	**152**	**4956**	**15038**	**2761**	**n.a.**	**5369**	**2241**	**46213**	**7610**	**3333**	**3128**	**12794**	**20227**	**834**	**601**	**285**	**n.a.**	**3999**	**557**	**41202**	**4556**	**-5011**	**-3054**
I.04	1296	1482	11	5	433	1611	338	109	184	133	5176	426	254	81	1164	1519	71	6	6	394	146	108	3101	648	-2075	222
II.04	1152	1318	4	79	395	1833	346	134	147	123	5127	404	297	72	1055	746	55	1	2	343	152	83	2228	578	-2899	174
III.04	1000	1067	0	91	420	1883	238	96	128	122	4699	346	326	172	1237	603	54	15	44	461	196	104	2451	761	-2248	415
IV.04	757	831	4	79	398	1737	149	218	169	144	3955	531	324	146	1035	845	64	3	87	251	110	65	2504	426	-1451	-105
V.04	407	455	0	14	397	1217	221	286	27	148	2711	461	401	473	1326	1494	60	22	11	261	0	119	3787	380	1076	-81
VI.04	296	449	1	62	396	1054	76	337	61	175	2334	573	542	328	1190	1416	61	97	114	212	6	82	3748	300	1414	-273
VII.04	256	485	0	27	412	865	147	161	74	101	2192	336	674	390	1069	1493	61	81	80	196	166	117	3848	479	1656	143
VIII.04	328	671	0	6	385	927	185	304	103	169	2502	576	427	389	1027	1672	60	197	36	167	5	60	3808	232	1306	-344
IX.04	568	1035	42	4	409	1165	271	182	0	94	3494	276	333	258	932	1443	65	108	27	346	0	147	3166	493	-328	217
X.04	730	1031	6	4	422	1516	363	171	43	81	4072	295	288	219	1006	1453	64	16	3	445	101	161	3049	707	-1023	412
XI.04	892	1413	25	7	420	1548	324	148	103	50	4629	301	292	165	1081	1544	63	12	32	415	189	63	3189	667	-1440	366
XII.04	1240	1593	51	18	441	2001	500	67	86	106	5844	259	307	93	994	1254	73	0	8	551	223	161	2729	935	-3115	676
2004	**8922**	**11830**	**144**	**396**	**4928**	**17357**	**3158**	**2213**	**1125**	**1446**	**46735**	**4784**	**4465**	**2786**	**13116**	**15482**	**751**	**558**	**450**	**4042**	**1294**	**1270**	**37608**	**6606**	**-9127**	**1822**

[1] These physical energy flows were measured on all cross-frontier transmission lines . These values may differ from the official statistics and the total physical balance in the table "Monthly values: Operation".

[2] Physical exchanges year 1999 and 2003 as sum Denmark, year 2004 exchanges with Denmark East

Security of supply

In 2004, Germany improved its installed capacity by around 3.000 MW, of which 2.180 MW were from renewable energy sources plants.

- Installed capacity: 114.900 MW
- Peak demand: 77.200 MW
- Total electricity generation (2005): 547.000 GWh
- Total electricity consumption (2005): 550.000 GWh

Customer service

The electricity market has been totally open since 1998. Significant customer protection is assured, mainly for household customers. But special tariffs for low-income customers do not exist.

	2005
Not eligible customers	0
Eligible customers	45.000.000
Not eligible customers (GWh)	0
Eligible customers (GWh)	524.000

Switching

Switching rates are not yet enough high, but a high percentage of them have renegotiated with their existing supplier.

Competition

The German wholesale market is almost totally dominated by bilateral trading, even if an increasing share of overall trade (around 10%) is done at the German power exchange (EEX). The 4 largest generation companies control around 70% of total generation capacity.

The German competition authority considers that the largest two companies (E.ON and RWE) maintain together a dominant position.

Prices

Household prices continue to be regulated (price caps) until 1st July 2007.

Euro/MWh	IG (24000 MWh/year)	IB (50 MWh/year)	DC (3500 KWh/year)
Germany price (July 2006)	78	165	141
EU15 average	70	122	109

Environment

The RES-E target to be achieved by Germany in 2010 is 12,5% of gross electricity consumption.

Currently they have achieved 9,7% of gross electricity consumption.

The main promotion scheme for renewable energy sources in Germany is the Renewable Energy Act.

Feed-in tariffs:

- Wind: 9 Eurocents/kWh for at least 5 years after installation. Reduction of tariff to 6 Eurocents/kWh depending on yield of system. Yearly reduction of tariff by 1,5%.
- Biomass up to 500 kW: 10 Eurocents/kWh, up to 5 MWp: 9 Eurocents/kWh, up to 20 MWp: 8,6 Eurocents/kWh
- Hydro, landfill gas, sewage gas: up to 500 kW: 7,7 Eurocents/kWh, from 501 kW to 5 MW: 6,6 Eurocents/kWh
- Photovoltaics: 48 Eurocents/kWh, yearly reduction of tariff by 5%.

Market Incentive Program: investment subsidy for most sources except wind

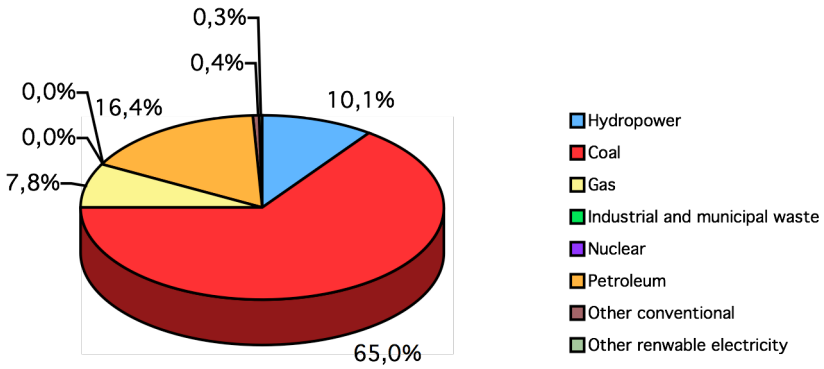
Income tax regulations on wind energy investment

Environment and energy efficiency programme: subsidised loans for major share of wind investments

A.1.8 Greece

Background

- Population: 11.125.200
- Size: 131.940 Km^2
- GDP (2005): 181.087.500 Euros
- Growth rate of GDP volume (2005): 3,7%
- Final electricity consumption per capita (2004): 4.503 kWh/capita
- Degree of liberalization: 70%
- Primary production:



Unbundling

The "Hellenic Transmission System Operator" S.A. (HTSO), established by Ministerial Decree 328/12.12.2000 is the Transmission System Operator. 51% of the HTSO is state owned and 49% is owned by the generators. The Public Power Corporation SA (PPC) is the only power generator in the Greek territory, therefore PPC controls 49% of the shares of the HTSO and appoints members to the Board of Directors of HTSO.

Legal and functional separation of the transmission system operator for electricity is assured.

Unbundling has not yet been implemented for the Distribution System Operator. PPC, the exclusive owner of the Distribution Network, is appointed as the Distribution System Operator under the legislation in force. PPC is the single distributor in Greece.

Cross-border exchanges

During 2004, the total net transfer capacity of the Northern interconnectors was 600 MW in each direction. The capacity of the undersea interconnections between Greece and Italy amounts to 500 MW for imports to Greece and 300 MW for exports to Italy. New interconnection capacity with Turkey and Bulgaria will be built.

Physical exchanges in interconnected operation [1]

Greece | **GWh**

MM_YY	GR→BG	GR→IT	GR→MK	GR→AL	GR_UCTE_EXP	GR_IIL_EXP	BG→GR	IT→GR	MK→GR	AL→GR	GR_UCTE_IMP	GR_IIL_IMP	GR_UCTE_SLD	GR_IIL_SLD
	Export (-)						Import (+)						Balance	
I.99	49	0	50	121	50	170	8	0	14	0	14	8	-36	-162
II.99	34	0	58	127	58	161	23	0	23	0	23	23	-35	-138
III.99	10	0	5	119	5	129	32	0	103	3	103	35	98	-94
IV.99	6	0	17	51	17	57	69	0	58	4	58	73	41	16
V.99	1	0	62	11	62	12	152	0	14	53	14	205	-48	193
VI.99	1	0	36	25	36	26	174	0	47	44	47	218	11	192
VII.99	0	0	1	43	1	43	196	0	107	10	107	206	106	163
VIII.99	1	0	2	43	2	44	210	0	87	7	87	217	85	173
IX.99	1	0	1	66	1	67	165	0	71	3	71	168	70	101
X.99	15	0	59	101	59	116	55	0	16	0	16	55	-43	-61
XI.99	66	0	60	157	60	223	16	0	13	0	13	16	-47	-207
XII.99	60	0	97	96	97	156	28	0	6	2	6	30	-91	-126
1999	**244**	**0**	**448**	**960**	**448**	**1204**	**1128**	**0**	**559**	**126**	**559**	**1254**	**111**	**50**
I.03	0	0	9	33	9	33	157	0	39	15	196	15	187	-18
II.03	0	3	8	19	11	19	129	0	41	13	170	13	159	-6
III.03	0	56	0	56	56	56	204	0	97	1	301	1	245	-55
IV.03	0	107	6	54	113	54	166	0	140	1	306	1	193	-53
V.03	0	223	0	70	223	70	281	0	128	0	409	0	186	-70
VI.03	0	73	5	73	78	73	289	0	109	0	398	0	320	-73
VII.03	0	14	4	72	18	72	399	10	75	0	484	0	466	-72
VIII.03	0	127	2	109	129	109	389	3	77	0	469	0	340	-109
IX.03	0	192	11	88	203	88	358	0	50	0	408	0	205	-88
X.03	0	74	43	60	117	60	233	12	26	11	271	11	154	-49
XI.03	1	139	27	66	167	66	315	3	37	8	355	8	188	-58
XII.03	0	125	38	76	163	76	382	0	19	2	401	2	238	-74
2003	**1**	**1133**	**153**	**776**	**1287**	**776**	**3302**	**28**	**838**	**51**	**4168**	**51**	**2881**	**-725**
I.04	0	56	51	41	107	41	365	0	12	10	377	10	270	-31
II.04	0	190	6	90	196	90	335	0	51	2	386	2	190	-88
III.04	0	220	8	22	228	22	277	0	60	28	337	28	109	6
IV.04	0	146	1	12	147	12	100	0	157	24	257	24	110	12
V.04	0	149	5	7	154	7	189	0	118	53	307	53	153	46
VI.04	0	26	1	3	27	3	266	0	79	49	345	49	318	46
VII.04	1	0	2	20	3	20	323	107	71	25	501	25	498	5
VIII.04	0	0	3	32	3	32	363	82	58	12	503	12	500	-20
IX.04	0	154	11	71	165	71	363	1	49	0	413	0	248	-71
X.04	0	195	2	88	197	88	341	0	81	0	422	0	225	-88
XI.04	0	192	8	61	200	61	348	1	46	2	395	2	195	-59
XII.04	0	96	4	69	100	69	363	0	51	0	414	0	314	-69
2004	**1**	**1424**	**102**	**516**	**1527**	**516**	**3633**	**191**	**833**	**205**	**4657**	**205**	**3130**	**-311**

[1] These physical energy flows were measured on the cross-frontier transmission lines (≥110 kV). These values may differ from the official statistics and the total physical balance in the table "Monthly values: Operation".

Security of supply

Reserve margins are relatively low, but two 400 MW plants are under construction.

The 2005 Grid and Power Exchange Code introduced a generation capacity assurance mechanism to increase the security of supply. This mechanism should reduce business risk of the investors of the new power plants, by providing guarantees for covering part of their capital cost.

- Installed capacity in the interconnected system: 11.350 MW
- Installed capacity in the non-interconnected islands: 1.605 MW
- Peak demand: 9510 MW
- Total electricity generation (2005): 59.500 GWh
- Total electricity consumption (2005): 61.200 GWh

Customer service

Families with more than three kids, consumers in the agricultural sector and Public Power Corporation (PPC) employees enjoy discount retail tariffs.

	2005
Not eligible customers	6.850.000
Eligible customers	7.100
Not eligible customers (GWh)	36.500
Eligible customers (GWh)	15.700

Switching

Practically, all customers connected to the medium and low voltage system are supplied by PPC. A few licensed suppliers operating in the retail market supply small amounts of electricity to commercial and light industrial sectors' customers. In 2004 this amounts to 398 GWh thus 0,78% of the overall consumption in the interconnected system.

Competition

The 2005 Grid and Power Exchange Code developed an organized daily wholesale market, where all electricity produced and consumed in Greece have to pass. But there is no a real time balancing market.

Prices

In 2005 electricity prices increased by an average of 3,5%. But electricity in Greece is still among the cheapest in Europe, especially for household consumers.

Euro/MWh	**IG (24000 MWh/year)**	**IB (50 MWh/year)**	**DC (3500 KWh/year)**
Greece price (July 2006)	56	98	64
EU15 average	70	122	109

Environment

The RES-E target to be achieved by Greece in 2010 is 20,1% of gross electricity consumption.

Currently they have achieved 9,5% of gross electricity consumption.

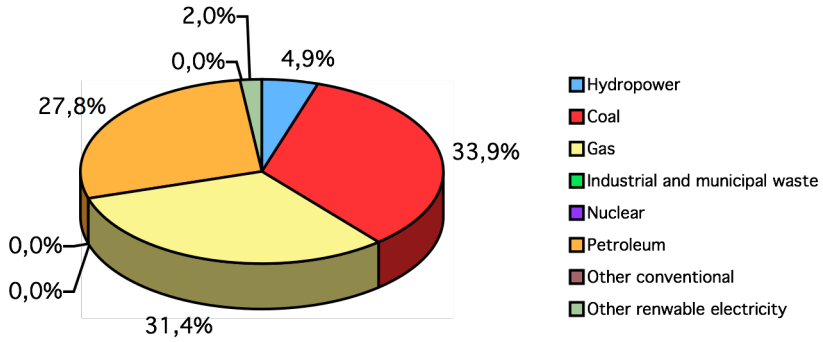
The main promotion schemes for renewable energy sources in Greece are:

- Law 2244/94 (feed-in tariff) and Law 2773/1999 (liberalisation) (Feed-in tariff of about 7,8 Eurocents/kWh on the islands and 7 € cents/kWh on the mainland)
- Development Law 2601/98. The Law supports investment activities (including energy investments) of private companies (investment subsidy of about 30%).
- The Operational Programme "Competitiveness" of the Hellenic Ministry of Development is part of the 3rd Community Support Framework (State aid for renewable energy sources investments, ranging from 30% to 50%).
- Law 2364/95 introduces a reduction of the taxable income of final users who install renewable energy systems in private buildings (75% of costs for purchase and installation is tax-deductible).

A.1.9 Ireland

Background

- Population: 4.209.000
- Size: 70.273 Km^2
- GDP (2005): 161.162.800 Euros
- Growth rate of GDP volume (2005): 5,5%
- Final electricity consumption per capita (2004): 5.718 kWh/capita
- Degree of liberalization: 100%
- Primary production:



Unbundling

There is one transmission system operator and one distribution system operator.

Functional and accounting separation of transmission system operators for electricity is assured.

Legal unbundling legislative framework has been introduced for the transmission system operator.

Functional and accounting separation of distribution system operators for electricity is assured, but not yet legal separation.

Cross-border exchanges

The governments of the Republic of Ireland and Northern Ireland agreed to the creation of an all-Ireland energy market. Interconnection capacity is now 330 MW. A further capacity will be built.

An undersea interconnection between Ireland and Great Britain of up to 1.000 MW is planned.

Security of supply

Margin reserve is considered low, but the planned investment in further capacity will guarantee improvements in security of supply.

- Installed capacity: 5.800 MW
- Peak demand: 4.500 MW
- Total electricity generation (2005): 27.400 GWh
- Total electricity consumption (2005): 26.900 GWh

Customer service

The electricity market has been totally open since February 2005.

Consumer protection guidelines have been put forward and minimum standards have been established by the regulatory agency.

	2005
Not eligible customers	0
Eligible customers	1.900.000
Not eligible customers (GWh)	0
Eligible customers (GWh)	24.400

Switching

Customers can change supplier without charge or delay. Around 30% have switched from the incumbent supplier or moved from a regulated to a competitively determined tariff.
Most switching has been from industrial and commercial customers. However some households have changed to renewable suppliers.

Competition

The wholesale market in Ireland is currently a bilateral trading market between generators and suppliers. Probably it will change to a centralized Pool structure that will manage the all-Ireland market for electricity.
Until 2000, the incumbent Electricity Supply Board (ESB) owned all generation plant.
The main new entrant into the generation market is Viridian which has 400 MW plant and is planning a further unit.
ESB's market share is still very high (80-90% of capacity).
There are seven independent electricity suppliers whose market share is 30% of total demand (among them it is also present ESB).

Prices

Euro/MWh	**IG (24000 MWh/year)**	**IB (50 MWh/year)**	**DC (3500 KWh/year)**
Ireland price (July 2006)	90	154	129
EU15 average	70	122	109

Environment

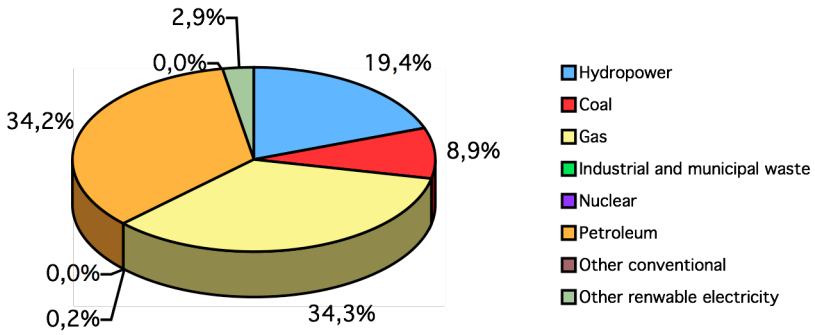
The RES-E target to be achieved by Ireland in 2010 is 13,2% of gross electricity consumption.
Currently they have achieved 5,1% of gross electricity consumption.
The Alternative Energy Requirement (tendering scheme) is the main support instrument.

Technology	Support level (Eurocents/kWh)	Specifics
Large scale wind	5,216	Up to 400 MW
Small scale wind	5,742	Up to 85 MW
Offshore wind	8,4	Up to 50 MW
Biomass	6,412	Up to 8 MW
Biomass-CHP	7,0	Up to 28 MW
Biomass-anaerobic digestion	7,0	Up to 2 MW
Hydro	7,018	Up to 5 MW

A.1.10 Italy

Background

- Population: 58.751.700
- Size: 301.336 Km^2
- GDP (2005): 1.417.241.400 Euros
- Growth rate of GDP volume (2005): 0%
- Final electricity consumption per capita (2004): 5.097 kWh/capita
- Degree of liberalization: 79%
- Primary production:



Unbundling

Until October 2005, the transmission system operator was the state owned company GRTN (*Gestore della Rete di Trasmissione Nazionale*). It managed the national transmission system, while TERNA, belonging to the Enel group, was the owner of the largest part of the grid. GRTN and TERNA merged, and Enel sold 29,99% of TERNA capital.

The Electricity Decree started to reorganize distribution that was carried out on a municipality basis. However, although the rules supporting the aggregation of minor

players, distribution remains very high fragmenteted in Italy, with monopolies of various sizes. As far as the unbundling rules concerned, legal unbundling was mandatory for distribution system operators with more than 300.000 customers, but now is applicable on a facultative basis. However, accounting unbundling is mandatory.

Cross-border exchanges

Italy has 18 electricity interconnection: 5 with France (2.500 MW), 9 with Switzerland (3.890 MW), 1 with Austria (220 MW), 2 with Slovenia (430 MW) and one undersea cable with Greece (400 MW). But these interconnections are not enough and there are several congestion problems.

Imports cover more than 14% of the demand.

Physical exchanges in interconnected operation [1]

Italy | **GWh**

MM_YY	IT→AT	IT→CH	IT→FR	IT→GR	IT→SI	IT_UCTE_EXP	IT_III_EXP	AT→IT	CH→IT	FR→IT	GR→IT	SI→IT	IT_UCTE_IMP	IT_III_IMP	IT_UCTE_SLD	IT_III_SLD
	Export (-)							Import (+)							Balance	
I.99	0	0	38	0	8	46	0	133	1784	1407	0	262	3586	0	3540	0
II.99	0	0	35	0	14	49	0	117	1565	1386	0	208	3276	0	3227	0
III.99	0	0	35	0	8	43	0	132	1742	1528	0	232	3634	0	3591	0
IV.99	0	0	26	0	2	28	0	135	1977	1281	0	270	3663	0	3635	0
V.99	0	7	16	0	0	23	0	141	2018	1350	0	341	3850	0	3827	0
VI.99	0	1	36	0	2	39	0	163	1916	1232	0	306	3617	0	3578	0
VII.99	0	1	70	0	0	71	0	160	2162	1190	0	358	3870	0	3799	0
VIII.99	0	1	87	0	1	89	0	78	1390	781	0	226	2475	0	2386	0
IX.99	0	36	33	0	0	69	0	167	1852	1237	0	295	3551	0	3482	0
X.99	0	2	10	0	0	12	0	158	1818	1422	0	344	3742	0	3730	0
XI.99	0	0	20	0	2	22	0	155	1717	1461	0	211	3544	0	3522	0
XII.99	0	0	35	0	1	36	0	148	1735	1495	0	353	3731	0	3695	0
1999	**0**	**48**	**441**	**0**	**38**	**527**	**0**	**1687**	**21676**	**15770**	**0**	**3406**	**42539**	**0**	**42012**	**0**
I.03	0	0	37	0	0	37	0	150	2273	1749	0	564	4736	0	4699	0
II.03	0	1	33	0	0	34	0	132	2111	1701	3	438	4385	0	4351	0
III.03	0	9	36	0	1	46	0	141	2328	1888	56	468	4881	0	4835	0
IV.03	0	0	35	0	0	35	0	145	2311	1666	107	494	4723	0	4688	0
V.03	0	1	33	0	0	34	0	151	2046	1600	223	381	4401	0	4367	0
VI.03	0	0	49	0	0	49	0	137	2209	1327	73	402	4148	0	4099	0
VII.03	0	2	55	10	0	67	0	138	2467	1334	14	324	4277	0	4210	0
VIII.03	0	1	60	3	33	97	0	74	1951	872	127	94	3118	0	3021	0
IX.03	0	0	22	0	9	31	0	157	2217	1601	192	178	4345	0	4314	0
X.03	0	0	16	12	0	28	0	157	2202	1373	74	438	4244	0	4216	0
XI.03	0	0	28	3	0	31	0	138	1909	1425	139	369	3980	0	3949	0
XII.03	0	0	30	0	0	30	0	144	1915	1489	125	398	4071	0	4041	0
2003	**0**	**14**	**434**	**28**	**43**	**519**	**0**	**1664**	**25939**	**18025**	**1133**	**4548**	**51309**	**0**	**50790**	**0**
I.04	0	0	32	0	1	33	0	137	2044	1527	56	425	4189	0	4156	0
II.04	0	0	34	0	0	34	0	126	1793	1416	190	530	4055	0	4021	0
III.04	0	0	33	0	0	33	0	139	1828	1635	220	478	4300	0	4267	0
IV.04	0	0	37	0	0	37	0	145	1608	1479	146	571	3949	0	3912	0
V.04	0	1	38	0	0	39	0	132	1493	1353	149	444	3571	0	3532	0
VI.04	0	3	45	0	0	48	0	141	1451	1285	26	516	3419	0	3371	0
VII.04	0	0	67	107	0	174	0	152	1666	1376	0	517	3711	0	3537	0
VIII.04	0	5	88	82	2	177	0	112	1150	1162	0	228	2652	0	2475	0
IX.04	0	0	50	1	0	51	0	125	1657	1362	154	445	3743	0	3692	0
X.04	0	3	19	0	0	22	0	136	1550	1499	195	544	3924	0	3902	0
XI.04	0	2	53	1	0	56	0	136	1862	1523	192	718	4431	0	4375	0
XII.04	0	0	48	0	0	48	0	140	1813	1508	96	764	4321	0	4273	0
2004	**0**	**14**	**544**	**191**	**3**	**752**	**0**	**1621**	**19915**	**17125**	**1424**	**6180**	**46265**	**0**	**45513**	**0**

[1] These physical energy flows were measured on the cross-frontier transmission lines (≥110 kV). These values may differ from the official statistics and the total physical balance in the table "Monthly values Operation".

Security of supply

In 2005 there was an increase in generating capacity, which rose by more than 5 GW, from 81.5 GW in 2004 to 86.8 GW in 2005.

- Installed capacity: 86.800 MW
- Peak demand: 55.015 MW
- Total electricity generation (2005): 302.400 GWh
- Total electricity consumption (2005): 329.400 GWh

Customer service

A range of customers is guaranteed protection measures: universal services, disconnection practice and service quality.

	2005
Not eligible customers	28.330.000
Eligible customers	5.082.000
Not eligible customers (GWh)	67.200
Eligible customers (GWh)	244.700

Switching

Electricity customers can change supplier without charge or delay. About 126.000 have actually changed supplier. It represents 60% of total consumption of eligible customers.

Competition

An electricity exchange is active since 1st April 2004. The types of market present in that market platform are: day-ahead market, balancing market and ancillary service market.

In the Italian electricity generation market there is one dominant player (Enel) whose market share is 43,9%. There is one main competitor (Edison) whose market share is 12,1%, and it also owns 40% of Edipower which has 9% of the market.

There are 119 distribution companies, but most of them are very small. *Enel distribuzione* has more than 50% of the distribution market.

Prices

Euro/MWh	IG (24000 MWh/year)	IB (50 MWh/year)	DC (3500 KWh/year)
Italy price (July 2006)	95	140	155
EU15 average	70	122	109

Environment

The RES-E target to be achieved by Italy in 2010 is 25% of gross electricity consumption. Currently they have achieved 15,9% of gross electricity consumption.

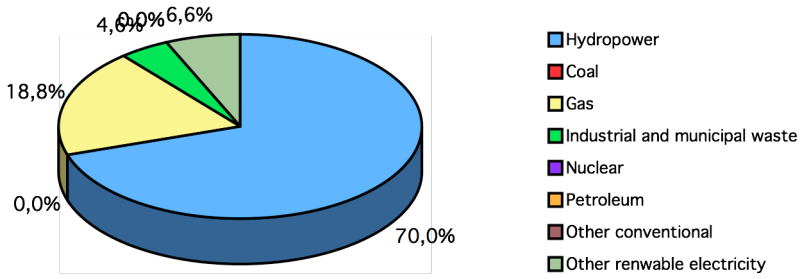
The main supporting policies are:

- Certificate system with mandatory demand
- Carbon dioxide tax with exemption for renewable energy sources
- Funds for specific technologies and/or municipalities

A.1.11 Luxembourg

Background

- Population: 459.500
- Size: 2.586 Km^2
- GDP (2005): 29.396.400 Euros
- Growth rate of GDP volume (2005): 4%
- Final electricity consumption per capita (2004): 14.121 kWh/capita
- Degree of liberalization: 57%
- Primary production:



Unbundling

Legal separation has been applied to the transmission system operators.

Cross-border exchanges

Luxembourg has two electricity transmission networks that are not interconnected between each other, but are integrated into its neighbouring countries: Belgium and Germany.

Physical exchanges in interconnected operation [1]

Luxembourg | GWh

MM_YY	LU→BE	LU→DE	LU_UCTE_IMP	LU_III_IMP	BE→LU	DE→LU	LU_UCTE_IMP	LU_III_IMP	LU_UCTE_SLD	LU_III_SLD
	IMPort (-)				Import (+)				Balance	
I.99	0	49	49	0	167	361	528	0	479	0
II.99	0	45	45	0	166	326	492	0	447	0
III.99	0	41	41	0	178	342	520	0	479	0
IV.99	0	42	42	0	163	343	506	0	464	0
V.99	0	49	49	0	154	328	482	0	433	0
VI.99	0	54	54	0	164	334	498	0	444	0
VII.99	0	43	43	0	178	330	508	0	465	0
VIII.99	0	53	53	0	109	321	430	0	377	0
IX.99	0	60	60	0	162	357	519	0	459	0
X.99	0	71	71	0	179	390	569	0	498	0
XI.99	0	78	78	0	181	400	581	0	503	0
XII.99	0	72	72	0	145	397	542	0	470	0
1999	**0**	**657**	**657**	**0**	**1946**	**4229**	**6175**	**0**	**5518**	**0**
I.03	176	71	247	0	135	433	568	0	321	0
II.03	202	55	257	0	123	388	511	0	254	0
III.03	88	52	140	0	167	395	562	0	422	0
IV.03	162	59	221	0	142	388	530	0	309	0
V.03	213	65	278	0	128	396	524	0	246	0
VI.03	193	67	260	0	124	395	519	0	259	0
VII.03	73	77	150	0	154	421	575	0	425	0
VIII.03	33	78	111	0	100	401	501	0	390	0
IX.03	188	70	258	0	120	408	528	0	270	0
X.03	218	79	297	0	139	445	584	0	287	0
XI.03	232	81	313	0	148	444	592	0	279	0
XII.03	181	80	261	0	122	442	564	0	303	0
2003	**1959**	**834**	**2793**	**0**	**1602**	**4956**	**6558**	**0**	**3765**	**0**
I.04	229	71	300	0	110	433	543	0	243	0
II.04	215	55	270	0	140	395	535	0	265	0
III.04	213	54	267	0	153	420	573	0	306	0
IV.04	195	64	259	0	122	398	520	0	261	0
V.04	109	60	169	0	152	397	549	0	380	0
VI.04	196	61	257	0	139	396	535	0	278	0
VII.04	204	61	265	0	148	412	560	0	295	0
VIII.04	215	60	275	0	98	385	483	0	208	0
IX.04	226	65	291	0	135	409	544	0	253	0
X.04	222	64	286	0	150	422	572	0	286	0
XI.04	192	63	255	0	105	420	525	0	270	0
XII.04	166	73	239	0	120	441	561	0	322	0
2004	**2382**	**751**	**3133**	**0**	**1572**	**4928**	**6500**	**0**	**3367**	**0**

[1] These physical energy flows were measured on the cross-frontier transmission lines (≥110 kV). These values may differ from the official statistics and the total physical balance in the table "Monthly values: Operation".

Security of supply

In this case security of supply is not a relevant concept considering Luxembourg alone because of the high level of interconnection with border countries.

- Installed capacity: 1700 MW
- Peak demand: 994 MW
- Total electricity generation (2005): 4.300 GWh
- Total electricity consumption (2005): 6.100 GWh

Customer service

All non-household customers are able to choose their supplier.

	2005
Not eligible customers	-
Eligible customers	-
Not eligible customers (GWh)	-
Eligible customers (GWh)	-

Switching

Customers with a total of around 10% of total national consumption have changed supplier.

Competition

There is no a real competition, because it is mainly from neighbouring countries.

Prices

Euro/MWh	**IG (24000 MWh/year)**	**IB (50 MWh/year)**	**DC (3500 KWh/year)**
Luxembourg price (July 2006)	Not available	Not available	139

EU15 average	70	122	109

Environment

The RES-E target to be achieved by Luxembourg in 2010 is 5,7% of gross electricity consumption.

Currently they have achieved 3,2% of gross electricity consumption.

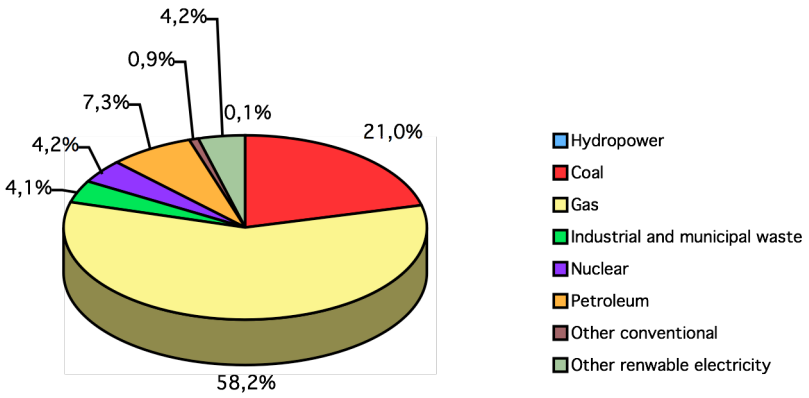
The main supporting policy is the feed-in tariff.

- Wind, hydro, biomass, biogas: up to 3 MW for 10 years 2,5 Eurocents/kWh
- PV for municipalities: up to 50 kW for 20 years 25 Eurocents/kWh
- PV for non-municipalities: up to 50 kW for 20 years 45 – 55 Eurocents/kWh

A.1.12 Netherlands

Background

- Population: 16.334.200
- Size: 41.526 Km^2
- GDP (2005): 505.646.000 Euros
- Growth rate of GDP volume (2005): 1,5%
- Final electricity consumption per capita (2004): 6.343 kWh/capita
- Degree of liberalization: 100%
- Primary production:



Unbundling

At present, the transmission system operator (TeeneT) and all the distribution system operators are legal, functional and accounting separated.

And the transmission system operator is totally separated and owned by the national government as separate company.

Cross-border exchanges

The Netherlands is well connected with neighbouring countries. Transmission capacity on the interconnectors with Belgium and Germany is 3650 MW. They have just started the construction of a cable 700 MW to Norway.

Physical exchanges in interconnected operation [1]

The Netherlands | GWh

MM_YY	NL→BE	NL→DE	NL_UCTE_EXP	NL_III_EXP	BE→NL	DE→NL	NL_UCTE_IMP	NL_III_IMP	NL_UCTE_SLD	NL_III_SLD
	Export (-)				Import (+)				Balance	
I.99	407	28	435	0	197	1456	1653	0	1218	0
II.99	290	18	308	0	263	1171	1434	0	1126	0
III.99	318	17	335	0	381	1304	1685	0	1350	0
IV.99	293	18	311	0	459	1400	1859	0	1548	0
V.99	272	80	352	0	475	1648	2123	0	1771	0
VI.99	274	103	377	0	395	1577	1972	0	1595	0
VII.99	163	101	264	0	532	1423	1955	0	1691	0
VIII.99	134	151	285	0	707	1276	1983	0	1698	0
IX.99	149	57	206	0	511	1451	1962	0	1756	0
X.99	235	24	259	0	419	1598	2017	0	1758	0
XI.99	274	34	308	0	477	1409	1886	0	1578	0
XII.99	279	34	313	0	432	1445	1877	0	1564	0
1999	**3088**	**665**	**3753**	**0**	**5248**	**17158**	**22406**	**0**	**18653**	**0**
I.03	406	91	497	0	448	1453	1901	0	1404	0
II.03	249	101	350	0	496	899	1395	0	1045	0
III.03	301	13	314	0	462	1178	1640	0	1326	0
IV.03	269	20	289	0	408	1235	1643	0	1354	0
V.03	239	16	255	0	443	1308	1751	0	1496	0
VI.03	167	63	230	0	742	1056	1798	0	1568	0
VII.03	133	174	307	0	685	698	1383	0	1076	0
VIII.03	104	66	170	0	702	856	1558	0	1388	0
IX.03	198	32	230	0	508	1048	1556	0	1326	0
X.03	435	4	439	0	226	1836	2062	0	1623	0
XI.03	302	3	305	0	358	1652	2010	0	1705	0
XII.03	409	18	427	0	301	1819	2120	0	1693	0
2003	**3212**	**601**	**3813**	**0**	**5779**	**15038**	**20817**	**0**	**17004**	**0**
I.04	406	6	412	0	374	1611	1985	0	1573	0
II.04	602	1	603	0	131	1833	1964	0	1361	0
III.04	598	15	613	0	134	1883	2017	0	1404	0
IV.04	480	3	483	0	239	1737	1976	0	1493	0
V.04	219	22	241	0	372	1217	1589	0	1348	0
VI.04	180	97	277	0	625	1054	1679	0	1402	0
VII.04	171	81	252	0	527	865	1392	0	1140	0
VIII.04	186	197	383	0	585	927	1512	0	1129	0
IX.04	398	108	506	0	285	1165	1450	0	944	0
X.04	351	16	367	0	251	1516	1767	0	1400	0
XI.04	461	12	473	0	352	1548	1900	0	1427	0
XII.04	581	0	581	0	178	2001	2179	0	1598	0
2004	**4633**	**558**	**5191**	**0**	**4053**	**17357**	**21410**	**0**	**16219**	**0**

[1] These physical energy flows were measuredon the cross-frontier transmission lines (≥110 kV). These values may differ from the official statistics and the total physical balance in the table "Monthly values: Operation".

Security of supply

- Installed capacity: 20.000 MW
- Peak demand: 16.500 MW
- Total electricity generation (2005): 102.000 GWh
- Total electricity consumption (2005): 118.000 GWh

Customer service

The electricity market has been fully open in July 2004.

	2005
Not eligible customers	0
Eligible customers	7.600.000
Not eligible customers (GWh)	0
Eligible customers (GWh)	113.600

Switching

Since July 2004, 1.022.058 customers have switched supplier. This represents 13.5% of the domestic consumers.

Competition

The three largest generators hold 69% of installed capacity and also have 83% of the supplier market. There are 18 other suppliers which each has a small part of the market below 5%.

The Dutch wholesale market is developed in various marketplaces: the bilateral market, the over the counter market, the day-ahead market and the balancing market.

Prices

Euro/MWh	**IG (24000 MWh/year)**	**IB (50 MWh/year)**	**DC (3500 KWh/year)**
Netherlands price	56	125	124

(July 2006)			
EU15 average	70	122	109

Environment

The RES-E target to be achieved by Netherlands in 2010 is 9% of gross electricity consumption.

Currently they have achieved 5,7% of gross electricity consumption.

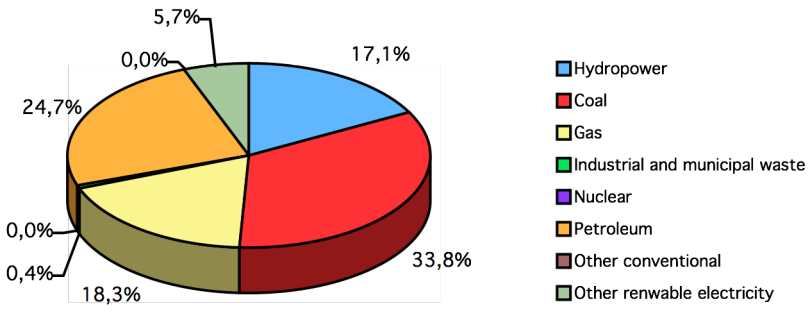
Subsidies are the main supporting policy for renewable energy sources in Netherlands:

- Mixed biomass and waste: 2,9 Eurocents/kWh
- Wind on shore: 7,7 Eurocents/kWh
- Wind off shore: 9,7 Eurocents/kWh
- PV: 9,7 Eurocents/kWh
- Tidal: 9,7 Eurocents/kWh
- Wave: 9,7 Eurocents/kWh
- Hydro: 9,7 Eurocents/kWh

A.1.13 Portugal

Background

- Population: 10.569.600
- Size: 92.391 Km^2
- GDP (2005): 147.378.400 Euros
- Growth rate of GDP volume (2005): 0,4%
- Final electricity consumption per capita (2004): 4.264 kWh/capita
- Degree of liberalization: 100%
- Primary production:



Unbundling

Red Electrica Nacional is the only transmission system operator; it does not belong to any company involved in generation or supply activities, so for this reason the unbundling requirements are not applicable.

In Portugal there is one big distribution system operator that is not vertically separated, and then there are 10 very small distribution system operators which have less than 10.000 customers. Only the accounting separation is assured.

Cross-border exchanges

Mibel (Mercado Ibérico de electricidade) should have started in 2003, but it is not yet operational.

Interconnection capacity is around 1.000/1.545 MW (it depends on season and direction) and should reach 1.610/2.330 MW by year 2007-2008.

In 2004 the imports from Spain covered 14,1% of total demand.

Physical exchanges in interconnected operation [1]

Portugal | **GWh**

MM_YY	PT→ES	PT_UCTE_EXP	PT_III_EXP	ES→PT	PT_UCTE_IMP	PT_III_IMP	PT_UCTE_SLD	PT_III_SLD
	Export (-)			Import (+)			Balance	
I.99	337	337	0	454	454	0	117	0
II.99	323	323	0	361	361	0	38	0
III.99	397	397	0	380	380	0	-17	0
IV.99	479	479	0	226	226	0	-253	0
V.99	482	482	0	141	141	0	-341	0
VI.99	480	480	0	200	200	0	-280	0
VII.99	449	449	0	386	386	0	-63	0
VIII.99	194	194	0	139	139	0	-55	0
IX.99	251	251	0	425	425	0	174	0
X.99	303	303	0	270	270	0	-33	0
XI.99	383	383	0	220	220	0	-163	0
XII.99	375	375	0	311	311	0	-64	0
1999	**4453**	**4453**	**0**	**3513**	**3513**	**0**	**-940**	**0**
I.03	362	362	0	443	443	0	81	0
II.03	297	297	0	388	388	0	91	0
III.03	279	279	0	383	383	0	104	0
IV.03	250	250	0	418	418	0	168	0
V.03	317	317	0	586	586	0	269	0
VI.03	308	308	0	470	470	0	162	0
VII.03	274	274	0	590	590	0	316	0
VIII.03	151	151	0	565	565	0	414	0
IX.03	203	203	0	544	544	0	341	0
X.03	171	171	0	523	523	0	352	0
XI.03	214	214	0	405	405	0	191	0
XII.03	281	281	0	455	455	0	174	0
2003	**3107**	**3107**	**0**	**5770**	**5770**	**0**	**2663**	**0**
I.04	268	268	0	689	689	0	421	0
II.04	215	215	0	618	618	0	403	0
III.04	188	188	0	701	701	0	513	0
IV.04	114	114	0	850	850	0	736	0
V.04	143	143	0	754	754	0	611	0
VI.04	118	118	0	733	733	0	615	0
VII.04	146	146	0	805	805	0	659	0
VIII.04	115	115	0	753	753	0	638	0
IX.04	158	158	0	625	625	0	467	0
X.04	190	190	0	727	727	0	537	0
XI.04	217	217	0	595	595	0	378	0
XII.04	258	258	0	673	673	0	415	0
2004	**2130**	**2130**	**0**	**8523**	**8523**	**0**	**6393**	**0**

[1] These physical energy flows were measured on the cross-frontier transmission lines (≥110 kV). These values may differ from the official statistics and the total physical balance in the table "Monthly values: Operation".

Security of supply

- Installed capacity: 11.708 MW
- Peak demand: 8.249 MW
- Total electricity generation (2005): 52.300 GWh
- Total electricity consumption (2005): 52.500 GWh

Customer service

In theory all electricity consumers since August 2004 are eligible, but in practice eligibility of household customers can only be implemented when the required computer platform becomes operational.

	2005
Not eligible customers	0
Eligible customers	6.139.000
Not eligible customers (GWh)	0
Eligible customers (GWh)	47.800

Switching

Customers can change supplier without charge or delay and switch back to the regulated tariff. Switching out of the regulated sector represents 19,8% of national market.

Competition

The wholesale market in Portugal is currently a bilateral trading market between generators and suppliers. The incumbent EDP still generates 52,9% of national consumption, and owns 69,4% on installed capacity.

Retail competition was developed principally thanks to imports from Spain where competition already exists.

Prices

Euro/MWh	**IG (24000**	**IB (50**	**DC (3500**

	MWh/year)	MWh/year)	KWh/year)
Portugal price (July 2006)	72	121	134
EU15 average	70	122	109

Environment

The RES-E target to be achieved by Portugal in 2010 is 39% of gross electricity consumption.

Currently they have achieved 24,4% of gross electricity consumption.

Feed-in tariffs are the main supporting policy for renewable energy sources in Portugal:

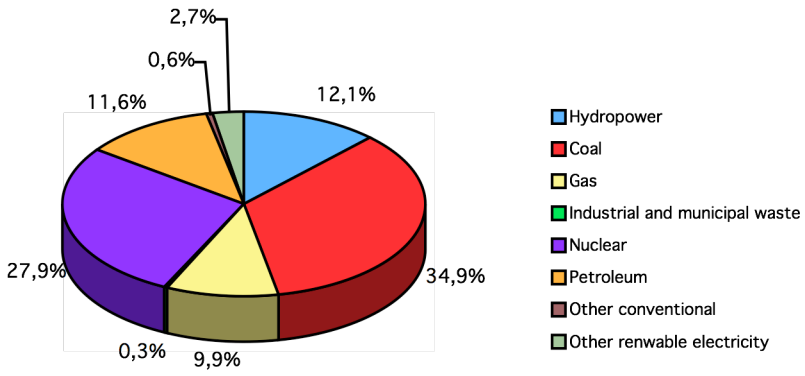
- Photovoltaic (< 5 kW): 41 Eurocents/kWh
- Photovoltaic (> 5 kW): 22,4 Eurocents/kWh
- Wave: 22,5 Eurocents/kWh
- Small hydro: 7,2 Eurocents/kWh
- Wind (beyond 2.600 hours): 4,3 Eurocents/kWh
- Wind (From 2.400 hours to 2.600 hours): 5,1 Eurocents/kWh
- Wind (From 2.200 hours to 2.400 hours): 6,0 Eurocents/kWh
- Wind (From 2.000 hours to 2.200 hours): 7,0 Eurocents/kWh
- Wind (First 2.000 hours): 8,3 Eurocents/kWh

In addiction, investment subsidies and tax deductions are used to support renewable energies.

A.1.14 Spain

Background

- Population: 43.758.300
- Size: 505.811 Km^2
- GDP (2005): 905.455.000 Euros
- Growth rate of GDP volume (2005): 3,5%
- Final electricity consumption per capita (2004): 5.447 kWh/capita
- Degree of liberalization: 100%
- Primary production:



Unbundling

Transmission is almost totally owned by *Red Eléctrica de Espana* (REE), which is unbundled in ownership terms.

Distribution is carried out principally by *Endesa, Iberdrola, Union Fenosa, Hidrocantabrico* and *Viesgo-Enel* and then there are some smaller companies. Legal, functional and accounting unbundling of distribution system operators is guaranteed.

Cross-border exchanges

During 2005, trade volumes exchanged with neighbouring member states represented about 7,64% of the energy in the wholesale market. Spain exports a big amount of electricity to Portugal and also exports to Morocco and Andorra. Spain also imports more than 7 million MWh from France.

Physical exchanges in interconnected operation [1]

Spain | GWh

MM_YY	ES→FR	ES→PT	ES→MA	ES_UCTE_EXP	ES_III_EXP	FR→ES	PT→ES	MA→ES	ES_UCTE_IMP	ES_III_IMP	ES_UCTE_SLD	ES_III_SLD
	Export (-)					Import (+)					Balance	
I.99	66	454	67	520	67	531	337	0	868	0	348	-67
II.99	55	361	60	416	60	560	323	0	883	0	467	-60
III.99	50	380	64	430	64	600	397	0	997	0	567	-64
IV.99	65	226	64	291	64	601	479	0	1080	0	789	-64
V.99	38	141	203	179	203	521	482	0	1003	0	824	-203
VI.99	35	200	175	235	175	503	480	0	983	0	748	-175
VII.99	56	386	186	442	186	706	449	0	1155	0	713	-186
VIII.99	25	139	198	164	198	673	194	0	867	0	703	-198
IX.99	47	425	211	472	211	648	251	0	899	0	427	-211
X.99	40	270	185	310	185	655	303	0	958	0	648	-185
XI.99	47	220	192	267	192	729	383	0	1112	0	845	-192
XII.99	65	311	198	376	198	678	375	0	1053	0	677	-198
1999	**589**	**3513**	**1803**	**4102**	**1803**	**7405**	**4453**	**0**	**11858**	**0**	**7756**	**-1803**
I.03	132	443	148	575	148	443	362	0	805	0	230	-148
II.03	61	388	100	449	100	356	297	0	653	0	204	-100
III.03	21	383	127	404	127	544	279	0	823	0	419	-127
IV.03	43	418	184	461	184	393	250	0	643	0	182	-184
V.03	24	586	212	610	212	651	317	0	968	0	358	-212
VI.03	22	470	98	492	98	703	308	0	1011	0	519	-98
VII.03	41	590	73	631	73	680	274	0	954	0	323	-73
VIII.03	14	565	96	579	96	683	151	0	834	0	255	-96
IX.03	20	544	124	564	124	660	203	0	863	0	299	-124
X.03	60	523	81	583	81	582	171	0	753	0	170	-81
XI.03	62	405	112	467	112	378	214	0	592	0	125	-112
XII.03	102	455	102	557	102	316	281	0	597	0	40	-102
2003	**602**	**5770**	**1457**	**6372**	**1457**	**6389**	**3107**	**0**	**9496**	**0**	**3124**	**-1457**
I.04	99	689	135	788	135	400	268	0	668	0	-120	-135
II.04	84	618	127	702	127	374	215	0	589	0	-113	-127
III.04	119	701	87	820	87	537	188	1	725	1	-95	-86
IV.04	95	850	169	945	169	402	114	0	516	0	-429	-169
V.04	51	754	124	805	124	486	143	1	629	1	-176	-123
VI.04	42	733	126	775	126	469	118	5	587	5	-188	-121
VII.04	44	805	127	849	127	593	146	4	739	4	-110	-123
VIII.04	66	753	120	819	120	366	115	2	481	2	-338	-118
IX.04	15	625	85	640	85	528	158	3	686	3	46	-82
X.04	67	727	193	794	193	498	190	1	688	1	-106	-192
XI.04	60	595	138	655	138	561	217	1	778	1	123	-137
XII.04	18	673	148	691	148	820	258	3	1078	3	387	-145
2004	**760**	**8523**	**1579**	**9283**	**1579**	**6034**	**2130**	**21**	**8164**	**21**	**-1119**	**-1558**

[1] These physical energy flows were measured on the cross-frontier transmission lines (≥110 kV). These values may differ from the official statistics and the total physical balance in the table "Monthly values: Operation".

Security of supply

- Installed capacity: 64.800 MW
- Peak demand: 43.378 MW
- Total electricity generation (2005): 262.100 GWh
- Total electricity consumption (2005): 262.000 GWh

Customer service

Since January 2003, all Spanish customers are able to freely negotiate their supply contracts with any authorized electricity energy supplier.

	2005
Not eligible customers	0
Eligible customers	23.000.000
Not eligible customers (GWh)	0
Eligible customers (GWh)	242.000

Switching

Customers can change supplier without any charge.

Competition

The generation companies with the largest market share are Iberdrola, Endesa and Uniòn Fenosa, whose market shares are up to approximately 84%.

There are 11 smaller companies which act in the market and which are independent of the electricity transport network and distribution managers.

Nine stranger commercialisation companies have penetrated the retail market, which share of the external commercialisation companies is about 8%.

Prices

Euro/MWh	**IG (24000 MWh/year)**	**IB (50 MWh/year)**	**DC (3500 KWh/year)**

Spain price (July 2006)	64	109	95
EU15 average	70	122	109

Environment

The RES-E target to be achieved by Spain in 2010 is 29,4% of gross electricity consumption.

Currently they have achieved 18,2% of gross electricity consumption.

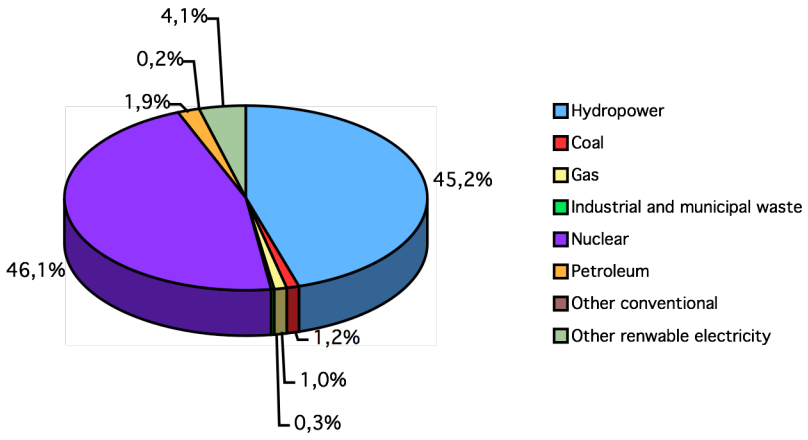
Renewable energy sources producers can choose between a fixed preferential tariff or a (variable) premium price on top of the market price:

Tariff specified for 2003	**Premium (Eurocents/kWh)**	**Feed-in (Eurocents/kWh)**
Photovoltaic (< 5 kW)	36,0	39,6
Solar (other installations)	18,0	21,6
Solar thermal electric	12,0	-
Wind	2,66	6,21
Primary biomass	3,32	6,85
Secondary biomass	2,51	6,05
Geothermal, wave and tidal	2,94	6,49

A.1.15 Sweden

Background

- Population: 9.047.800
- Size: 449.964 Km^2
- Final electricity consumption per capita (2004):
- GDP (2005): 287.706.300 Euros
- Growth rate of GDP volume (2005): 2,9%
- Final electricity consumption per capita (2004): 14.524 kWh/capita
- Degree of liberalization: 100%
- Primary production:



Unbundling

Sweden has one transmission system operator (Svenska Kraftnät) that is ownership unbundled and is part of the Swedish state.

Sweden has 175 distribution system operators, and only 6 of these have more than 100.000 customers. But they have a share of 60% of all customers. Because Sweden has adopted

the 100.000 customers exemption, 169 distribution system operators do not have to be unbundled in functional terms.

All of the distribution system operators are legally and accounting unbundled.

Cross-border exchanges

Interconnection capacity of Sweden is about 8.500 MW with Norway, Finland, Germany and Poland. An increase of 600 – 800 MW with Finland has been planned.

Figure 3 Nordpool exchange for electricity 2005 (GWh) (Nordel,2005)

From: To:	Denmark	Finland	Norway	Sweden	Other countries[1)]	∑ From
Denmark	-	-	470	759	10,394	11,623
Finland	-	-	131	1,394	.	1,525
Norway	4,712	164	.	10,816	.	15,692
Sweden	7,692	7,193	2,836	.	4,251	21,972
Other countries [1]	594	11,312	215	1,606	.	13,727
∑ To	12,998	18,669	3,652	14,575	14,645	64,539
						Nordel
Total to	12,998	18,669	3,652	14,575		49,894
Total from	11,623	1,525	15,692	21,972		50,812
Net imports	1,375	17,144	-12,040	-7,397		-918
Net imports/total consumption	3.8 %	20.2 %	-9.6 %	-5.0 %		-0.2 %

[1)] Germany, Russia and Poland.

Security of supply

- Installed capacity: 33.200 MW
- Peak demand: 27.000 MW
- Total electricity generation (2005): 142.400 GWh
- Total electricity consumption (2005): 148.400 GWh

Reserve margin is relatively low, but in the Nordic market as a whole, taking into account the interconnectors, it is considered sufficient.

Customer service

Since 1999, all customers for electricity are able to choose freely the electricity supplier.

	2005
Not eligible customers	0
Eligible customers	5.125.000
Not eligible customers (GWh)	0
Eligible customers (GWh)	137.700

Switching

In the Swedish electricity retail supply market about 54% of household customers have changed supplier or renegotiated their contracts between 1996 and 2004.

Competition

The wholesale market in Sweden is integrated to the Nordic power market. It consists of a bilateral trading market between generators on one hand and suppliers and industrial companies on the other hand, and of a voluntary Nordic power exchange Nordpool which has a spot market and a forward market.

Prices

Euro/MWh	IG (24000 MWh/year)	IB (50 MWh/year)	DC (3500 KWh/year)
Sweden price (July 2006)	63	93	98
EU15 average	70	122	109

Environment

The RES-E target to be achieved by Sweden in 2010 is 60% of gross electricity consumption.

Currently they have achieved 46,1% of gross electricity consumption.

Electricity certificates for wind, solar, biomass, geothermal and small hydro were introduced in May 2003. The system has created an obligation for end users to buy a

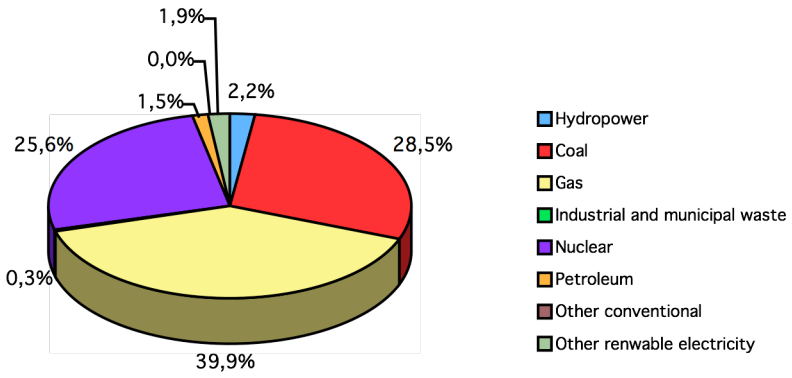
certain amount of renewable certificates as part of their total electricity consumption. Non-compliance leads to a penalty which is fixed at 150% of a year's average price.

For wind energy investments grants which offer 15% reduction of costs will remain available. As a transition measure, an environmental bonus for wind will also be available.

A.1.16 UK

Background

- Population: 60.393.100
- Size: 244.820 Km^2
- GDP (2005): 1.790.671.200 Euros
- Growth rate of GDP volume (2005): 1,9%
- Final electricity consumption per capita (2004): 5.696 kWh/capita
- Degree of liberalization: 100%
- Primary production:



Unbundling

Great Britain has gone beyond the requirement of the Directives with the introduction of the British Electricity Transmission Trading Arrangements (BETTA) that introduced a single system operator independent of generation and supply interests for the whole United Kingdom.

Legal and functional unbundling are guaranteed, and ownership unbundling is guaranteed

in terms of operations.

As far as distribution concerned, there are 14 distribution system operators with more than 100.000 customers, and legal and functional unbundling has been guaranteed since 2000.

Cross-border exchanges

There are interconnections between Great Britain and France and Ireland. Increased connections between Republic of Ireland and Northern Ireland are likely in the context of the creation of an all-Ireland energy market.

A new undersea interconnection between Ireland and UK of up to 1.000 MW is being discussed. A project between Great Britain and Netherlands is also possible.

Security of supply

- Installed capacity: 77.400 MW
- Peak demand: 62.200 MW
- Total electricity generation (2005): 395.000 GWh
- Total electricity consumption (2005): 392.300 GWh

Reserve margin is around 20%. An additional 1.800 MW capacity is expected by 2008.

Customer service

In Great Britain there are 30 million electricity customers. The market has been fully open since 1998 and since 2002 there is no price control. There are some customer protection guidelines: a code of practice on billing and late payment, protection of vulnerable customers, transparency relating to contract conditions, rules for terminating contracts.

	2005
Not eligible customers	0
Eligible customers	30.000.000
Not eligible customers (GWh)	0
Eligible customers (GWh)	360.700

Switching

45% of customers have changed supplier. Almost all industrial and commercial customers have changed supplier at least once.

Competition

The British wholesale market is a bilateral market. There are more power exchange platforms and UKPX is the biggest one.

8 companies produce a share of 70% of total capacity.

Prices

Euro/MWh	IG (24000 MWh/year)	IB (50 MWh/year)	DC (3500 KWh/year)
UK price (July 2006)	67	116	110
EU15 average	70	122	109

Environment

The RES-E target to be achieved by United Kingdom in 2010 is 10% of gross electricity consumption.

Currently they have achieved 3,7% of gross electricity consumption.

The main supporting policies are:

- Obligatory targets with tradable green certificate system. The non-compliance "buy-out" price for 2003-2004 was set at 30,51£/MWh. This buy-out is annually adjusted in line with the retail price index.
- Climate Change Levy: renewable electricity is exempted from the climate change levy on electricity of 0,43 p/kWh.
- Grants schemes: funds are reserved from the New Opportunities Fund for new capital grants for investments in energy crops/biomass power generation, small scale biomass, CHP heating and planting grants for energy crops.