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ELECTRICITY FOR EUROPE

Environment and Sustainable Development Report

2012 EDITION

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ELECTRICITY FOR EUROPE

The **Union of the Electricity Industry – EURELECTRIC** is the sector association representing the common interests of the electricity industry at pan-European level, plus its affiliates and associates on several other continents.

In line with its mission, EURELECTRIC seeks to contribute to the competitiveness of the electricity industry, to provide effective representation for the industry in public affairs, and to promote the role of electricity both in the advancement of society and in helping provide solutions to the challenges of sustainable development.

EURELECTRIC's formal opinions, policy positions and reports are formulated in Working Groups, composed of experts from the electricity industry, supervised by five Committees. This "structure of expertise" ensures that EURELECTRIC's published documents are based on high-quality input with up-to-date information.

For further information on EURELECTRIC activities, visit our website, which provides general information on the association and on policy issues relevant to the electricity industry; latest news of our activities; EURELECTRIC positions and statements; a publications catalogue listing EURELECTRIC reports; and information on our events and conferences.

EURELECTRIC pursues in all its activities the application of the following sustainable development values:

Economic Development
- Growth, added-value, efficiency

Environmental Leadership
- Commitment, innovation, pro-activeness

Social Responsibility
- Transparency, ethics, accountability

May 2012

FOREWORD

Sustainability is – together with competitiveness, innovation and security of supply – a key pillar of the European Union energy policy. This fifth edition of the Environment and Sustainable Development Report illustrates the major strides taken by the European Electricity Industry to improve its environmental, social and economic performance.

The European Union has set itself ambitious targets to be achieved by 2020 to improve the sustainability of its energy policy by increasing renewables, saving energy and reducing greenhouse gas emissions. Without a strong commitment from the electricity industry, these objectives cannot be achieved. The report gives valuable insight into the measures taken by the European Electricity Industry in combating climate change but also in addressing a number of other key challenges such as energy efficiency, security of supply, infrastructure, development and integration of smart grids, air pollution, biodiversity, and water management.

As chairwoman of the European Parliament's Committee for Industry, Research and Energy (ITRE), I can only encourage EURELECTRIC to continue preparing such reports, which give us a better understanding of the electricity sector in the twenty-first century and provide us with useful information for shaping our future energy policy as outlined in the Energy Roadmap 2050.

Amalia SARTORI
Chairwoman Committee on Industry, Research and Energy,
European Parliament

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ACKNOWLEDGEMENTS

EURELECTRIC's 5th Environment and Sustainable Development Report (ESDR) aims at covering the wide range of activities in which EURELECTRIC's members are engaged to reduce the negative impacts of generation, supply, transmission and distribution of electricity, and to strengthen the positive ones. Data have been collected in economic, social and environmental activities to embrace the three pillars of sustainable development: social, economic and environmental.

In order to reach a better understanding of the figures and information published in this report, please keep the following in mind:

Sources of data and geographical coverage

EURELECTRIC counts 33 full members, including all 27 member states of the European Union (EU), acceding country (Croatia), candidate countries (Iceland, the Former Yugoslav Republic of Macedonia – FYROM –, Turkey), plus other European countries from the Organisation for Economic Cooperation and Development (OECD) (Norway, Switzerland).

The data in the report are collected by our members, which are national electricity associations, where such a body exists, or the leading electricity enterprise in each country (see annex). Therefore the data published in this report do not always cover 100% of the electricity sector of a given country.

The 2012 ESDR edition presents new figures from 2009-2010. However, the report itself covers up-to-date issues, from 2009 onwards.

In terms of geographical coverage, while the report aims at covering EURELECTRIC full membership, there is variability through the report as to the countries represented in the various data sets.

Aggregated data and distinction between electricity generation and transmission/distribution

In an effort to improve the statistical representation of our industry, we have decided to make a distinction between generation on one side and transmission/distribution on the other, whenever possible and appropriate. Not all of our members were able to provide data according to this distinction. We have decided therefore to publish both kinds of data as in the example.

Examples of aggregated data (Austria) and distinction (Belgium):

	2009	2010
AUSTRIA	34	36
BELGIUM	24 / 32	28 / -

In the case of Austria, 34 and 36 are aggregated data, representing the whole sector for 2009 and 2010. In the case of Belgium in 2009, 24 represents the electricity generation sector and 32 represents electricity transmission/distribution. In 2010, 28 represents the generation sector, but we do not have any data for electricity transmission/distribution (-). Aggregated figures have been highlighted in light blue, while data with distinction between sectors have been highlighted in dark blue.

Distinction between social and societal

We have chosen a broader approach to define the "social" pillar of sustainable development: social and societal. Social issues cover all aspects of human resources policy such as training, safety, equality, job opportunities and social dialogue. By societal, we mean the contribution of companies to the well-being of citizens (raising awareness towards energy issues, energy for all, reducing fuel poverty, development of territories where the companies operate...).

Special Thanks

We would like to thank Mr. Jason ANDERSON (WWF), Mrs. Anca-Diana BARBU (European Environmental Agency), Mr. Jan Willem GOUDRIAAN (European Federation of Public Services Unions) and Mr. Stefaan VERGOTE (European Commission, DG Climate Action) for their suggestions to improve the report.

INTRODUCTION

Nowadays, progress and growth are inseparable from sustainable development and the balance between its three pillars: economic performance, well-being of workers and stakeholders, and the protection of the environment.

Climate change, other environmental issues and the economic recession are increasingly affecting many people and the future of the planet. Therefore, the integration of sustainable development in all policies is even more important to tackle these problems. Not only is the concept of sustainable development a collective expression, it also implies a strong commitment and a new way of thinking, debating, deciding and acting.

The electricity industry has already been working on sustainable development for many years, well aware of the complexity of its business. Electricity is essential for the well-being of society and contributes to the quality of everyday life. Its generation and transportation unfortunately have impacts on our environment. Aware of these negative effects, the industry is working proactively to reduce them in an efficient way from the environment and the economic points of view. Particular attention is paid to greenhouse gas (GHG) emissions, as our companies are working hard to shift toward a low-carbon economy. In 2009, the power sector committed itself to a carbon-neutral electricity supply by 2050. Dramatic reductions in air pollutants have also been achieved in our sector in the last 30 years: between 1980 and 2009, emissions of SO_2 and NO_x were reduced in the EU-27 by around 80% and 57% respectively. In addition, the industry is also tackling many other issues: developing innovative energy alternatives, raising awareness among consumers (energy-efficient behaviour), involvement in international projects, ensuring health and safety for its employees and the population.

The content of the 5th ESDR builds on the legacy of the previous editions, aiming to cover the wide range of activities in which the electricity industry is engaged to reduce the negative impacts of electricity generation, transmission and distribution and strengthen the positive ones. In addition to environmental achievements, the report also covers the industry's economic activities and social efforts. Energy policy is driven by the triple sustainability challenge of reducing the impact of the industry on the natural environment while ensuring a secure supply of energy, all at reasonable cost to the economy and with due respect of social policy.

For this 5th edition, a special chapter focuses on biodiversity, as 2010 was officially declared the International Year of Biodiversity by the United Nations (UN). Our industry has undertaken many actions to minimise its impact on nature and to protect animal and plant species as well as landscapes.

A. PREAMBLE

Energy is a key factor of modern life. It is essential for the well-being of our society.

The Electricity Industry does, however, impact on the environment by the way of emissions into the atmosphere, use of fuels, generation of waste and land use.

It is the intention of the members of the European Electricity Industry to continue to seek to reduce constantly the adverse effects associated with the generation, transmission, distribution and supply of electricity. Naturally, as a minimum, we will continue, as responsible citizens of our society, to ensure that we always comply with legal requirements and other commitments.

Our ambition is to continue and reinforce our proactive approach.

In addressing our environmental responsibility, we will maintain a close dialogue with our diverse stakeholders.

B. TAKING RESPONSIBILITY

Building on our previous record.

We will continue to apply the environmental policy and management systems at all levels in our organisation to ensure that environmental aspects are included in all decision-making processes at all stages of electricity generation, transmission, distribution and supply.

We will encourage the adoption of environmental action plans as well as the monitoring and reporting of environmental performance.

We will encourage business partners and suppliers to implement environmental management systems.

We will promote research and development into technologies that reduce the environmental impact from our activities.

We will contribute to the reduction of the environmental impacts by helping our customers to use energy more efficiently and promote the development of such solutions.

C. PROTECTION OF OUR ENVIRONMENT

We will take care to use natural resources as efficiently as possible.

We will play an active part in the reduction of the greenhouse gas emissions.

We will reduce our pollutant emissions to air to a level where they are considered as not giving rise to any significant environmental impacts.

We will reduce waste, recycle waste and otherwise dispose of it in a way that does as little harm to the environment as possible.

We will reduce wastewater discharges to protect the quality of rivers and other aquatic environments.

We will strive to reduce the impacts of our activities on landscape and bio-diversity.

D. COMMUNICATION WITH STAKEHOLDERS

Employees at all levels in the Electricity Industry are kept informed of the environmental policy of the company and their individual role and duties to protect the environment, and on all other important aspects and developments concerning the protection of the environment, in order that they behave consistently with their company's environmental policy.

We will sustain an open discussion and dialogue with our customers, suppliers, local communities, regulators, shareholders and the general public.

Both companies and EURELECTRIC will report regularly on the progress made towards improving environmental performance.

Our environmental performance data and information will remain clear, unambiguous and verifiable.

THE EURELECTRIC ENVIRONMENTAL GUIDELINES 2003

The *EURELECTRIC Environmental Guidelines* establish the environmental principles that guide the actions of the Electricity Industry *(EURELECTRIC, 2003)*. The guidelines intend to be the cornerstone of an environmental policy for the European electricity sector. In particular, they should be the basis for achieving the following objectives:

- Addressing the main environmental issues arising from the generation, transmission, distribution and supply of energy;
- Providing measures to address these challenges;
- Installing a reporting system to demonstrate and exemplify the achievements;
- Supporting communication with stakeholders.

These guidelines, as set out on page 8, are the backbone of EURELECTRIC's Environmental and Sustainable Development Report. Nevertheless, the scope of this report is broader and touches on all three pillars of the sustainability approach: economic performance, well-being of workers and stakeholders, and the protection of the environment.

EURELECTRIC'S ROADMAP FOR SUSTAINABLE DEVELOPMENT

The *Roadmap for Sustainable Development (RSD)* is another example of proactive initiatives developed at EURELECTRIC. Launched in 2004, it seeks to encompass the social, environmental and economic aspects of the electricity industry, the ultimate goal being to incorporate sustainable development (SD) values into all industry activities (*EURELECTRIC, 2004*). This RSD intends to provide EURELECTRIC members and staff with an approach to the core SD values that should guide the organisation's strategic choices, commitments to resources, activities and publications.

The *Roadmap* is not a mere checklist of issues that concern our industry; it contains concrete actions for implementation by EURELECTRIC's structure of expertise, together with clear timelines. The three main areas in the RSD are:

1. **Sustainable Development values** to be implemented externally and internally. This is the key element of the *Roadmap*, which requires implementation by EURELECTRIC's structure of expertise. EURELECTRIC's strategic choices, commitment to resources, publications and activities should be checked against the sustainable development values:
   - economic development (growth, added-value, efficiency)
   - environmental leadership (commitment, innovation, pro-activeness)
   - social and societal responsibility (transparency, ethics, accountability).

   These values must be shared with external stakeholders in EURELECTRIC's mission statement, reports, position papers and brochures.

2. **Showing by doing**, meaning leading SD-related case studies and projects. This area comprises concrete actions carried out or supported by EURELECTRIC, which demonstrate in practice the electricity industry's commitment to sustainable development. The report in your hands is just one example.

3. **SD-related areas for improvement and future intervention**. Current energy systems are failing to meet the needs of the world's poor. Worldwide, 2.7 billion people rely on traditional biomass for cooking and 1.3 billion people – about a fifth of the human race – do not have access to electricity. In its "New Policies Scenario", the International Energy Agency (IEA) estimates that $38 trillion in global investment in energy supply infrastructure is required from 2011 to 2035, an average of $1.5 trillion per year (in year 2010 dollars). Two-thirds of this is required in non-OECD countries. In spite of the progress made and because of population growth, it should still leave 1 billion people without electricity and 2.7 billion without clean cooking facilities by 2030 (IEA, 2011). The objective is to launch an internal debate on how the European Electricity Industry could, in co-operation with EU institutions and national governments, address this issue.

1 SETTING THE SCENE: ECONOMIC, SOCIAL, ENVIRONMENTAL FRAMEWORK AND CHALLENGES

The recent years have been eventful ones for the European Electricity Industry. External events and ambitious energy, climate and environmental policies are shaping the future of our sector.

1.1 FINANCIAL CRISIS

In 2007-2008, due to unsound risk management practices, opaque financial products, excessive leverage and too lenient regulation, several financial institutions entered into severe liquidity problems and had to be rescued by public authorities. Since then, the entire economy has faced a deep and global financial crisis that has a strong impact on all sectors and on society as a whole.

As outlined in EURELECTRIC's report on the financial situation of the Electricity Industry, published in December 2010 (*EURELECTRIC, 2010a*), European electricity companies were affected by the credit crisis not so much in terms of availability of lending volumes, but more in terms of their debt costs, which soared as they had to pay higher risk premiums to refinance their debts. The Electricity Industry also had to cope with a challenging macroeconomic environment, derived from the consequences of the financial crisis, which has depressed electricity demand in particular in the industry.

1.2 FUKUSHIMA DAIICHI

On 11 March 2011, a powerful earthquake occurred on the east coast of Japan, followed by a tsunami that seriously damaged the nuclear power plant Fukushima Daiichi, one of the 15 largest power plants in the world. The reactor cooling systems were disabled, leading to nuclear radiation leaks. A 30 km evacuation zone and a 20km exclusion zone were set around the power plant. This accident was rated 7 on the International Nuclear Event Scale, the highest level for a nuclear event, happening for the second time after the Chernobyl disaster in 1987.

After Fukushima, the role of nuclear was re-examined in some European countries: Germany decided on a complete phase-out by 2022, reversing its lifetime extension decision agreed in September 2010, and a referendum halted the planned nuclear programme in Italy. The tragic events of Fukushima highlighted the need to reinforce safety in nuclear power plants in cases where it is today insufficient. Soon after the disaster, EU Energy Commissioner Günther Oettinger proposed nuclear "stress tests" to harmonise safety standards in Europe. EURELECTRIC is advocating a European approach to nuclear safety. In terms of energy choices, EURELECTRIC supports a "use them all" principle, as from a power generator's perspective all technologies are needed and welcome, to fulfil framework conditions such as decarbonisation, competitive prices and security of supply.

1.3 FIGHTING CLIMATE CHANGE – MEETING THE 2020 TARGETS

Fighting climate change is a top priority of the EU. In 2010, a new Directorate-General was established to tackle the issues specifically related to Climate Change, previously in the remit of DG Environment. DG for Climate Action ("DG CLIMA") helps the EU to deal with the impacts of climate change, develops and implements the EU Emissions Trading Scheme (ETS) and leads international negotiations on climate.

In December 2008, the Council of the European Union and the European Parliament approved the Climate and Energy Package, which sets the 20-20-20 targets: a 20% cut in emissions of GHG by 2020 compared to 1990 levels, a 20% share of renewable energy sources (RES) in final energy consumption, and a 20% reduction in primary energy use compared with projected levels, to be achieved by improving energy efficiency. The two first objectives are binding.

The electricity sector plays a pivotal role in delivering a low-carbon economy and society. It remains committed to delivering carbon-neutral electricity by mid-century (*EURELECTRIC, 2009a*). It is crucial to allow the Electricity Industry to fulfil its role as a vehicle for cost-effective decarbonisation of the energy system. A well-functioning single European energy market and an effective EU ETS are the best way of ensuring the objectives of the European energy policy are met. They will ensure a cost-effective transition to a low-carbon economy, while guaranteeing security of supply and system stability. The EU ETS should be the key driver for decarbonisation as coherent and integrated policy instruments based on the ETS can best serve the EU's decarbonisation goal.

To reach the EU's 20% RES target by 2020, about one third of the EU's electricity will need to be generated from RES. The electricity industry is an important investor in RES in Europe. The involvement of EURELECTRIC members in large-scale renewables projects paints a clear picture of an industry embracing the renewable agenda. The take-off of RES, especially increasing amount of variable electricity generation, will transform Europe's energy system, networks and markets, opening up investment opportunities but also posing unique challenges. EURELECTRIC's Renewables Action Plan (RESAP), whose results were released in November 2011 (*EURELECTRIC, 2011b*), reflects the industry's firm commitment to

the 2020 RES target. It presents a comprehensive industry-wide strategy for RES, based on a series of reports, examining the effects of a growing share of RES on all parts of the electricity value chain, from generation to end-use. EURELECTRIC's RESAP outlines the challenges, answers, costs and options for the development of RES in Europe. It calls for competitive flexibility from all angles: different generation technologies and solutions, a large variety of demand-side responses and approaches, further development of market design, and more transmission capacities across Europe.

In June 2011, the European Commission published its proposal for an Energy Efficiency Directive (*European Commission, 2011f*). Although the proposal foresaw no binding targets for member states, it included many binding measures directly affecting the electricity sector, with national obligation schemes, compulsory combined heat and power on all thermal power plants as default options and possible energy efficiency considerations in permitting procedures. Derogations are however possible, which might allow member states to adopt a more flexible and pragmatic approach.

As of March 2012, negotiations have started between the European Parliament and the Council on the proposed directive, after the adoption by the European Parliament's Energy Committee of its first reading resolution. EURELECTRIC believes that the directive should take care to propose measures that are in line with the EU's long-term decarbonisation objective. EURELECTRIC is concerned that the draft directive will penalise the use of electricity by artificially reducing the efficiency of electrical appliances compared to other appliances, for example in heating. This would be in contradiction with the increased role electricity will have to play to contribute to the decarbonisation of transport and heating/cooling, as confirmed by the Commission Energy Roadmap 2050.

1.4 IMPROVING THE PROTECTION OF HEALTH AND ENVIRONMENT – REACH REGULATION

The European Regulation REACH – Registration, Evaluation, Authorisation and restriction of Chemicals – (*Council of the European Union, European Parliament, 2006b*) entered into force on 1st June 2007. Its main impact on our sector was the obligation to register some substances (most hazardous or with tonnage) before December 2010.

As this registration implies the submission of a detailed technical dossier, the producers of similar substances joined their workforces in different consortia to be ready on time and save costs. This has been done for the gypsum which is generated by the flue gas desulfurization systems, coal ashes, biomass ashes, lime milk, which is used in the waste water treatment. Other substances will have to be registered later such as sulfur trioxide used to improve the efficiency of the electro-statics precipitators, some biocides generated locally. Final deadline is the middle of 2018.

The most hazardous substances will also be subjected to the authorization or restriction procedures that make their use safer, or that restrict or even prohibited their use. The ongoing work of the European Chemical Agency is being followed attentively.

So far, our regulatory obligations have been met, but an attentive follow-up will remain for the next years.

1.5 SUSTAINABLE WATER MANAGEMENT

The Water Framework Directive (WFD) (*Council of the European Union, European Parliament, 2000*) entered into force in 2000. It establishes a legal framework to protect and restore clean water in Europe and ensure its sustainable use. Member states committed themselves to achieve good qualitative and quantitative status of all water bodies and their ecosystems by 2015.

By the end of 2009, member states submitted River Basin Management Plans (RBMP) to the European Commission. Those plans are currently being assessed by the European Commission and, together with three other items (review of the EU action on Water Scarcity and Drought; assessment of the vulnerability of water resources to climate change and other man made pressures; "Fitness Check" of the EU Freshwater Policy) and a large number of studies, they will form the basis for the adoption in November 2012 of the Commission's Blueprint to Safeguard Europe's Water. Its ambition is to be the EU policy response to old and emerging water challenges and their impact on EU water policy goals. The Blueprint will synthesise policy recommendations based on the on-going assessments.

Water is a crucial element for the power sector as the Electricity Industry has many lifelong water dependent assets. Water is used in hydropower but also in thermal power generation plants (e.g. for steam turbines, emission abatement and in cooling processes). This dependence on water will prove even more crucial in the context of adaptation to climate change. The Commission has engaged in a series of consultations with stakeholders, in which EURELECTRIC took part. The Electricity Industry acknowledges the EU water policy has brought a major contribution to the improvement of the aquatic environment in Europe. EURELECTRIC considers that the existing legislation is sufficient to provide appropriate protection but, although formally the mechanisms for achieving balance of the pillars of sustainable development are usually there, in practice the interaction of the various Directives in the field of water and their implementing regulations create considerable uncertainty for power station developers and operators.

In June 2008, the EU adopted a Marine Strategy Framework Directive (MSFD) (*Council of the European Union, European Parliament, 2008c*) whose objective is to protect more effectively the marine environment across Europe. It aims to achieve good environmental status of the EU's marine waters by 2020 and to protect the resource base upon which marine-related economic and social activities depend. The implementation process has started, based on the model used for the implementation of the Water Framework Directive. In spite of the close ties between the two instruments, there are considerable differences in the way that ecosystem protection is to be assessed in the Water Framework Directive. Some waters are covered directly by both directives and there may be further indirect linkages through the dependence of marine ecosystems on freshwaters and vice versa. It is by no means clear how these differences will be resolved.

1.6 ROADMAP TO A RESOURCE EFFICIENT EUROPE

Adopted in September 2011, the Commission's Roadmap to a resource efficient Europe (*European Commission, 2011a*) suggests new methods to achieve sustainable growth by 2050. The objective is to direct the economy onto a resource-efficient path through the achievement of sustainable production and consumption, the use of waste as resource, support for research and innovation, the phasing out of harmful subsidies and the development of right price signals, including shifting the burden of taxation from labour to the environment. The Commission identifies food, building and transport as the sectors where resources are the most exploited, together accounting for 70-80% of all environmental impacts. The Commission recommends the creation of resource efficient indicators, to be defined by the end of 2013. A lead indicator, "resource productivity", would measure Gross Domestic Product (GDP) against material consumption expressed in euro/tonnes, completed by other indicators based on natural resources (water, carbon, materials…). The roadmap indicates resource-specific objectives that the Commission would like to see achieved by 2020. The objectives are accompanied by policy initiatives that the Commission intends to present over the coming years. They cover ecosystem services, biodiversity, minerals and metals, water, air, land and soils, and marine resources.

2 INTERNATIONAL INVOLVEMENT

2.1 INTERNATIONAL ELECTRICITY PARTNERSHIP

In the context of globalisation, it is necessary to widen the scope of actions and foster strong cooperation between continents, in order to fight climate change in an efficient way. Regularly, Electricity Industry leaders from the world's largest economies meet at the International Electricity Chief Executives Summit to agree on common goals and actions. The International Electricity Partnership (IEP) was formed in 2008 in this context and includes the Edison Electric Institute (United States), EURELECTRIC, the Federation of Electric Power Companies of Japan, the Canadian Electricity Association and the Energy Supply Association of Australia. In 2011, they were joined for the first time by senior executives from the State Grid of China and from South and Central America represented by the Regional Energy Integration Commission (CIER).

The last summit was organised mid-October 2011 by EURELECTRIC and ENEL, in Rome, and chaired by EURELECTRIC President Fulvio Conti. The members of the IEP reaffirmed the international electricity sector's common mission of providing economic and reliable electricity. They also outlined their commitment to participate in the shaping of a low-carbon future coupled with sustainable economic growth. A joint statement was issued and stressed that the greater use of electricity drives choices of technology leading to a sustainable energy future, greater energy efficiency, economic growth, job creation, and solutions for addressing climate change.

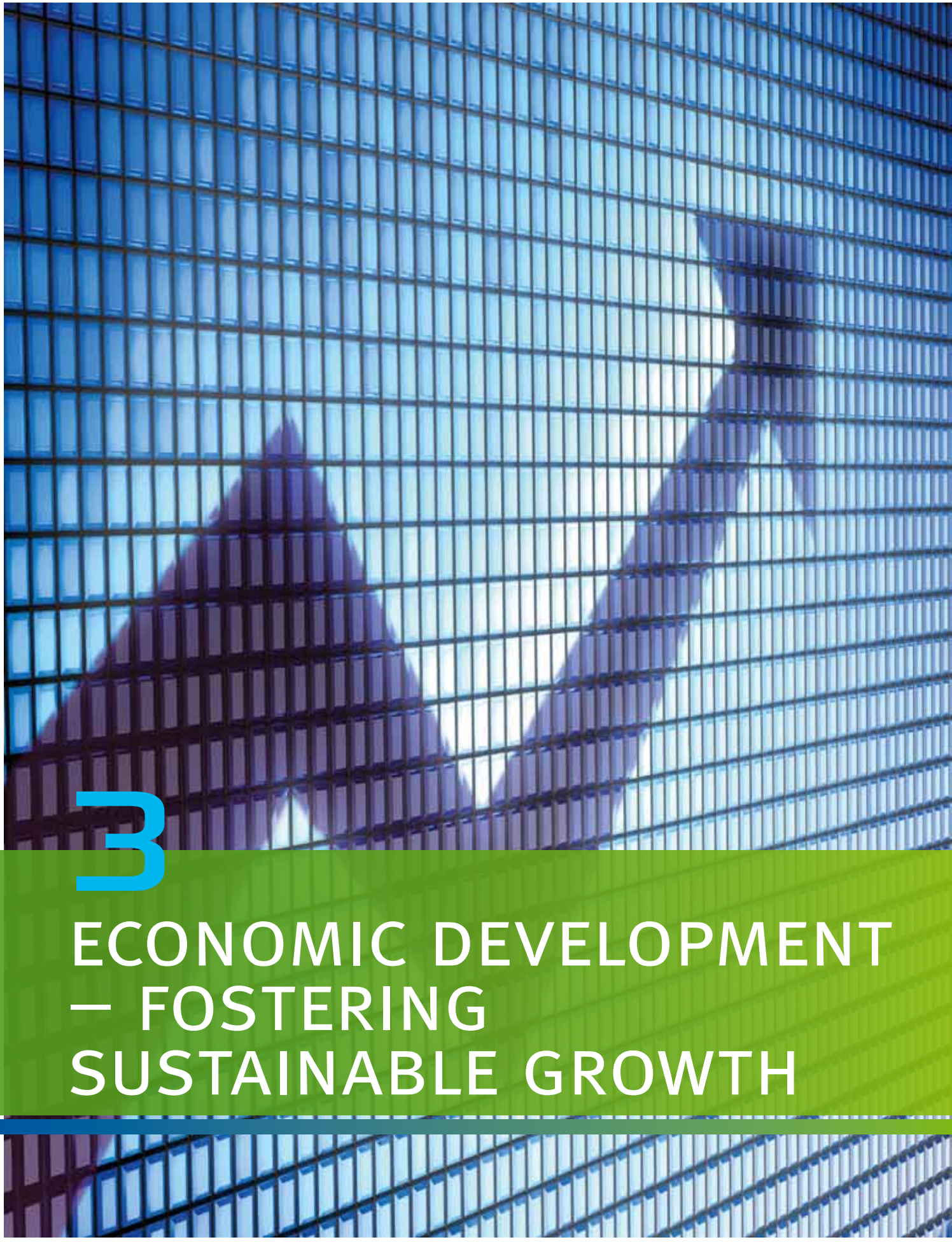
2.2 INVOLVEMENT IN INTERNATIONAL CLIMATE CHANGE AND AIR POLLUTION DISCUSSIONS

In December 2011, the Seventeenth session of the Conference of the Parties (COP 17) on climate change took place in Durban. The EU played a determining role for the final decision, which also states that the process shall aim to limit global warming to 2°C. In return, the EU agreed to accept binding emissions reduction targets under a second period of the Kyoto Protocol. Several other countries, including Norway, Iceland, Ukraine and Switzerland, also agreed to take part. The targets and length of this new period will be discussed and finalised in 2012. It is not yet clear whether the new commitment period will run until 2017 or 2020.

The COP also adopted rules for including carbon capture and storage projects in the clean development mechanism (CDM). A review process by the CDM executive board was formally introduced and a new materiality standard for emissions reporting was adopted. The EU asked for a new market-based mechanism, but the issue was postponed until 2012 and there were no details of what it might be.

EURELECTRIC staff and members attended the COP17, spoke at numerous side events and participated in meetings with various delegations (United States, EU and Japan) on topics relating to the CDM and the new technology mechanisms. They also met with the president of the COP and the chairs of the various subsidiary bodies. In particular, William S. Kyte, EURELECTRIC's Chief Advisor for International Climate Policy, was a member of the panel at an event which discussed ways of improving stakeholder participation in the process.

EURELECTRIC is also an observer in the United Nations Economic Commission for Europe (UNECE), following the work and negotiations related to the revision of the 1999 Gothenburg Protocol (*United Nations Economic Commission for Europe, 1999*) to the Convention on Long-Range Transboundary Air Pollution (CLRTAP) (*United Nations Economic Commission for Europe, 1979*). Its objective is to abate acidification, eutrophication and ground-level ozone. Discussions on 2020 ceilings for sulphur dioxide (SO_2), nitrogen oxides (NO_x), volatile organic compounds and ammonia are expected to be finalised in 2012. An additional ceiling related to emissions of PM 2.5 should also be adopted. One of the crucial objectives of the Protocol is its implementation across all its Members, with a particular focus on Eastern Europe, the Caucasus and Central Asia and South-East Europe. The revised Protocol will be a key element for the upcoming revision of the National Emission Ceilings Directive (NECD) (*Council of the European Union, European Parliament, 2001b*), in the EU, now expected in 2013.



3 ECONOMIC DEVELOPMENT — FOSTERING SUSTAINABLE GROWTH

3.1 KEY FIGURES OF THE ELECTRICITY INDUSTRY

Annual investments and annual turnover are two important indicators to measure the economic health of the electricity sector in Europe.

As far as investments are concerned, great variability exists in the trends across European countries. However, for most of the countries for which data is available between 2004 and 2009, an increase in investments was reported. See *Table 1* for more details:

TABLE 1: INVESTMENTS MADE BY THE ELECTRICITY INDUSTRY IN EUROPEAN COUNTRIES BETWEEN 2004 AND 2009

ANNUAL INVESTMENTS (MILLION OF EUR)[1]					
	2004	2005	2006	2007	2009
AUSTRIA	737	1,168	1,162	1,300	1,600
CYPRUS	150	96	120.9	158.3	166
CZECH REPUBLIC	1,000	1,100	1,000	1,200	1,300
ESTONIA	-	-	-	173	205
FINLAND	300	-	-	-	-
FRANCE	2,808	3,096	-	-	9,514
GERMANY[2]	8,300	13,800	12,630	13,900	19,500
GREECE[3]	771	739	713.3	856.8	1,104
ITALY	4,150	-	-	-	-
LATVIA	162	125	176.4	315	210
LITHUANIA	118	160	182	201	137
LUXEMBOURG	635.7	642.6	-	-	-
MALTA	16.1	15.5	13.5	15.4	24
NETHERLANDS	-	-	1,909	-	-
NORWAY	679	937	999	1,399	-
POLAND	942	1,150	1,369.2	1,774.4	1,843
PORTUGAL[4]	798.2	905.2	860.8	1,292	1,582
SPAIN	4,482	4,916	5,681	6,585	5,270
SWEDEN	1,700	1,935	2,254	2,600	3,303
SWITZERLAND	702	673	845	988	-
TURKEY	-	803	-	-	-
UNITED KINGDOM	4,000	3,000	7,200	8,054	-

Source: EURELECTRIC Power Statistics 2011

1 Unless otherwise specified, data shown in the table refer to 100% national coverage. Figures expressed in nominal value of the currency for the year reported. Inflation not accounted for.

2 German data for 2005 cover only public supply (collected data). German data for 2006, 2007 and 2009 include third-party investments (collected data for public supply + estimates for Independent power and other renewable energy producer).

3 Greek data represent between 88 and 97% of total installed capacity in Greece.

4 These values include data for generation, transmission, distribution and commercialization. Data for generation and commercialization do not refer to the whole country. These values include data for Madeira and the Azores.

Table 2 shows the turnover of the electricity industry in Europe during the period 2004-2009. A general rise in annual turnover is observed in this period, partly attributable to increased trading and increased fuel prices.

Table 2: Turnover of the Electricity Industry in European countries between 2004 and 2009

Annual turnover (million of EUR)[5]					
	2004	2005	2006	2007	2009
AUSTRIA	7,561	-	-	-	-
CYPRUS	359	430	513.1	546.7	-
CZECH REPUBLIC	2,730	3,000	3,300	3,600	4,000
DENMARK	-	2,519	-	-	
ESTONIA	-	-	-	575	800
FINLAND	5,000	5,000	7,000	-	-
FRANCE	33,729	39,729	-	-	45,374
GERMANY	47,000	51,500	56,000	57,500	63,000
GREECE[6]	4,075	4,291	4,787.4	5,154.2	6,030
HUNGARY	2,589	2,899	3,048	3,684	4,213
ITALY	48,600	-	-	-	-
LATVIA	326	346	415.5	430	733
LITHUANIA	1,020	940	894	1,013	1,222
LUXEMBOURG	63.9	55	-	-	-
MALTA	132.5	170.3	213.4	210.4	264
NETHERLANDS	7,000	7,600	8,500	9,700	-
NORWAY	7,325	6,750	8,000	7,500	8,360
POLAND	6,318	7,398.2	8,275.3	8,585.4	10,483
PORTUGAL[7]	8,646.8	9,857.4	10,490.1	8,353.4	8,187
SPAIN	16,566	16,947	17,054	17,486	20,739
SWEDEN	7,645	7,646	9,041	8,521	9,934
SWITZERLAND	5,533	5,572	5,276	5,169.5	-
TURKEY	-	15,683	-	-	-
UNITED KINGDOM	22,850	29,650	36,600	38,179	-

Source: EURELECTRIC Power Statistics 2011

5 Unless otherwise specified, data shown in the table refer to 100% national coverage. Figures expressed in nominal value of the currency for the year reported. Inflation not accounted for.

6 Greek data represent between 89% and 97% of total installed capacity in Greece.

7 These values include data for generation, transmission, distribution and commercialization. Data for generation and commercialization do not refer to the whole country. These values include for Madeira and the Azores.

Another key feature of the electricity industry is the generation mix, describing the share of different energy sources used in electricity generation (nuclear, fossil fuel, hydropower and other RES). *Figure 1* displays the total generation capacity in Europe from 1980 to 2010 by main energy sources.

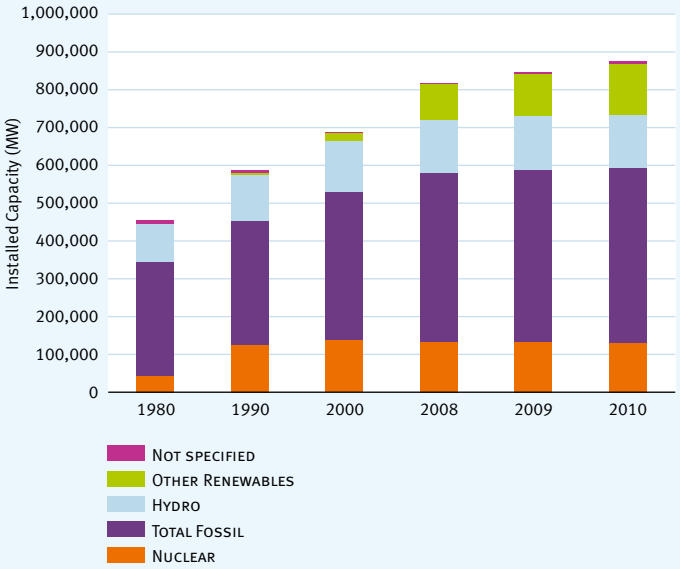
The figure shows a steady rise of total capacity and renewables over the period 1980-2010 with an acceleration in recent years. In 1980, renewable energy sources other than hydro represented 0.4% of the total capacity for the EU-27 (1,613 MW of the "other RES" out of 452,259 MW in total). In 2000, the same source represented 3.2% of the total capacity for the EU-27 (21,942 MW out of 684,790 MW), whereas they represented 15.4% in 2010 for the EU-27 (133,940 MW out of 869,659 MW in total).

Nuclear represents about 20% of the total installed capacity in 2000 (136,847 MW out of 684,790 MW) compared to 15% in 2010 (130,538 MW out of 869,659 MW in total).

Despite a steady rise of total fuel capacity, a switch to gas is also contributing to reduce CO_2 emissions.

Figure 2 displays total generated electricity, from 1980 until 2010, also by primary source. We can observe a continuous increase as the need for electricity expands: in 1980, the total generated electricity equalled to 1,837 TWh compared to 2,878 TWh in 2000 and 3,218 TWh in 2010.

Figure 1: Total Installed Generation Capacity – EU-27 (1980-2010)

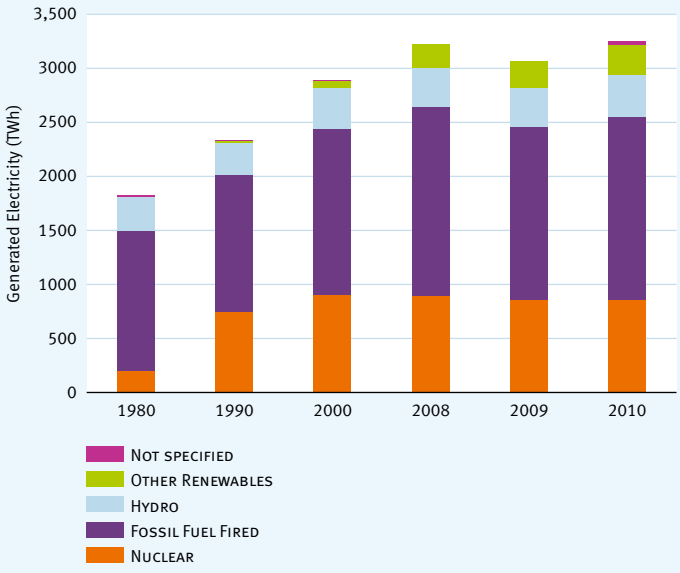


In 1980, RES (including hydro) represented 22.2% of the total installed capacity for the EU-27.

In 2010, RES represent 31.5% of the total installed capacity for the EU-27

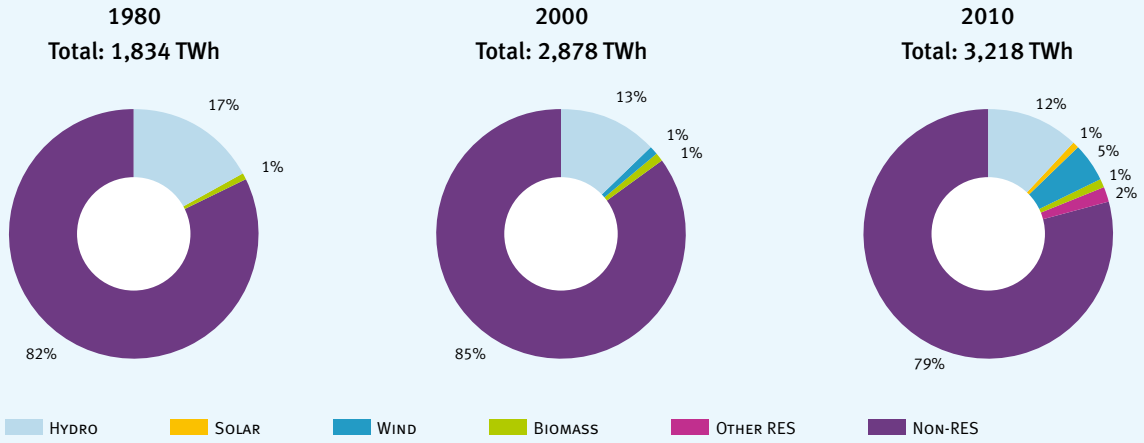
The share of the total generated electricity attributable to renewables (other than hydro) increased from 1% to 9% in the period 1980-2010 (EU-27)

Figure 2: Total Generated Electricity – EU-27 (1980-2010)



A rapid increase in electricity produced from RES can also be observed (*Figure 3*). The share of renewables and low carbon technologies has increased in the period 1980-2010 (*EURELECTRIC, 2011a*). We will focus later on that aspect (*Section 5.3 Investing in Renewable Energy Sources*).

Figure 3: Share of hydro, solar, wind, biomass and other RES out of the total generated electricity in 1980, 2000 and 2010, EU-27



Source: EURELECTRIC

3.2 Improving environmental performance through research and development

The context in which energy is produced has changed; new challenges have arisen. By investing in research and development (R&D), electricity companies are trying to find innovative solutions to reduce the impact of their actions. R&D is a key instrument to achieve the goal of carbon-neutrality by 2050 in a cost-efficient way.

Developing, testing and improving the way we generate, transport and store our electricity is costly, risky and time-intensive. It requires the best support from the industry and the public sector to deliver on the EU's ambitious climate and energy goals. EURELECTRIC has made innovation a key priority in 2012. We welcomed *Horizon 2020*, the European Commission's proposal for an EU Framework Programme on Research and Innovation for 2014-2020 and its increased energy budget of €6.5bn, simplified administrative procedures and support for all phases of the innovation cycle. It correctly identifies the development of secure, clean and efficient energy as one of society's major challenges. Supporting innovative companies and helping cleaner, more effective energy technologies reach market competitiveness is central to attaining our goal of a carbon-neutral European power sector by 2050.

With negotiations on the EU budget currently underway, it will be vital to reinforce the central role of research, development and demonstration (RD&D) spending on future technologies. Negotiations have to avoid horse-trading between RD&D spending on the one hand and, for instance, energy infrastructure on the other hand – both are vital and must be supported equally. EURELECTRIC also believes that new renewable technologies should be supported essentially via appropriate RD&D support, which distorts markets far less than, for example, feed-in tariffs.

EDF (FRANCE)

TECHNOLOGY AND ENVIRONMENT, FINDING THE RIGHT FIT: THE PLANNED TIDAL TURBINE FARM OFF THE COAST OF PAIMPOL-BRÉHAT

Following consultation with stakeholders, a demonstration project of four tidal turbines is under construction in a zone where fish are not trawled. With an installed capacity of 2 MW, it will generate 4 GWh annually, as of 2012, without CO_2 emissions and from a renewable source.

All technological decisions have been taken with the environment in mind. The team opted for turbines that can be installed without drilling or anchorage. Their profile has been studied to ease the escape of animals and keep vibration to a minimum. They have a limited number of mechanical and hydraulic components, and do not require lubricating fluid. Furthermore, the cables have been placed to avoid a zone of protected algae.

HC ENERGÍA (SPAIN)

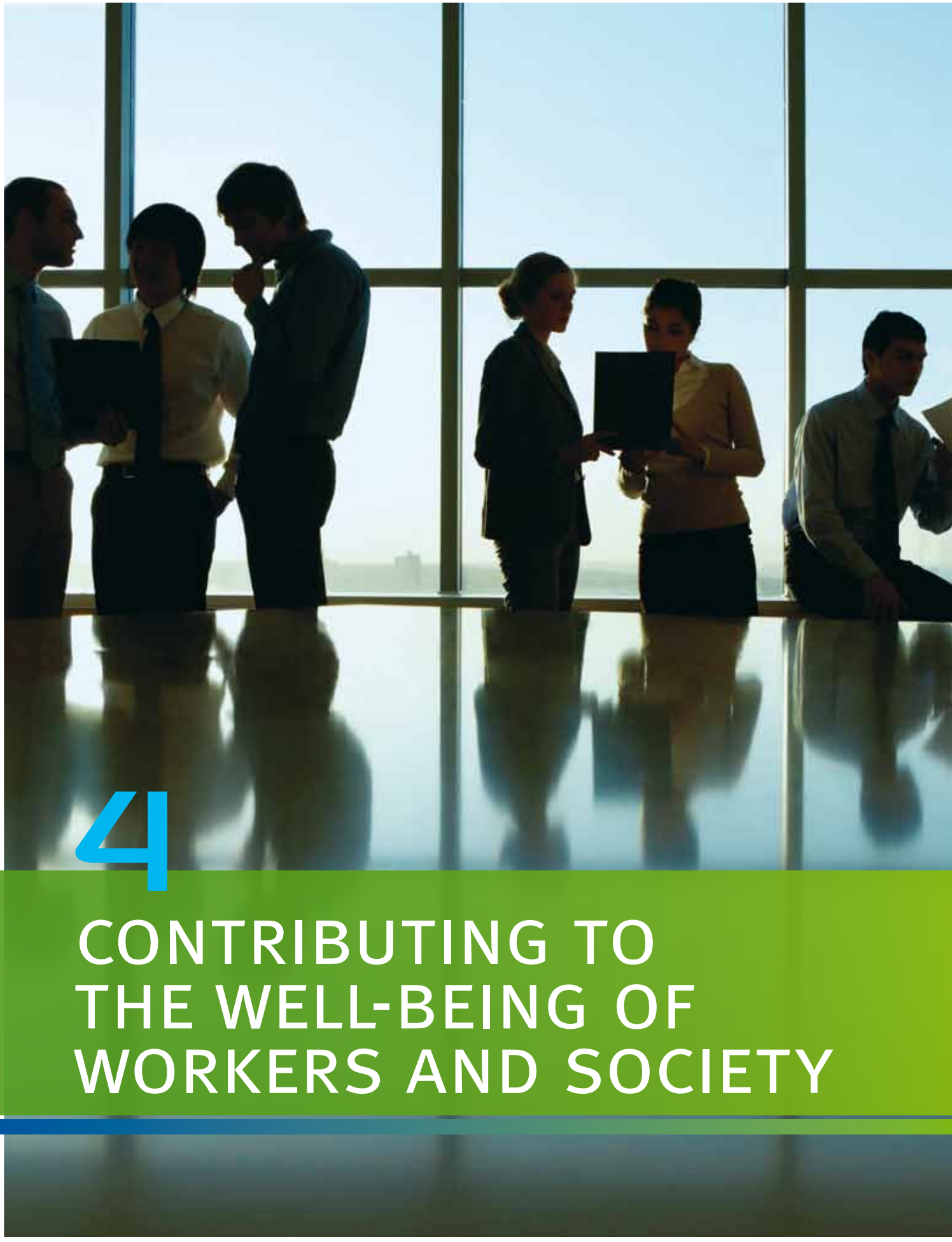
CONFERENCE "CON CIENCIA EN LA ENERGIA"

On 6-7 October 2011 the conference "Con ciencia en la energia" (Science for energy) took place in Oviedo, organised by HC Energy with the cooperation of the Foundation for the Promotion in Asturias of Scientific and Technological Research, the University of Oviedo, and the Asturian Federation of Entrepreneurs. This event brought together senior scientists in four areas in which HC Energía develops R&D activities, and put them in touch with other scientists, technologists and entrepreneurs. One of the objectives of this event was to create a discussion among the speakers of each panel and the audience. To have a systematic and productive debate, professional moderators managed the group work. The findings of the debate will be available in a document for science and technology system, as an input reference. The videos of the debates will be available at www.concienciaenlaenergia.es.

EURELECTRIC PUBLICATION

HOW TO FOSTER RESEARCH, DEVELOPMENT AND DEPLOYMENT OF RES-E TECHNOLOGIES (A RESAP REPORT)

As part of RESAP, EURELECTRIC addressed the need for a stable and incentivising RD&D framework for RES technologies if Europe is to meet its ambitious 2020 goals. In order to deliver on the 20% RES targets by 2020, EURELECTRIC recommends a significant increase of the energy-related RD&D budget. In addition, a clear and stable European framework is necessary to undertake basic RD&D and to create an investment climate that allows RES technologies to gain commercial competitiveness. It should enhance cooperation between member states' deployment experiences and R&D priorities, in order to avoid duplication of efforts. The new "Horizon 2020" framework programme should focus clearly on technologies with the potential to reach market viability before 2020 to contribute to reaching the 2020 targets. "*Horizon 2020*" will cover the period 2014-2020 and incorporate three formerly separate instruments, namely the 7th Research Framework Programme (FP7), the Competitiveness and Innovation FP (CIP) as well as the EU contribution to the European Institute of Innovation and Technology (EIT).



4

CONTRIBUTING TO THE WELL-BEING OF WORKERS AND SOCIETY

Maintaining and improving the necessary framework for a smooth functioning of the European electricity sector is one of EURELECTRIC's priorities, as well as contributing actively to the well-being of society.

4.1 A DYNAMIC SOCIAL POLICY

4.1.1 ATTRACTING TALENTS AND DEVELOPING SKILLS

The electricity sector is attractive as it offers many types of jobs, such as engineers, technicians, sales or client support. *Table 3* below displays the number of employees in the electricity industry in the period 2007-2010. Despite the economic crisis, the overall workforce has remained relatively stable.

Table 3: Number of employees in the Electricity Industry across European countries (2007-2010)

NUMBER OF EMPLOYEES				
	2007	2008	2009	2010
AUSTRIA	NA	NA	20,000	20,000
CROATIA	NA	NA	14,197	13,390
CYPRUS	NA	NA	649 / 1,516	631 / 1,525
CZECH REPUBLIC	NA	6,723 / 4,382	6,825 / 4,422	6,725 / 3,822
ESTONIA	8,500	NA	4,200	NA
FINLAND	NA	NA	NA	10,777 / 14,765
FRANCE	NA	69,741 / 43,520	69,821 / 43,229	71,300 / 42,749
GERMANY	132,506	132,250	130,417	132,030
GREECE	24,602	NA	22,582	21,681
HUNGARY	12,844	NA	12,960	NA
IRELAND	NA	NA	1,110 / 3,520	1,020 / 3,470
ITALY	58,683	57,287	57,192	39,326
LATVIA	5,500	1,801 / 4,129	1,912 / 3,623	1,929 / 3,335
LITHUANIA	9,795	8,817	NA	NA
MALTA	NA	NA	620 / 494	588 / 453
THE NETHERLANDS	23,200	23,200	22,270	22,700
NORWAY	16,500	17,200	17,900	18,200
POLAND	NA	NA	74,428	NA
PORTUGAL	1,758 / 4,846	1,971 / 4,422	1,921 / 4,207	1,893 / 4,126
SPAIN	9,251 / 14,375	10,363 / 14,488	NA	NA
SWEDEN	19,840	NA	20,000	20,000

Aggregated data | Generation / Transmission & Distribution data

Source: EURELECTRIC

Table 4 below displays the percentage of employees of the Electricity Industry by age category in 2009-2010. For most countries, the majority of the Electricity Industry's employees are between **35 and 54 years old**. These results stay in line with earlier conclusions about demographic change in the Electricity Industry. In 2005, a European Working Conditions survey found that 40 per cent of workers in the electricity, gas and water sector were over the age of 45, of whom just one half were over the age of 55. The same survey found that, in Europe as a whole, an ageing population would result in an overall shortage of 20.8 million people of working age by 2030.

The best practices promoting age diversity and age management strategies brought together in the toolkit elaborated by EURELECTRIC and its social partners, the European Federation of Public Service Unions (EPSU) and the European Mine, Chemical and Energy workers' Federation (EMCEF) in 2009 remain relevant. The European Commission has made proposals to establish Sector Councils on employment and skills at the European level. Their objective would be to gain insights into likely developments in employment and skills needs and to analyse developments in sectoral labour markets. They would be based on European networks of existing national observatories and councils.

Table 4: Overview of the percentage of Electricity Industry employees by age category (2009-2010)

PERCENTAGE OF EMPLOYEES BY AGE CATEGORY										
	15-24 YEARS OLD		25-34 YEARS OLD		35-44 YEARS OLD		45-54 YEARS OLD		55 + YEARS OLD	
	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010
AUSTRIA	7	7	12	12	28	28	39	39	14	14
CROATIA	1.4	0.8	14.4	13.2	24.8	24.5	34.6	34	24.9	27.6
CZECH REPUBLIC[8]	1	1	15	16	30	29	33	32	21	20
CYPRUS	2.6	2.2	28.3	27.4	36	36.5	23.1	24.8	9.6	9.2
FINLAND	NA	5/3	NA	13/20	NA	27/21	NA	38/31	NA	18/24
FRANCE	NA	9/15	NA	24/18	NA	27/23	NA	34/44	NA	6/5
GERMANY	9/11	10/13	12/14	12/13	26/27	22/25	42/37	43/37	11/11	13/12
HUNGARY	3.2	2.6	21.5	21.5	28.8	29.7	31.8	30.8	14.6	15.4
IRELAND	2/9	1/9	9/15	10/16	21/19	21/20	47/39	50/39	21/18	18/16
LATVIA	8/5.4	4.4/3.9	21.2/21.6	22/21	23.8/23	25.4/25.3	27.1/29.2	26.3/28.4	20/20.9	21.9/21.4
MALTA	0/1	0/2	7/11	7/11	32/38	34/39	42/33	43/33	18/17	16/16
THE NETHERLANDS	6	6	28	28	26	26	24	24	16	16
NORWAY	7	NA	14	NA	25	NA	29	NA	25	NA
PORTUGAL	1.4/0.7	1.3/1	13.4/12.2	14/12.9	16.1/13.4	15.9/13.5	49.4/51.9	45.2/46.5	19.6/21.9	23.7/26.2

Aggregated data | Generation / Transmission & Distribution data

Source: EURELECTRIC

In order to foster the development of employees' potential and adapt their skills to new challenges, electricity companies are organising training programmes. Training is indeed a key element in the sustainable development strategy to strengthen employees' performance. *Table 5* shows the number of training hours per employee in 2009-2010, with clear variations across European countries.

8 These figures only cover CEZ, the biggest electricity company in the Czech Republic.

Table 5: Number of training hours per employee in the Electricity Industry across European countries (2009-2010)

	NUMBER OF TRAINING HOURS PER EMPLOYEES			
	2007	2008	2009	2010
AUSTRIA	27.1	NA	31.5	31.5
BELGIUM	34	NA	45 / 49.3	56.5 / 52.4
CYPRUS	1.2	1.2	1.8	1.1
CZECH REPUBLIC[9]	42	45	49	55
FINLAND	31	31	NA	24 / 24
FRANCE	NA	NA	52 / -	59 / -
GREECE	8,5	8	NA	NA
HUNGARY	28	31	11.8	12.4
IRELAND	30	30	NA	NA
LATVIA[10]	NA	NA	26 / 10.7	10 / 5.2
LITHUANIA	12	18.2	NA	NA
MACEDONIA	0,1	0,4	NA	NA
MALTA	NA	NA	12.8	12.7
PORTUGAL	30.4 / 23.7	41.7 / 22.1	40.5 / 17.4	31.8 / 25.1
SLOVAKIA	43	45	NA	NA
SPAIN	47.3	49.5	NA	NA
SWEDEN	139	169	NA	NA

Aggregated data | Generation / Transmission & Distribution data

Source: EURELECTRIC

EURELECTRIC / EPSU / EMCEF REPORT
TOWARD A LOW-CARBON ELECTRICITY SECTOR: EMPLOYMENT EFFECTS AND OPPORTUNITIES FOR SOCIAL PARTNERS

The transition towards a low-carbon economy will induce significant changes in jobs and qualifications, in production, transmission and distribution of electricity.

In January 2011, EURELECTRIC and its social partners EPSU (the European Federation of Public Service Unions) and EMCEF (the European Mine, Chemical and Energy Workers Federation) published a study on the concept of "Just Transition" in the energy sector, which aims at achieving a smooth social transition towards a more sustainable economy through adaptation and mitigation action, as well as through the development of skilling and reskilling programmes – or just new skills – and the creation of quality jobs.

In their conclusions, social partners stressed that low-carbon technologies will require a large amount of investment in training and a supportive public policy environment combined with support from public authorities. Due to the scale of this investment, the sector will need to increasingly rely on both the public and private sectors as sources of finance. Public authorities have the capacity to support employers through this transition by offering funding for training and establishing occupational standards for qualifications, inward investment opportunities and ensuring that the overall demand for skills from the industry is met with an adequate supply of qualified and competent people.

9 These figures only cover CEZ, the biggest electricity company in the Czech Republic.

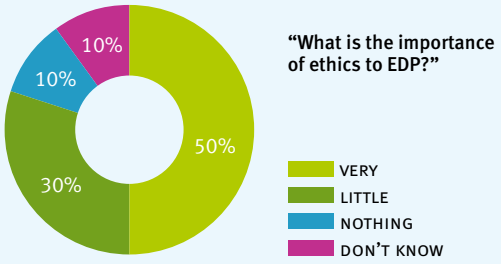
10 These figures only cover LATVENERGO group, which represents approximately 89% of electricity generation (2010), 100% of transmission and 99% of distribution in Latvia.

EDP (PORTUGAL)

ETICA PROGRAMME: TRAINING TO UNDERSTAND ETHICS

EDP organised a corporate ethics training and awareness raising programme for around 6,000 employees in Portugal, running from October 2009 to June 2010. The key objectives were: helping employees understand what it means to apply ethics in a corporate context; teaching employees about the code of ethics and the ethics "process" at EDP (organisation, procedures and responsibilities) and improving their trust in ethical practices at EDP.

This programme was developed in four steps: diagnosis, through an inquiry sent to all employees; a brainstorming about the ethics code and what it means; a special training for management staff; global training and final evaluation. Following these sessions, the perceived importance of ethics to EDP was assessed by the employees.



The etica programme is a matter of raising awareness. Ethics within a company is very important: it is what separates the companies that win from the ones that do not. (...) The key word of all of this is conscience.

António Mexia
Chairman of the Executive Board of Directors

EDF (FRANCE)

TRAINING CHALLENGE: A FLAGSHIP PROGRAMME

Signed in 2010 by the chairman of EDF and the five labour unions representing all Group employees in France, from EDF, ERDF and RTE-EDF Transport, the Training Challenge (Défi Formation) agreement has two objectives: develop employee skills and meet their expectations. The agreement focuses on work-study contracts at all levels. In the next five years, more than 4% of employees should benefit, as will 25% of the technicians and operatives hired (4% for managers). Skills academies (Académies des métiers) will be responsible for developing professional excellence in technical and support functions. Thirteen key businesses will have their own skills academies. Internal training will be developed to support promotions to managerial level and in some cases promotions to supervisory level.

The Group will implement a general system for work-study training, and a specific mechanism for promoting operatives directly to management positions will be tested.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Employees will also be able to take more initiatives to develop their skills. They will in fact be more involved than ever in their own careers, with access to internal training that can lead to positions with more responsibilities.

The creation of an EDF Campus network in France and other countries is part of the Training Challenge strategy, as is the accessibility of the Group University to all levels of management.

4.1.2 GUARANTEEING EQUALITY AND SAFETY TO EMPLOYEES

The electricity sector is usually seen as a male-dominated world. If this statement is partly true, the number of women working for electricity companies is nevertheless rising, indicating a slight improvement in the gender balance. *Table 6* displays the percentage of female workers in the electricity industry between 2007 and 2010.

TABLE 6: SHARE OF FEMALE WORKERS IN THE ELECTRICITY INDUSTRY ACROSS EUROPEAN COUNTRIES (2007-2010)

PERCENTAGE OF FEMALE WORKERS				
	2007	2008	2009	2010
AUSTRIA	15,4	16,2	16,2	16,2
BELGIUM	26.8 / 19.7	29.2 / 22.4	28.9	28.7
CROATIA	2.5 / 15.9	2.6 / 15.9	21.7	21.4
CYPRUS	18 / 15	18 / 14	NA	NA
CZECH REPUBLIC[11]	9 / 28	9 / 21	18.5 / NA	18.5 / NA
ESTONIA	18 / -	18 / -	NA	NA
FRANCE	23	23	NA	25 / 18
GERMANY	22	24	25	26
GREECE	9.6 / 19.2	9.6 / 19.4	NA	NA
HUNGARY	25.3 / 41	24.3 / 38.3	14.8	15.1
IRELAND	10 / 11	10 / 11	NA	NA
ITALY	15.5 / 16.5	15.5 / 16.5	16.5 / 16.9	17 / 17.5
LATVIA	NA	NA	36.2 / 18.4	37.3 / 17.1
LITHUANIA	18.6 / 24.7	16.7 / 24.7	NA	NA
MALTA	1.5 / 3.4	1.2 / 3.3	1 / 6	2 / 7
THE NETHERLANDS	26 / 15	28 / 15	27	27.1
NORWAY	18	20	20	20
PORTUGAL	11.4 / 9.4	11.7 / 8.3	12.7 / 8.7	12.6 / 9.3
ROMANIA	26.6	26.6	NA	NA
SLOVAKIA	2.9	3.3	NA	NA
SLOVENIA	23	23	NA	NA
SPAIN	16.3	16.9	NA	NA
SWEDEN	22.6 / 25.5	24.4 / 24.6	26	26
SWITZERLAND	21	21	NA	NA
UNITED KINGDOM	32.8	32.8	NA	NA

Aggregated data | Generation / Transmission & Distribution data

Source: EURELECTRIC

11 These figures only cover CEZ, the biggest electricity company in the Czech Republic.

Table 7 displays the percentage of female employees in management positions in the electricity sector between 2007 and 2010.

Table 7: Female managers as percentage of management staff in the Electricity Industry across European countries (2007-2010)

FEMALE MANAGERS AS % OF MANAGEMENT STAFF				
	2007	2008	2009	2010
AUSTRIA	NA	NA	9	9
CROATIA	9	8.9	8.7	8.6
CYPRUS	5	5	0.1 / 0.5	0.2 / 0.4
CZECH REPUBLIC[12]	11	9.1	8.9	8.5
ESTONIA	6	6	NA	NA
FRANCE	20.6	20.6	NA	20 / 21
GERMANY	8	8	8	9
GREECE	23.5	25.3	NA	NA
HUNGARY	12.3	11.5	9	9
IRELAND	16	14 / 16	17 / 17	NA
ITALY	NA	2.3 / 2.2	2.5 / 2.2	3 / 2.9
LATVIA[13]	NA	NA	24.4 / 9.1	25 / 10.5
LITHUANIA	6.2	14.7	NA	NA
MACEDONIA	0.8	0.7	NA	NA
MALTA	0	3	9	9
THE NETHERLANDS	15	16	14.9	17.9
NORWAY	NA	19	NA	NA
PORTUGAL	11.1 / 9.4	13.7 / 8.3	14.7 / 13.9	16.4 / 15.7
ROMANIA	0.8	0.8	NA	NA
SLOVENIA	NA	34.8	NA	NA
SWEDEN	16.7	16.8	23	27

Aggregated data | Generation / Transmission & Distribution data

Source: EURELECTRIC

12 These figures only cover CEZ, the biggest electricity company in the Czech Republic.

13 These figures only cover LATVENERGO group, which represents approximately 89% of electricity generation (2010), 100% of transmission and 99% of distribution in Latvia.

A workplace also needs to be safe – to avoid accidents and protect the health of the employees. Electricity companies have therefore implemented rigorous health and safety measures to reduce potential harm to workers. *Table 8* presents information on accidents in the electricity sector across European countries.

Table 8: Number of workdays lost due to accidents per thousand hours of work in the Electricity Industry across European countries from 2007 until 2010

	LOST TIME INJURY			
	2007	2008	2009	2010
CYPRUS	NA	NA	0.19 / 0.22	0.15 / 0.39
CZECH REPUBLIC[14]	0.14 / -	0.08 / -	0.09 / -	0.10 / -
ESTONIA	0.02 / 0.02	0.08 / 0.03	NA	NA
FRANCE	0.18 / 0.18	0.18 / 0.18	NA	0.16 / -
GERMANY	5 / -	NA	NA	NA
GREECE	0.11 / 0.19	0.09 / 0.16	NA	NA
HUNGARY	2 / 0.1	1.8 / -	0.3 / 0.8	0.4 / 0.7
IRELAND	0.07 / 0.12	0.04 / 0.13	0.07 / 0.1	0.19 / 0.05
LATVIA	NA	NA	0.01 / 0.22	0.01 / 0.24
LITHUANIA	0.08 / 0.06	0.14 / 0.05	NA	NA
MALTA	1.19 / 0.6	1.01 / 0.37	0.22 / 0.38	0.45 / 0.25
THE NETHERLANDS[15]	4.7 / 4.7	4.3 / 4.3	4	2.5
NORWAY	0.07 / 0.12	0.08 / 0.21	0.1 / 0.05	0.13 / 0.19
PORTUGAL	0.14 / 0.8	0.07 / 0.6	0.05 / 0.12	0.35 / 0.9
SLOVAKIA	0.15 / -	0.12 / -	NA	NA
SLOVENIA	0.8 / 0.8	NA	NA	NA
SPAIN	0.44 / 0.39	0.31 / 0.43	0.28 / 0.36	0.18 / 0.37
SWEDEN	0.02 / 0	0.01 / 0	2.05[15]	2.8[15]

Aggregated data | Generation / Transmission & Distribution data

Source: EURELECTRIC

14 These figures only cover CEZ, the biggest electricity company in the Czech Republic.

15 Figure calculated according to "Lost Time Injury Frequency", meaning work related accident with lost time per million working hour.

Table 9 shows the number of fatal accidents that occurred in electricity companies between 2007 and 2010. Thanks to strict safety management systems, the number of fatal accident remains very low.

Table 9: Number of fatal accidents in the Electricity Industry across European countries (2007-2010)

	NUMBER OF FATAL ACCIDENTS			
	2007	2008	2009	2010
AUSTRIA	0	NA	NA	NA
CROATIA	1	0	1	0
CYPRUS	0	0	0	0
CZECH REPUBLIC[16]	1 / -	2	1 / -	0 / -
DENMARK	1	NA	NA	NA
ESTONIA	0	0	NA	NA
FINLAND	1	NA	NA	1 / 1
FRANCE	NA	NA	0 / -	0 / -
GERMANY	NA	NA	0 / 1	1 / 1
GREECE	0	3	NA	0
HUNGARY	0	1	0	0
IRELAND	0	0	0 / 0	0 / 0
ITALY	NA	1 / 1	1 / 2	NA
LATVIA	NA	NA	0 / 1	0 / 0
LITHUANIA	3	0	NA	NA
MALTA	0	0	0 / 0	0 / 0
THE NETHERLANDS	0	1	NA	NA
NORWAY	1	1	1 / 3	1 / 0
PORTUGAL	0 / 0	0 / 0	0 / 1	0 / 0
ROMANIA	0	0	NA	NA
SLOVAKIA	0	0	NA	NA
SLOVENIA	0	2	NA	NA
SPAIN	0	0 / 0	2 / 1	0 / 1
SWEDEN	1	1	NA	NA
SWITZERLAND	0	1	NA	NA
UNITED KINGDOM	6	3	NA	NA

Aggregated data | Generation / Transmission & Distribution data

Source: EURELECTRIC

16 These figures only cover CEZ, the biggest electricity company in the Czech Republic.

EURELECTRIC/EPSU/EMCEF JOINT POSITION

SECURITY AND SAFETY IN THE NUCLEAR INDUSTRY

In March 2011, the events of Fukushima raised the issue of the direct impact incidents might have on the health and safety of the workers in the sector, whether employed in the power stations, active in emergency and disaster prevention services or acting as subcontractors.

In December 2011, social partners for the electricity sector published a joint position on Security and Safety in the Nuclear Industry in which they support the nuclear stress tests proposed by the EU and encourage the involvement of trade union representatives and employers in areas such as security, transparency, accountability, health and skills. They also recognised that decommissioning requires a long-term commitment to social dialogue, information and consultation. As a conclusion, employers and trade unions suggested that the European Commission prepare, together with European social partners, an overview on the impact that future developments in the nuclear industry may have on employment and future skill needs and an overview on the impact of decommissioning on employment, skills and qualifications, and health and safety.

TAURON (POLAND)

EMPLOYEE INVOLVEMENT IN POWER PLANT SAFETY

The power plant's employees are involved in the functioning of the occupational health and safety system, which is very closely linked to the environmental protection system. Identification of threats and updates of occupational risk assessment charts always take place with the involvement of the workers. At the early stages of implementing the occupational health and safety management system, a large group of employees was involved in the occupational risk assessments for the individual jobs. Now that monitoring of occupational risks consists of monitoring and updating identified threats, the process is conducted by the mid-level technical supervision staff (approx. 150 persons). The risk has been assessed and is being updated using the RiskScore method.

The risk is assessed on the basis of the following three parameters: potential consequences (their gravity) of the danger, exposure to the danger, and probability of negative consequences. The parameters are used to assess the risk using an appropriate formula. Depending on the calculated values risk can then be divided into five categories. The first two categories, i.e. negligible and low risk, are acceptable. Categories 3, 4, and 5 require mitigating actions. Such actions often involve improvement of the power plant's environmental impact.

4.1.3 SOCIAL COMMITMENT

The smooth functioning of a company depends on good communication and trust between employers and employees. *Table 10* below shows the percentage of electricity sector employees covered by collective bargaining agreements from 2007 until 2010. For most countries where data were available, the majority of employees are covered by such agreements. Employees of the European electricity sector are deeply involved in the discussions and negotiations with employers regarding their work conditions.

TABLE 10: SHARE OF EMPLOYEES IN THE ELECTRICITY INDUSTRY COVERED BY COLLECTIVE BARGAINING AGREEMENTS ACROSS EUROPE (2007-2010)

% OF EMPLOYEES COVERED BY COLLECTIVE BARGAINING AGREEMENTS				
	2007	2008	2009	2010
AUSTRIA	NA	NA	100	100
BELGIUM	NA	NA	100 / 100	100 / 100
CROATIA	100	100	100	100
CYPRUS	100	100	100	100
CZECH REPUBLIC	100	100	100	100
ESTONIA	100	100	NA	NA
FINLAND	NA	NA	NA	100 / 100
FRANCE	100 / 100	100 / 100	100 / 100	100 / 100
GERMANY	85	NA	93 / 93	93 / 94
GREECE	100	100	100	100
HUNGARY	95.3	95	72.2	72.3
IRELAND	86	86	95 / 99	94 / 99
ITALY	100 / 100	100 / 100	100 / 100	100 / 100
LATVIA[17]	NA	NA	100 / 100	100 / 100
LITHUANIA	100	100	NA	NA
MALTA	100 / 100	100 / 100	100 / 100	100 / 100
THE NETHERLANDS	98 / 98	98 / 98	98 / 98	98 / 98
NORWAY	80 / 80	80 / 80	80 / 80	80 / 80
PORTUGAL	64 / 87	65 / 87	76 / 89	74 / 87
SLOVAKIA	100	100	NA	NA
SLOVENIA	97.8	97.8	NA	NA
SPAIN	100 / 100	100 / 100	100 / 100	100 / 100
SWEDEN	97.8	96.5	98 / 98	98 / 98
UNITED KINGDOM	80.3	80.3	NA	NA

Aggregated data | Generation / Transmission & Distribution data

Source: EURELECTRIC

17 These figures only cover LATVENERGO group, which represents approximately 89% of electricity generation (2010), 100% of transmission and 99% of distribution in Latvia.

20th Anniversary of the European Social Dialogue

"The internal market and climate change are key issues impacting on workers and companies. As unions we want to ensure just transition, decent jobs, public services and fair and just prices. Working with the industry and EURELECTRIC will deliver on this important issue. I hope the report will serve as a statement of our progress."
Jan Willem Goudriaan, EPSU

In 2002, EURELECTRIC joined the European Social Dialogue (ESD), which aims at bringing together social partners according to sectors and to foster dialogue between them and the European institutions. As a social partner representing the employer side, EURELECTRIC is very much involved in the electricity sector's social dialogue. It addresses numerous sector-wide issues with the European trade union bodies, EMCEF – the European Mine, Chemical and Energy Workers Federation – and EPSU – the European Federation of Public Service Unions, with the support of the European Commission.

Since 2009, the Lisbon Treaty requires the European Commission to consult the European Social Dialogue when proposing any policy that will have a social impact on the sector concerned. With its social partners and the Commission EURELECTRIC has thus been working on many issues such as workers' exposure to electromagnetic fields or the transition to a low-carbon economy and its consequences for employees.

For the 20th anniversary of the European Social Dialogue and the 10th anniversary of EURELECTRIC's participation, **Mrs. Emanuela Preiti**, Chair of EURELECTRIC's WG Social Affairs and Human Resources, and **Mr. Jan Willem Goudriaan**, Deputy General Secretary of EPSU, share their experiences of their partnership and their active involvement in the European Social Dialogue.

Mrs. Emanuela PREITI (Enel)

EURELECTRIC Chairwoman WG Social Affairs and Human Resources

"At the beginning of its activity and up to 2008, the Social Dialogue Committee mainly focused on emblematic Human Resources issues, namely training and life-long learning, health and safety, demographic ageing, equal opportunities and diversity, Corporate Social Responsibility (CSR), restructuring – in particular the latter with the aim to first analyse and then develop joint recommendations on how to manage restructuring processes based on best practices in the sector.

With the intensification of EU legislation affecting the entire sectorial value chain, the tasks and agenda of the Committee changed. The Committee was encouraged by the European Commission to be proactive wherever possible, e.g. in impact assessment processes, vis-à-vis all new EU legislative proposals that were likely to affect the electricity sector. In this framework, EURELECTRIC, as European social partner, began a new path trying to evaluate possible consequences of new legislation in a timely manner.

Furthermore, activity largely focused on looking into drivers of continuous industrial restructuring, besides the evolution of EU legislation towards a low-carbon scenario. In this context, a focal point underlined in the ESD activity was the preservation of social cohesion, as a distinctive element of the European social model, and the subsequent need of supporting the introduction of accompanying policies in order to reduce significantly the related social cost as well as the research of alternative sources for the creation of work places. The accent was on how to preserve workers' employability and to facilitate their transition toward a different job with equal dignity. In this framework the joint project "Towards a low carbon electricity industry: employment effects & opportunities for the social partners" took place in 2009/2010, financed by the European Commission.

In 2011, the ESD work programme focused first on consequences of Fukushima [see box p.31] and the launch of a new project on the possible set-up of a "European sectorial skill council", a feasibility study. The project will be funded by the Commission and will run throughout 2012 with the main purpose of investigating the current national state of play of bodies focused on skills needs in the sector, and whether it would be advisable to create a Skill Council at European level.

As a final evaluation on the overall ESD activity in the electricity sector, the electricity sector has developed, during these first 10 years of participation, a robust social dialogue. The electricity industry has been able to gradually gain the trust of the European Trade Union Federation as well as the European Commission. On the other hand we have certainly had difficult issues to discuss, both internally amongst members and between employers group and unions. Nevertheless challenges have proved to be a key element in building up authentic industrial relations, with remarkable outcomes.

Concerning the future, major challenges are around the corner – if we just consider the future European electricity scenario and related targets to be achieved – and there is room for improvement in terms of representativeness of the delegation employers

group (trying especially to attract representatives from the newer EU member states) as well as national follow-up of the work carried out at European level. EURELECTRIC is and wants to be at the forefront in the ESD, considering a good ESD as a crucial component to get the consensus required for all future strategic choices that the European electricity industry will make to remain competitive on the global market."

Mr. Jan Willem GOUDRIAAN
EPSU Deputy General Secretary

Participating in the European Social Dialogue

"Playing an active role within the European Social Dialogue (ESD) is very important, as the purpose of this dialogue is to bring social partners together and give common opinions toward the European institutions, on issues we as social partners deem important. In this framework, both employers and trade unions can deliver strong positions from their perspective, giving valuable expertise to the European decision-makers on many issues faced by the electricity sector. EURELECTRIC, EPSU and EMCEF are all very representative organisations, as they cover numerous European countries and different energy sources. Despite this active participation in the ESD, our opinions do not always have the impact we expect. They are sometimes not considered enough by the decision-makers, and we strongly wish that our positions would have more authority within the industry and nationally.

We have considered many issues, including joint positions on equality, health and safety, the impact of climate change, the impact of smart meters and our contribution to the Energy Roadmap 2050.

Next challenges

In a context of continuous change and more competition between companies –including from beyond the EU, notably China – and between different sources of energy, one of our main challenges for the future is to ensure a high standard of employment conditions for the employees in the industry. Employees should not be sacrificed to companies' efficiency.

In addition to that, there is also a demographic challenge over the next 5-10 years, as many employees are going to retire. This may open new perspectives for employment and training. Another important factor of change is global warming and the shift towards a low-carbon economy. This is a challenge to some parts of the industry where we have to protect the interest of workers. It also opens the possibility of new job creation in the development of renewables, investments in networks, smart grids, etc. Our mission – EURELECTRIC, EPSU and EMCEF – is to ensure that this transition is a "just" transition, with decent jobs, decent working conditions and salaries. The Social Dialogue should also be respected and ensure it is relevant for company and national level representatives. We would certainly like to see more commitment to the results of our joint work.

In this context of deep change, the work done by EURELECTRIC, EPSU and EMCEF in the framework of the European Social Dialogue should have an important role to play in order to defend high standards of employment conditions."

EURELECTRIC/EPSU/EMCEF JOINT POSITION
"SMART METERS"

In the framework of the electricity Social Dialogue Committee, EURELECTRIC and trade unions EPSU and EMCEF discussed the implications of the roll-out of smart meters on employment in the electricity sector. A joint position on the issue was adopted mid-December 2010, in which both employers and trade unions stressed the possibility of negative impacts – certain occupations and jobs could disappear – but they also recognised some positive impacts, such as creating new jobs requiring new skills and qualifications. As a consequence, social partners underlined the need for careful planning, implementation and monitoring, as well as the importance for companies to ensure appropriate training for the workers concerned.

4.2 CONTRIBUTING TO THE WELL-BEING OF SOCIETY

4.2.1 INVOLVEMENT IN SOCIETAL ISSUES

Next to water, health, telecoms and transports, energy is also considered by the EU as a service of general interest, subject to specific public service obligations as electricity is a basic need for everyone and every citizen should have access to it.

The financial crisis has led to a rise of energy prices for consumers – on average, household electricity prices rose by 6.9% between the first half of 2010 and the first half of 2011[18] – and the spread of unemployment among the population. These two factors have sadly contributed to increased fuel poverty in Europe. There is no common European definition yet for fuel poverty, but it can be presented as the inability to pay fuel bills, when some households cannot pay for essential services such as energy because they choose to spend their limited resources on other goods and services (*EPEE, 2009*). The United Kingdom is the only country that established an official definition: a household lives in fuel poverty when it spends more than 10% of its income to keep an adequate temperature in the house. The consequences for households in fuel poverty are risks for physical and mental health, dangers due to degradation of dwellings and excessive debts among others.

This issue has been addressed under the Belgian Presidency of the EU (1st July-31st December 2010), and the institutions are now working on a common definition and strategies to fight fuel poverty. Electricity companies are very much involved with associations and national, regional, local authorities to tackle this issue, especially through projects and funding. In November 2011, ELISAN, the European Local Inclusion and Social Action Network, and the corporate Foundation GDF-Suez launched a call for European experiences in local initiatives aiming at fighting fuel poverty – "European Award – Energy poverty, how to get out?" – in order to collect best practices at the European level.

Well aware of the importance of electricity to society, electricity companies are strongly involved in many societal issues, such as providing clean and secure electricity, participating in the efforts of CO_2 reduction by supporting the introduction of electric cars and raising awareness among consumers on energy efficiency. To succeed, electricity companies are establishing strong partnerships with local authorities, governments and consumers.

LATVENERGO (LATVIA)
SOCIAL PROGRAMME FOR LOW-INCOME HOUSEHOLDS

In 2010, Latvenergo AS in cooperation with the Latvian Association of Local and Regional Governments implemented a social support programme for low-income households. The programme ensured support to residents from various social groups by providing 100,000 households with a gift of a 500 kWh Electricity payment card. The total amount contributed by the Latvenergo AS programme was 3.7 million lats. In order to ensure access to as many of its least socially protected customers as possible, Latvenergo AS simplified the agreement conclusion process, facilitating quicker provision of the service, and introduced an alternative for an easier conclusion of electricity supply agreements. In 2010, the gift cards were used the most by residents in Riga, Liepāja, Rēzekne, Daugavpils, Kuldīga, Madona, Jelgava and Ogre.

18 Eurostat – Energy Statistics November 2011.

EDF (FRANCE)

PARTNERING REGIONAL AUTHORITIES AND LOW-INCOME HOUSING AGENCIES

Maintaining its roots in the French regions is a priority for the EDF Group, and the actions initiated in 2009 are major steps in this direction. EDF works hard at its relationship with local authorities and assigns a single advisor to each of these accounts. The creation of the *EDF Collectivités* brand in 2009 was yet another illustration of EDF's commitment to local engagement, expertise and the public interest.

Energy efficiency and sustainable development partnerships with associations of elected officials and regional professionals were reinforced over the year, and the Group forged stronger ties with local players, including semi-public companies. For instance, a partnership was signed in 2009 with the French Federation of Local Public Enterprises.

EDF is participating in the creation of eco-neighbourhoods like the *ZAC Andromède* urban development zone in Toulouse, as well as in urban renewal programmes (an energy project for the Saint Cyprien district in Poitiers and a CO_2 emissions review in Cannes). It guides local and regional authorities in investing in high-efficiency technologies via the Energy savings certificates scheme (ESC), while also providing advisory services for demand-side management, CO_2 emissions reduction and the use of renewable energies.

Under the new "Low-Carbon Events" (*Evénements bas carbone*) service, users can offset the carbon footprint created by events they organise with CO_2 reduction measures and Kyoto credits. In 2009, beneficiaries included the *Châlons-en-Champagne Expo* and a trade show for innovative buildings, *Bâtiment Innovant du Nord Est*. Also during the year, the *Montant de Charges service* allowed low-income housing agencies to complete the thermal renovation of 64,200 units. This service is affiliated with the ESC scheme. Inspections are conducted after construction to ensure that the work is properly executed.

ESB (IRELAND)

AREA BASED ENERGY EFFICIENCY RETROFIT

Ireland is working to deliver on its EU 2020 energy efficiency commitment and has a national energy efficiency action plan in place. This includes provisions for placing an obligation on energy supply companies to deliver energy efficiency improvements to help meet government targets. The residential sector is a key area of potential for delivering energy efficiency, accounting for 30% of national primary energy consumption in 2010. It is estimated that in 2009, 20.5% of households are "fuel poor" ("fuel poor" being cases where household expenditure on energy is greater than 10% of household disposable income).

While there are successful national programmes to retrofit homes with energy-efficient measures in Ireland, these have so far been based on individual houses. Ireland's recently published "Strategy for Affordable Energy in Ireland (November 2011)" emphasises area-based retrofitting, in order to achieve economies of scale. This project was aimed at testing the area-based approach in practice.

The project retrofitted energy-efficient measures in a mixed ownership estate of 126 houses (68 private homes, 58 local authority homes) in Dundalk, Ireland in 2011. The project was a partnership between Electric Ireland, Dundalk Town Council and the Sustainable Energy Authority of Ireland (SEAI).

Following a detailed survey and technical evaluation of a sample of 20 homes, an optimum package of retrofit measures was identified and the take-up was forecast based on a detailed sample survey. Two information evenings were held to communicate the objectives of the work to the residents. The upgrade package typically consisted of attic insulation, cavity wall insulation, draught-proofing, condensing boiler and full heating controls.

LATVENERGO (LATVIA)
CHILDREN'S SAFETY WHEN USING ELECTRIC APPLIANCES

For the sixth autumn in a row, timed to coincide with the beginning of the school year, a new film devoted to schoolchildren's safety called *Tava vasara* (Your Summer) came out within the framework of the *Lai dzīvo bērni*! (Long live the children!) project. The Latvenergo Group participated in its creation by including in the plot a piece devoted to children's safety with electric appliances. The film was screened in schools during the traditional autumn Safety Week in cooperation with the Ministry of Education and Science State Educational Content Centre.

The mascot Zibo, with his friendly catchphrase *"Don't be afraid of electricity, learn and become friends with it"*, has successfully established the Latvenergo Group's communication with younger children, educating them about safe electricity use. This is evident from events where Zibo visited children's summer camps, where most children turned out to know about Zibo's website and were engaged in playing the games and doing the exercises available on it.

LATVENERGO (LATVIA)
ENERGY RISK INSURANCE

In 2010, in cooperation with insurance company BALTA AAS, Latvenergo AS began to offer its electricity market customers in Latvia a new service never before seen on the Baltic market: energy risk insurance (ERI). ERI provides insurance of all technological equipment, machine tools, stock, utilities, goods, raw materials, unfinished and finished products that are owned by a company, including other movable assets within the zone of coverage of the insurance policy beyond the electric facility border of belonging. ERI is particularly suited for cases such as damage caused by lightning. Whereas earlier, damage caused due to electricity supply interruptions or lightning would have to be covered at a customer's own expense, now, BALTA AAS will cover damages to the insured company according to the ERI insurance provisions. For example, BALTA AAS will cover losses if lightning strikes the power supply system, damaging a company's fire extinguishing system or other equipment. In 2010, Latvenergo AS gave customers a total of 510 ERI certificates. 24 customers received ERI compensations within half a year.

ENERGIE-NETHERLANDS (NETHERLANDS)
DUTCH POWER INDUSTRY LOOKS AT RESPONSIBLE COAL SOURCING

Demands regarding the origin of coal and the effect of coal mining on the environment and human rights are growing. Politicians, NGOs and the public at large are putting pressure on energy companies to be more transparent and take more responsibility in the coal supply chain.

In summer 2010, the energy companies owning coal plants in the Netherlands started, under the flag of the industry organisation *Energie-Nederland*, a multi-stakeholder dialogue to explore possibilities of improving coal supply chain responsibility in practice.

The group met to: share knowledge and practices; identify where there is common understanding and where there is a need to improve current practices; and agree on next steps in those areas. This first phase of the coal dialogue entailed strengthening assurance processes, with a view to improving local circumstances for communities, the work force and the environment in places where coal for the Dutch market originates. This process also entails respecting human rights, labour, the environment and conflict-sensitive business practices and improving transparency in the coal supply chain towards Dutch end-consumers. On 28 February 2011 the final report of the Dutch Coal Dialogue was published under the title "Working on understanding and contributing to improvements".

Following the Dutch Coal Dialogue, a group of European utilities has joined forces and started the *Bettercoal* initiative. The primary role of *Bettercoal* will be to advance the continuous improvement of corporate responsibility in the coal supply chain, based on the *'Bettercoal Code of Practice'*. This code will build upon existing mining standards and sets out social, environmental and ethical standards that coal mining companies will be encouraged to implement.

HC ENERGIA (SPAIN)
SCHOOL PROGRAMME "VIVA NUESTRA ENERGÍA"

HC ENERGIA has launched a school programme called "VIVA NUESTRA ENERGÍA" presenting different ways of obtaining and producing electricity, distinguishing between renewable and non-renewable sources, in order to understand the consequences of our energy consumption on the environment. The initiative consists of a teaching unit of about an hour, adjusted to primary school children (from six to ten years old). Each session is conducted by specialised instructors who, through an interactive screen, introduce five cartoon characters who star in a video about their journey through their respective "renewable energy world" (wind, solar, hydraulic, geothermal and biomass).

With this engaging and innovative video, protagonists of the different worlds introduce the children to each renewable energy source, explaining how they are used to generate electricity. The programme also has a section with energy efficiency tips and advice for the safe use of electricity. As support materials, student groups receive a poster and stickers with a number of different tips for safety and energy efficiency, as a school activity to develop their own "Decalogue of good practices". As a joint activity, the training session concludes with a commitment from the group to the Earth: "The Earth is in your hands. Help save the Planet".

Finally, and to consolidate the knowledge acquired, students are asked to answer a set of questions and finally receive a gift and a variety of materials to work with at home or at school, as well as posters for their classroom.

4.2.2 PROMOTION OF SUSTAINABLE DEVELOPMENT VALUES IN INTERNATIONAL PROJECTS

Access to sustainable energy is a key prerequisite to combating poverty and fostering growth in developing countries. Energy can increase industrial and agricultural production, create jobs, improve education and health care, and open new opportunities of development for everybody. Access to electricity is particularly crucial for certain basic needs, such as lighting, refrigeration and the use of household appliances. According to the latest World Energy Outlook (*IEA, 2011*), 1.3 billion individuals have no access to electricity and 2.7 billion still use traditional biomass to cook food. 2012 was declared International Year of Sustainable Energy for All by the UN. It aims at ensuring universal access to modern energy services, doubling the rate of improvement in energy efficiency, and doubling the share of renewables in the energy mix, all by 2030. A common effort of public funding and private capitals should be put in place together with an innovative, multi-stakeholder partnership to respond to those needs.

European electricity companies are involved in business around the globe. When they invest in an international project, electricity companies actively support the development of the communities in which their subsidiaries operate. Strong cooperation is established with municipalities, local actors and electricity companies. This contributes to improving the quality of life of the local population, providing them with access to energy, creating jobs and training to develop their skills, organising social and environmental projects.

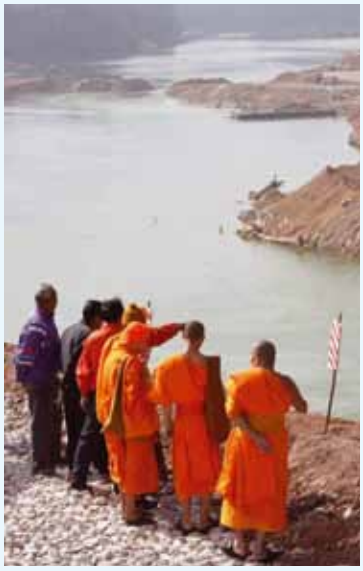
STATKRAFT (NORWAY)

SUSTAINABLE DEVELOPMENT OF RENEWABLE ENERGY RESOURCES IN LAOS

Laos is endowed with abundant water resources that have the potential to be a source of clean energy for the development of the country and for export to neighbouring countries. Only a small fraction of potential hydropower sites has been developed so far, but the government is committed to developing this resource in a sustainable manner as a catalyst for economic and social development.

The Theun-Hinboun Power Company (THPC) was the first independent power producer in the hydropower sector of Laos. THPC's shareholders include Electricité du Laos (EdL) (60%), Statkraft of Norway (20%) and GMS Lao Company Limited, an investor in energy projects based in Thailand (20%). All shareholders are committed long-term investors with experience in hydropower production. The present expansion project will increase production from 210 MW to 500 MW, providing electricity to the local grid (60 MW) and for export to Thailand.

From the start of planning, THPC has been committed to the highest standards of social and environmental mitigation. The Environmental Impact Assessment (EIA), Environmental Mitigation and Management Plan (EMMP) and the Resettlement Action Plan (RAP) were prepared in accordance with Asian Development Bank safeguard policies, the Equator Principles for lending banks and the national laws of Laos. An innovative approach has been developed to go beyond these regulations in order to ensure that impacted people become "project beneficiaries" and that there is truly sustainable development.



The project is committed to income targets for the more than 4000 resettlers from 12 villages and for relocation along the downstream areas, and intends to rehabilitate tracts of degraded forests in the catchment. In addition, THPC will measure results in terms of human development indicators.

Statkraft, a leading energy company in Norway, has as a partner encouraged high standards on social, sustainability and environmental performance in the project. This responsible engagement ensures optimized development towards welfare and prosperity based on natural resources while also respecting the considerable social and environmental challenges.

GDF SUEZ (FRANCE)

RASSEMBLEURS D'ENERGIE – INNOVATE TO REDUCE ENERGY SCARCITY

As many developing countries are facing energy scarcity, it is essential to help these populations not to fall into or remain in a situation of energy scarcity and fuel poverty. This applies to national public authorities as well as energy suppliers. It is therefore GDF SUEZ's decision to:

- Scrupulously respect regulations put in place to help vulnerable customers (and suggest improvements),
- Provide complementary, voluntary initiatives in developed countries as well as in developing countries.

The innovative initiative "GDF SUEZ Rassembleurs d'Energies" launched in 2011 goes in that direction. Its objective is to support social entrepreneurs in the area of sustainable energy access to poor populations and fight energy scarcity by simultaneously or sequentially using three distinct and complementary levers:

- Donations through philanthropic programmes of the GDF SUEZ Foundation,
- Technical assistance with the participation of GDF SUEZ employees,
- Investment through the creation of a specific solidarity fund.

In 2011, 8 experimental projects were launched. Whether in Bangladesh, Burkina Faso, India or in the North of France, the method is the same. High social impact projects that respect the environment are selected and linked to innovative low capital return financing, including, as appropriate, carbon financing. GDF SUEZ's effort is substantial. It comes from the affirmed willingness to be a major socially and environmentally responsible energy company.

The worldwide ambition of GDF SUEZ Rassembleurs d'Energies is part of the 2012 international year of sustainable energy access for all.

EDF (FRANCE)
NAM-THEUN 2 (LAOS)

In Laos, EDF is the major shareholder in Nam Theun 2 Power Company (NTPC, 40% EDF) that built and operates a dam that was flooded in 2009. This installation, built by 8000 workers of whom 80% were Laotian, contributes to development in Laos, and will sell 95% of the electricity produced to Thailand. The social and environmental programmes put in place mobilized 10% of the total budget ($1.29 bn).

NPTC committed to doubling the revenues of local populations within five years of their relocation. Most of the households have already reached the revenue targets set out in the concession agreement. To ensure the sustainability of these improvements, the development programs will continue until 2015.

NTPC prepared agricultural lands and trained villagers on sustainable forestry (30,000 hectares are reserved for their use). The company also provided boats and fishing equipment. A system of microcredit facilitated the development of economic activities and 14 markets were created. Fishing zones were selected and a reservoir committee and village fishing association created. Irrigation systems were installed and water quality closely examined. On the Nakai plateau, all infrastructures (1,300 houses, building and community infrastructures, 330 wells, roads and electricity networks) were transferred to the local communities and administration in January 2010.

The programme on health is ongoing. Indicators from the Nakai Plateau show an improvement in sanitary conditions (lower rates of parasitical infestation and malnutrition in children under five, etc.).

The environmental program is also ongoing: around the Nam Theun 2 dam, wild animal, plant life and habitat programs are enabling the listing and protection of species impacted by the facility. NTPC will be providing financial support to the Nakai-Nam Theun Biodiversity Conservation Area until the end of the concession agreement in 2035, as well as to the national elephant conservation program in the Nakai Plateau.

NTPC is pursuing environmental education initiatives: the aquatic environment laboratory created by EDF and NTPC closely monitors the water quality and hydrobiology of the reservoir and water bodies linked to the project. In 2010, the chemical and biological parameters of the water, verified by independent experts, were in line with specifications. The laboratory also contributes to research programs on the reservoir's greenhouse gas emissions.

ENEL (ITALY)
ENABLE ELECTRICITY

In the framework of the UN initiative "Sustainable Energy for All", Enel wants to make its own contribution by guaranteeing access to energy where it is still not available through the *"Enabling Electricity"* program. This focuses on two targets: people who live in isolated areas and disadvantaged communities in peripheral, rural and suburban areas. The program aims to act in three directions:

- projects which guarantee access to technology and infrastructure;
- projects which remove economic obstacles in low-income areas;
- projects for the development and sharing of professional know-how and skills in the energy sector (*"capacity building"*).

Below are shown three significant projects to which Enel is contributing:

- **The Triangle-based Omni-purpose Building (TOB) System** is an independent habitable structure which is easily assembled and completely flexible, since it is made with modular components and this enables it to be assembled in various forms depending on need. The structure, which was devised by the Research Unit of Enel "Engineering & Innovation" and the design for which is an Enel international patent, integrates photovoltaic modules and accumulation systems, but has been designed to be able to house various technologies to exploit renewable sources on the basis of the specific resources of the various sites.

- **Haiti – "Efficient Cook Stoves Program"**
  In May 2011 Enel Trade signed an agreement with D&E Green Enterprises for the realization of an initiative aimed at the production and distribution of high-efficiency kitchens in Haiti. In addition to the real and measurable reduction in greenhouse gas emissions, the project will also produce economic and social benefits for local communities, since it will contribute to mitigating the high rate of unemployment, chronic deforestation of the country and health problems arising from the use of coal as a primary fuel source for cooking.

- **Congo – "Pointe Noire"**
  As part of the project to enhance the medium voltage distribution network in the city of Pointe Noire in Congo, in order to increase the availability of electricity in the city, Enel Distribuzione has given its support to EniCongo SA for work relating to engineering, material *procurement*, project coordination, and the supervision of the work undertaken.

5 PROTECTING THE ENVIRONMENT – CONTROLLING OUR ENVIRONMENTAL IMPACT

2009 key figures (EU-27)

CO_2 specific emissions

down to 359.7g/kWh *(Figure 5)*

SO_2 specific emissions

down to 0.9g/kWh *(Figure 9)*

NO_x specific emissions

down to 0.47/kWh *(Figure 10)*

19.6% of total generated electricity from

Renewable Energy Sources *(Figure 3)*

5.1 OUR PRO-ACTIVE ENVIRONMENTAL STRATEGIES

European electricity companies are committed to the development of environmental strategies. They are establishing environmental management systems (EMS) or setting voluntary targets on environmental performance, in order to respond to current environmental challenges.

The two most frequently used standards for EMS design and certification are the international standard ISO 14001 and the EU Eco-Management and Audit Scheme (EMAS). Both voluntary schemes, they are used by companies to evaluate, monitor, manage and improve their environmental performance. While there are national differences in the degree to which these systems have been adopted, a considerable uptake of EMS within the European electricity sector can generally be observed, as shown in *Table 11*.

Table 11: Uptake of ISO and/or EMAS certified EMS across European countries (2007-2010)

UPTAKE ISO AN/OR EMAS CERTIFIED EMS				
	2007	2008	2009	2010
AUSTRIA	64	64	64	64
BELGIUM	76.6	76.6	86.8	86.8
CYPRUS	NA	NA	NA	30 / 60
CZECH REPUBLIC	40 / 65.2	39.3 / 65.2	73 / 65.2	73 / 65.2
DENMARK	46 / -	46.1	NA	NA
ESTONIA	99.6 / 100	99.6 / 100	NA	NA
FINLAND	16 / -	16	NA	90 / 90
FRANCE	95	95	NA	- / 100[19]
GERMANY	43 / -	45 / -	59 / -	60 / -
GREECE	92 / 0	94 / 0	NA	NA
HUNGARY	77.2 / 100	78.3 / 100	70	70
IRELAND	100 / 0	100 / 0	100 / 0	100 / 0
ITALY	96.2 / 100	95.7 / 100	90.7 / 100	91,6 / 100
LATVIA	95 / -	95 / -	92 / 100	92 / 100
THE NETHERLANDS	55	55	60	60
NORWAY	40 / 100	40 / 100	40 / 100	40 / 100
PORTUGAL	92 / 100	90 / 100	86 / 100	93 / 100
SLOVAKIA	80 / 45	85 / 100	NA	NA
SLOVENIA	100 / -	100 / 100	NA	NA
SPAIN	87 / 83	88.5 / 83	NA	NA
SWEDEN	97.2 / 100	97.2 / 100	100 / 100	100 / 100
UNITED KINGDOM	88.4 / -	88.5 / -	NA	75

Aggregated data | Generation / Transmission & Distribution data

Source: EURELECTRIC

19 This figure covers only ERDF activities, which represents more than 85% of distribution in France.

HC ENERGIA (SPAIN)
ISO/EMAS CERTIFICATIONS

HC ENERGIA introduced environmental variables in all company processes, based on the environmental policy approved by the Board of Directors in 2004 and revised in 2010. This commitment has been formalised with environmental management systems in businesses that have the biggest environmental impact: electricity generation and electrical distribution. These systems are available in all thermal and hydraulic power plants, in addition to the most important cogeneration plants (like Sevares and Sidergás) and have been certified as conforming to ISO 14001 by AENOR. In 2011 the EITO cogeneration plant was added to this certification.

Over the last years we have made an additional and decisive effort in our environmental management through the adherence to EMAS, as a proof of our interest in transparent and open dialogue with the stakeholders and in diffusion of environmental performance. Combined cycle and hydraulic power plants as well as our biggest cogeneration plant are included in the EMAS register.

In total, over 97% of HC ENERGIA capacity is environmentally certified (about 3721 MW). In addition to thermal and hydro generation, electricity distribution activities are to obtain their certification on Environmental Management System in 2011.

ENEMALTA (MALTA)
ISO 14001 CERTIFICATION

Enemalta Corporation was awarded the ISO 14001 certification, an internationally recognised environmental management standard that specifies a set of requirements for environmental management systems (EMS). Enemalta received the ISO 14001 certification for all its generation activities at Delimara Power Station (DPS) and Marsa Power Station (MPS), as well as for its distribution and development activities, making it one of the largest companies on the island to acquire this prestigious environmental certification. The purpose of this standard is to help all types of organisations to protect the environment, to prevent pollution, and to improve their environmental performance on an on-going basis. Moreover, such a standard can be integrated with other management requirements and help organisations achieve economic goals.

Enemalta Corporation has acknowledged various challenges that it faces in environmental protection, both on its own premises as well as in protecting the country's environment. Being a major industry in Malta, Enemalta poses an ecological threat by affecting air, land and sea conditions. With EU accession, Marsa and Delimara Power Stations have to comply with the Integrated Pollution Prevention and Control Directive (IPPC). The corporation, in a planned and documented manner, will be implementing the requirements set out by the Directive. The implementation of the ISO 14001 standard involves a myriad of activities and ample co-ordination, as well as changes in perception in order to attain the desired benchmarks. A team of managers, engineers and other workers from various sections have in fact been working on the implementation of the EMS since 2008.

As a requisite to the standard, Enemalta has now compiled an environmental policy that states its "mission" and commitment towards the environment. This policy acknowledges the corporation's responsibility to generate and distribute electricity to its customers in a safe and efficient manner whilst safeguarding the environment. Furthermore it acknowledges that Enemalta's operations inevitably impact the environment and that we are committed to assessing, preventing and reducing, wherever possible, these impacts and to continuously improving our performance.

LATVENERGO (LATVIA)
ISO/EMAS CERTIFICATIONS

The management system of Latvenergo AS Generation technical function (Ķeguma HES, Pļaviņu HES, Rīgas HES, Rīgas TEC-1) is consistent with ISO 9001:2000, ISO 14001:2004 and OHSAS 18001:2007.

To guarantee compliance with the requirements of environmental legislation, the Latvenergo Group actively co-operates with state environmental institutions by providing the required environmental information, organising the environmental impact assessment procedures, observing the provisions of permits for polluting activities as well as carrying out consultations on environmental issues. In 2010, there were no significant spills of hazardous chemicals in the environment, nor any other major violations. Therefore, in 2010, the Group received no important warnings, penalties or sanctions from the controlling environmental institutions regarding its activities.

In order to communicate their actions to tackle environmental and sustainability issues, European electricity companies frequently publish environmental and/or CSR and/or sustainable development reports. *Table 12* shows to which extent European countries have produced environmental or CSR reports between 2007 and 2010.

Table 12: Coverage of environmental reports and/or CRS reports across European countries (2007-2010)

COVERAGE OF ENVIRONMENTAL REPORTS AND/OR CSR REPORTS				
	2007	2008	2009	2010
BELGIUM	100 /100	100 / 100	100 / -	100 / -
CYPRUS	NA	NA	100 / 100	100 / 100
CZECH REPUBLIC	74.8 / 65.2	73.2 / 65.2	73.2 / 65.2	73.2 / 65.2
DENMARK	64.7 / 13.8	63.2 / 13.4	NA	NA
ESTONIA	99.6 / 100	99.6 / 100	NA	NA
FINLAND	NA	NA	NA	90 / 90
FRANCE	98	98	100 / 100	100 / 100
GERMANY	94 / 70	93 / 70	92 / 70	93 / 70
GREECE	100 / 100	100 / 100	NA	NA
HUNGARY	94.5 / 19.8	95.1 / 95.3	40	40
IRELAND	NA	NA	100 / 100	100 / 100
ITALY	99.7 / 100	86.7 / 100	99.4 / 100	99.4 / 100
LATVIA	95 / 100	95 / 100	95 / 100	95 / 100
LITHUANIA	60 / 67	60 / 67	NA	NA
MALTA	100 / 100	100 / 100	100 / 100	100 / 100
THE NETHERLANDS	100 / 100	100 / 100	100 / 100	100 / 100
NORWAY	80 / 100	80 / 100	90 / 80	80 / 90
PORTUGAL	100 / 100	100 / 100	100 / 100	100 / 100
ROMANIA	95 / 100	95 / 100	NA	NA
SLOVAKIA	100 / 29	100 / 29	NA	NA
SPAIN	100 / 96	100 / 96	100 / 100	100 / 100
SWEDEN	NA	NA	100 / 100	100 / 100
UNITED KINGDOM	95.8 / -	95.8 / -	NA	93 / -

Aggregated data | Generation / Transmission & Distribution data

Source: EURELECTRIC

5.2 CLIMATE CHANGE AND GREENHOUSE GASES EMISSIONS

Climate change caused by ever increasing emissions of GHG is anticipated to become the biggest environmental threat the planet (and in particular mankind) is facing in the longer term leading, for instance, to increasing air and water temperatures, widespread melting of snow and ice, and rising sea levels. According to the scientific community, there is little doubt about the anthropogenic origin of these radical changes: some greenhouse gases occur naturally in the atmosphere, while others results from human activities – mainly transport, agriculture and industry – such as the burning of fossil fuels, solid wastes, the production and transport of coal, natural gas and oil. This is aggravated by a weakening of natural sinks through deforestation and aggressive land use patterns.

The sections below set out the Electricity Industry's support for the ETS as key driver for the EU decarbonisation agenda and present some information on the most important greenhouse gases – those included under the United Nations Framework Convention on Climate Change (UNFCCC) (*UNEP, 1992a*). In particular, we consider anthropogenic sources of these gases, their global warming potential and their relation to the electricity industry.

5.2.1 The EU emissions trading scheme (EU ETS)

"Through the Climate and Energy Package, the EU is taking important steps towards a competitive low-carbon economy. This report gives useful insights into the progress made so far by the European electricity sector as an important contributor to this process."[20]

Stefaan Vergote, EU Commission, DG Climate Action

The EU ETS was established in 2003 and entered into force in January 2005 in order to help the EU meet its obligations under the Kyoto Protocol (*Council of the European Union, European Parliament, 2003*). The world's first international emissions trading scheme, it works on a "cap-and-trade" basis, forcing companies to either reduce their own emissions or buy excess permits from companies that do. Under the ETS, operators receive emission allowances from their national government based on national allocation rules (e.g. using benchmarks, historic emissions or projected emissions) or increasingly through auctioning. The EU ETS covers over 10,000 power and heat generators, oil refineries and other stationary sources of greenhouse gas pollution in the EU's 27 countries (such as installations for the production of ferrous metal, cement, lime, glass, ceramic materials and pulp and paper). Other sectors such as residential, transport, agriculture and waste treatment/disposal are not covered by the current EU ETS.

On 23 January 2008, the European Commission proposed a revision of the EU ETS for **Phase 3**, covering the period 2013-2020. This proposal was released as part of an "Energy and Climate Package" that was approved in December 2008 (*Council of the European Union, European Parliament, 2009c*).

The key elements of the revised EU ETS Directive are:

- A centrally defined annual cap: the EU ETS sectors will have to deliver a 21% GHG reduction (versus the 2005 level) by 2020, following a linear reduction trajectory of 1.74% each year. For the sectors out of the ETS, the effort required is 10% reduction compared to 2005 levels, divided into national ceilings for each of the 27 EU MS;
- Full auctioning (100%-auctioned emission allowances except for use of waste gases) for the power sector from 2013, although the Directive grants derogations to ten of the newest EU member states (Slovenia and Slovakia are the exception), enabling some power stations to obtain up to 70% of their allowances free of charge in 2013, declining to zero by 2020 at the latest. All other industrial sectors will receive 80% free allowances from 2013, declining to 30% in 2020 with the aim to reach full auctioning by 2027, except for those exposed to "carbon leakage" who will receive 100% free allowances based on a benchmarking methodology.

In March 2011, the European Commission published *"A Roadmap for moving to a competitive low carbon economy in 2050"* (*European Commission, 2011c*). EURELECTRIC took an active part in the debate by publishing a response to the Commission roadmap, stressing the sector's need for long-term clarity and predictability, in order to plan investments and deploy low-carbon technologies. Given the power sector's commitment to achieving carbon-neutrality by 2050, EURELECTRIC strongly believes the EU ETS should be the key driver for decarbonisation as coherent and integrated policy instruments based on the ETS can best serve the EU's decarbonisation goal.

In December 2011, the European Commission adopted its *"Energy Roadmap 2050"* (*European Commission, 2011g*). It explores the challenges posed by delivering the EU's decarbonisation objective while at the same time ensuring security of energy supply and competitiveness. EURELECTRIC welcomed the Roadmap's recognition that electricity will play a much greater role in decarbonising transport and heating/cooling. In detailed comments published in February 2012 (*EURELECTRIC, 2012a*), EURELECTRIC called for:

20 This quote is Stefaan Vergote's personal view and cannot be regarded as an official position of the European Commission.

- A least-cost approach delivered through markets,
- A coherent system approach to the energy transformation, based on policies which:
  - Are EU-wide, rather than 27 national variations,
  - Are clear and consistent over time,
  - Provide a level playing field for all generation technologies,
  - Support a coordinated approach to the expansion of generation and grids, and
  - Do not contradict each other.

EURELECTRIC emphasised that the key policies to achieve this are:

- Completion of a well-functioning internal energy market, and
- Early agreement on a firm 2030 climate target with the ETS as its central policy instrument.

Apart from the ETS, the Energy Taxation Directive (*Council of the European Union, 2003*) harmonises – to a certain degree – energy taxes at the EU level, in order to avoid competitive distortions in the energy sector (heating, electricity and motor fuel) within the internal market. In order to promote energy efficiency and the consumption of environmentally friendly, the European Commission launched a revision of the directive in April 2011 (*European Commission, 2011d*).

The proposed directive aims at restructuring the way in which energy products are taxed to support the objective of moving to a low-carbon and energy-efficient economy, and to avoid distortions of competition in the internal market. According to the proposed new rules, energy taxes would be split into two components, taking into account their CO_2 emissions and energy content. As far as electricity is concerned, taxes related to the energy content would still be levied at the point of consumption and the minimum rate would not be modified. The Commission set an exemption from the proposed new CO_2 tax component for sectors covered by the EU ETS, which also includes the electricity sector. EURELECTRIC welcomed this measure and considers it appropriate as it will avoid any overlap and any double tax burden for our sector. Nevertheless, the CO_2 element of the tax will apply to small electricity generation installations which, because of their size, are not covered by the ETS.

It must be noted that some Member States do impose taxes or levies on fossil fuels used for power generation or on hydro and nuclear power generation. These different national taxes hamper market integration and distort competition.

5.2.2 REDUCTION OF EMISSIONS

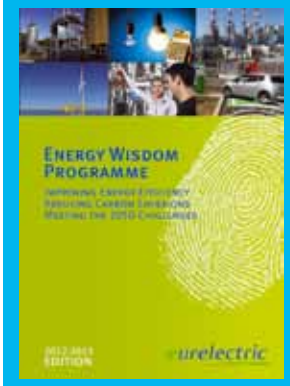
Carbon Dioxide (CO_2)

CO_2 is released in the atmosphere mainly because of fossil fuel (oil, natural gases and coal) combustion, deforestation and land use changes. Despite its relatively low radiative forcing on a molecule-by-molecule basis, CO_2 is one of the greatest contributors to climate change, representing 81% of GHG emissions (*GHG UNFCCC*). This is due to the vast amounts of CO_2 annually released into the atmosphere: 4.6 Gt CO_2 in 2009 (*EEA, 2011a*), which means approximately 83% of all GHG emissions in Europe (*EEA, 2011a*).

In the Electricity Industry, GHG relevant CO_2 is generated mainly from the burning of fossil fuels and non-biogenic solid waste in thermal power plants. CO_2 emissions from electricity and heat production is the largest key source in the EU-27 accounting for 23.9% of total greenhouse gas emissions in 2009 and for 84% of greenhouse gas emissions of the Energy Industries Sector (*EEA, 2011a*). Between 1990 and 2009, CO_2 emissions from electricity and heat production decreased by 6% in the EU-27 (*EEA, 2011a*). *Figure 4* shows the trend in total and electricity related CO_2 emissions from 1990 to 2009.

EURELECTRIC PUBLICATION

THE ENERGY WISDOM PROGRAMME



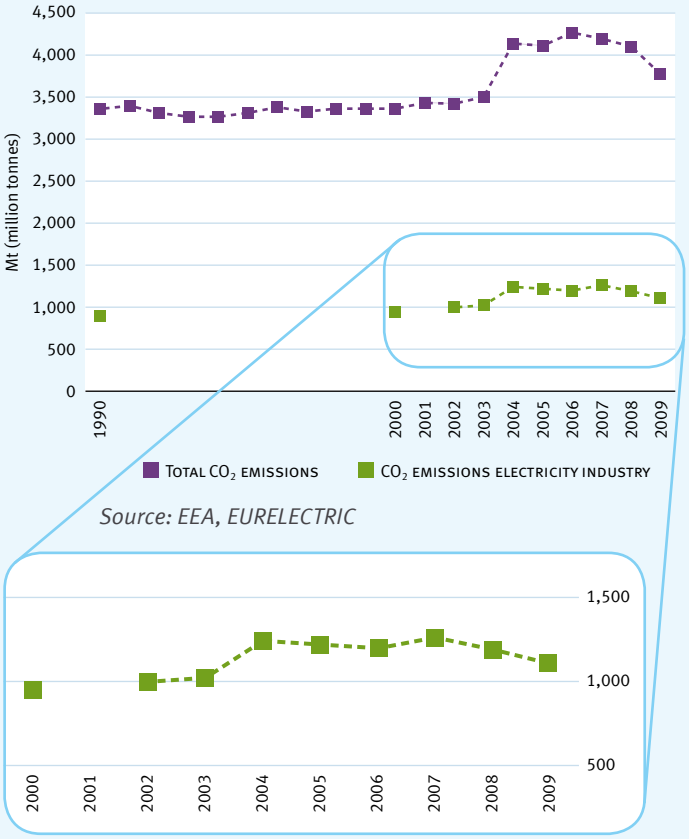
Since 1998 the Energy Wisdom Programme has been the key platform for European electricity companies to report voluntarily on how they are rising to the challenge of **reducing greenhouse gas emissions** and **improving energy efficiency** through the implementation of highly innovative projects. Over 600 projects, covering the period 1990 to 2011, have been reported and **730 Mt CO_2 eq. have been saved** since the programme started. Over 150 projects were reported in the 2010-2011 edition, with 99 Mt CO_2 equivalent saved. The 6th edition, reporting for the period 2010-2011, was published in May 2012 and allowed CEOs and project managers to promote their visions and actions towards "greening" the electricity sector, while sending project-based policy recommendations to European and national policymakers.

Figure 5 shows the reduction in CO_2 specific emissions in the Electricity Industry during the period 1980-2009. Between those two dates, the Electricity Industry reduced its CO_2 specific emissions from 712.5 g/kWh to 359.7 g/kWh. While electricity generation increased by 75%, electricity related CO_2 emissions have been reduced by 48%.

Methane (CH_4)

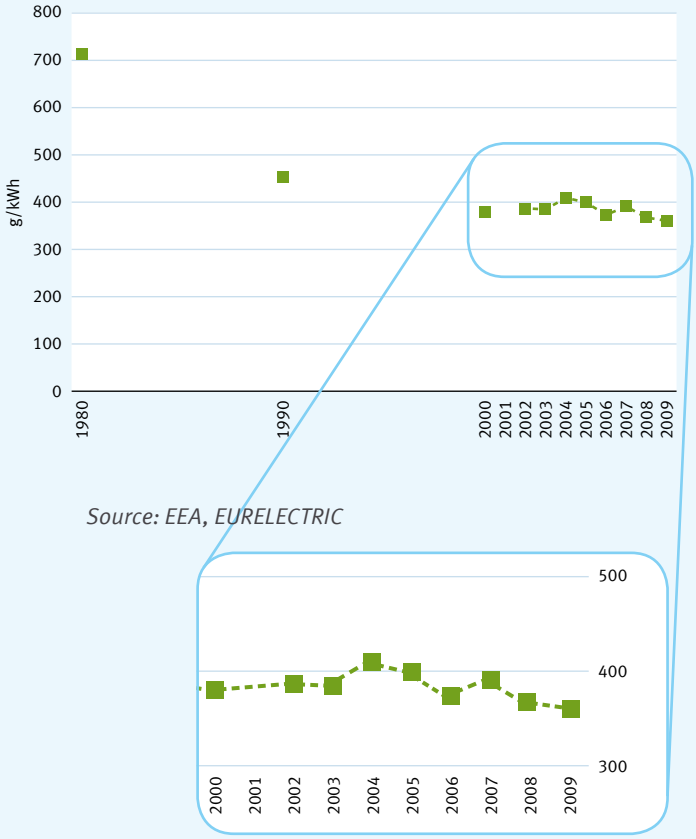
Methane is produced whenever organic matter decays in the absence of oxygen. It is also released during coal, gas and oil extraction, as well as in landfills and by agriculture activities such as rice cultivation. In 2009, 418 Mt CH_4 were emitted into the atmosphere in the EU-27 (*EEA, 2011*), which means approximately 9% of all GHG emissions in Europe. Most CH_4 emissions in the energy industry are released during extractions of oil, coal and gas, as well as from leakages in the natural gas transportation and distribution systems. The emissions of methane from the Electricity Industry are, however, negligible, as observed in *Table 13*.

Figure 4[21]: Total and electricity-related CO_2 emissions – EU-27 (1990-2009)



Source: EEA, EURELECTRIC

Figure 5[21]: Specific CO_2 emissions from the European Electricity Industry – EU-27 (1980-2009)



Source: EEA, EURELECTRIC

Between 1980 and 2009, the Electricity Industry reduced its CO_2 specific emissions from 712.5 g/kWh to 359.7 g/kWh

21 In the few cases where yearly national emission data were not available, we used the corresponding data from the EEA for 'public electricity and heat production'. 'Public electricity and heat production' corresponds to the combustion of fossil fuels by energy industries to produce electricity or heat that will later be consumed by end users (other industries, households, services, etc.). Public utilities are defined as those under takings whose primary activity is to supply the public. They may be in public or private ownership. This category includes emissions from own on – site use of fuel but not emissions from auto producers (undertakings which generate electricity/heat wholly or partly for their own use, as an activity which supports their primary activity). Electricity-related emissions are only a sub-set of the public electricity and heat sector comprising emissions from electricity only plants as well as the share of emissions attributable to electricity generation from combined heat and power (CHP) plants. Emissions from (district) heat only plants as well as emissions attributable to heat generation from CHP plants are usually not taken into account when calculating specific emissions from electricity generation.

Nitrous Oxide (N_2O)

N_2O is emitted during agricultural and industrial activities as well as during combustion of solid waste and fossil fuels. In 2009, 358 Mt N_2O were emitted in the EU-27 (*EEA, 2011*) approximately 7.8% of all GHG emissions in Europe. The majority of N_2O emissions comes from agricultural activities. As far as the Electricity Industry is concerned, some N_2O is also released in the burning of fossil fuels. In particular, around 10 Mt CO_2 of N_2O were emitted in 2009 by the public electricity and heat production industry (*GHG Data – UNFCCC*).

Hydrofluorocarbons (HFCs) and Perfluorocarbons (PFCs)

HFCs and PFCs are very potent GHGs. They are currently used as replacement for ozone-depleting substances (ODS), such as chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs) and others, as these are to be gradually phased out according to the Montreal Protocol (*UNEP, 1987*). These gases are largely irrelevant to the Electricity Industry.

Sulphur Hexafluoride (SF_6)

SF_6 is a very potent GHG. In 2009, approximately 6 Mt CO_2 eq. were released in the atmosphere in the EU-27 (*EEA, 2011a*). Although the electricity industry itself is not directly responsible for major emissions of SF_6, we are concerned about emissions from the manufacture of electrical equipment, and evidence proves that progress can be made. In a 2007 study, the consultancy firm ICF International estimated that, in the 2004-2007 period, for high voltage switchgear, recovered SF_6 was recycled about 85%, reclaimed or destroyed at 14% and stored definitely at 1% (*ICF International, 2008*). Moreover, life-cycle assessments (LCAs) show that the use of SF_6 in electrical equipment can reduce overall GHG emissions by helping to limit network losses. SF_6 possesses a unique combination of properties including non-toxicity, non-ozone depletion, non-flammability and outstanding electrical properties. A comparison of air-insulated and SF_6– insulated technologies shows the advantages of the SF_6– insulated technology with regard to primary energy demand and global warming potential (*ABB e.a., 2003*). In medium-voltage systems, the amount of SF_6 used per functional unit is very low and emissions are negligible. Technological developments in the field of SF_6 containment such as sealed-for life and improved/minimal handling result in continuing emission reduction. A closed loop for SF_6 reuse at end of life is ensured by manufacturers as well as specialised companies (*T&D Europe, 2009*).

Table 13: Summary of GHG emissions in the EU-27 and in the public electricity and heat production industry in 2005 and 2009

Total Emissions in EU-27		Share of total GHG emissions in EU-27		Emissions from public electricity and heat production industry		Share of total emissions from public electricity and heat production industry		Share of emissions from public electricity and heat production industry out of total		Global Warming Potential – 100 yr (GWP)[22]
	2005	2009	2005	2009	2005	2009	2005	2009	2005	2009	
CO_2	4,241	3,765	82.4	81.5	1,357	1,218	99.2	99.1	32	32	1
CH_4	445	418	8.6	9.0	1	1	0.1	0.08	0.2	0.2	25
N_2O	398	358	7.7	7.8	10	10	0.7	0.9	2.6	3	298
HFCs	60	72	1.2	1.6	-	-	-	-	-	-	650 to 15.000
PFCs	5	3	0.1	0.06	-	-	-	-	-	-	12.500
SF_6	8	6	0.2	0.13	-	-	-	-	-	-	22.800
Total	**5,157**	**4,622**	**100**	**100**	**1,368**	**1,229**	**100.0**	**100.0**	**-**	**-**	**-**

Source: EEA, 2011a / GHG Data – UNFCCC[23]

22 The GWP measures the relative heat trapping capacity of a gas on a molecule-by-molecule basis, as compared to CO_2.

23 'Public electricity and heat production' corresponds to the combustion of fossil fuels by energy industries to produce electricity or heat that will later be consumed by end users (other industries, households, services, etc.). Public utilities are defined as those undertakings whose primary activity is to supply the public. They may be in public or private ownership. This category includes emissions from own on – site use of fuel but not emissions from auto producers (undertakings which generate electricity/heat wholly or partly for their own use, as an activity which supports their primary activity). Electricity-related emissions are only a sub-set of the public electricity and heat sector comprising emissions from electricity only plants as well as the share of emissions attributable to electricity generation from combined heat and power (CHP) plants. Emissions from (district) heat only plants as well as emissions attributable to heat generation from CHP plants are usually not taken into account when calculating specific emissions from electricity generation.

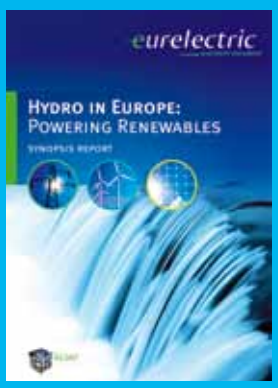
5.3 INVESTING IN RENEWABLE ENERGY SOURCES (RES)

Many European electricity companies are investing heavily in RES projects across the continent to address the EU's 20% RES target for 2020 (*Council of the European Union, European Parliament, 2009b*). Given the current limitations of the other two sectors where increases in renewable energy could be achieved – namely transport and heating/cooling – the electricity sector will have to bear most of the burden. This, together with the EU's ambitious greenhouse gas targets – a 20% reduction by 2020 as compared to 1990 – puts the Electricity Industry under pressure.

In this context, it is important not to neglect the crucial role that hydropower has played in the past, and still has to play in the future. Hydropower is the most significant source of renewable energy in Europe. The storage and pumped storage of water is fundamental in the security of electricity supply. Moreover, this storage and pumped storage system is part of the solution to the variability of RES.

EURELECTRIC PUBLICATION

HYDRO IN EUROPE: POWERING RENEWABLES (A RESAP REPORT)



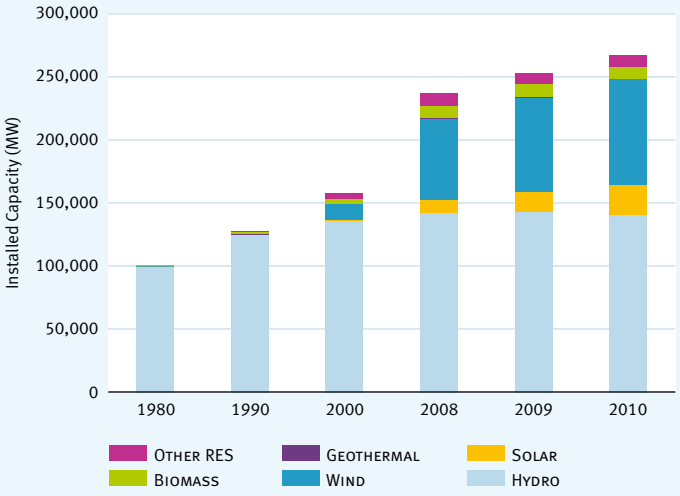
In October 2011, EURELECTRIC published a report showcasing the benefits of hydropower as a major source of renewable electricity. EURELECTRIC experts worked to present the technical hydropower potential still available in Europe. With about 140 GW of installed capacity in 2010, hydropower already accounts for the lion's share of renewable electricity generation in Europe, at 57%. In addition, it offers a host of other benefits such as: improving system stability by ensuring a continuous supply thus facilitating the integration of variable renewables such as wind and solar; balancing power and supply by providing flexibility and storage capacity; contributing to climate change mitigation due to its low carbon footprint and high conversion efficiency. EURELECTRIC expressed its concerns about the consistency across the EU legislative framework, in particular between the objectives of climate mitigation and increase in renewable energy sources, on the one hand, and the implementation of the Water Framework Directive (WFD), on the other hand. The Electricity Industry is particularly concerned by the differences in implementation of the WFD across the EU and urged the European Commission to address this issue and support industry and stakeholders in their efforts to assess and overcome existing trade-offs.

Figures 6 and 7 show total installed capacity and total generated electricity from RES from 1980 to 2010. Both have steadily increased.

Figure 8 shows the share of hydro and other RES out of the total of RES capacity. The increase in RES other than hydro has been spurred mainly by the increase in wind energy capacity. In 2010, approximately 148 TWh of electricity were generated by wind energy, 31% of total RES generation. Biomass and solar energy – both photovoltaic and thermal – complete the vast majority of the observed increase.

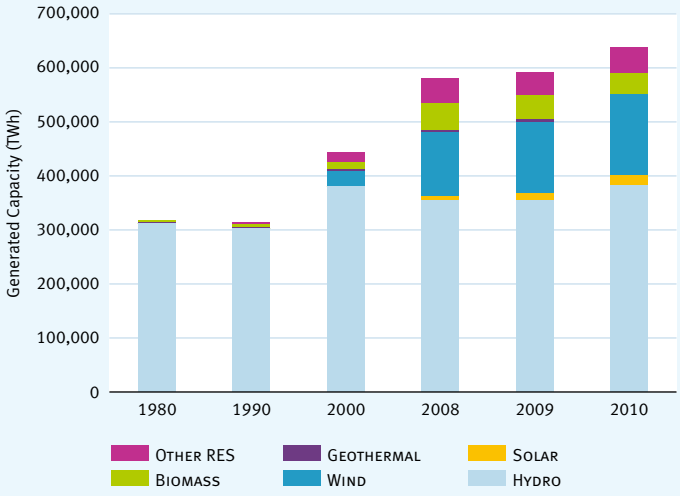
It is also interesting to compare the installed capacity and the electricity generated from RES. As seen in *Figure 8*, despite the increase of installed capacity, the actual electricity generated by wind and solar is still limited because of their variable nature.

Figure 6: Total Installed Generation Capacity from RES



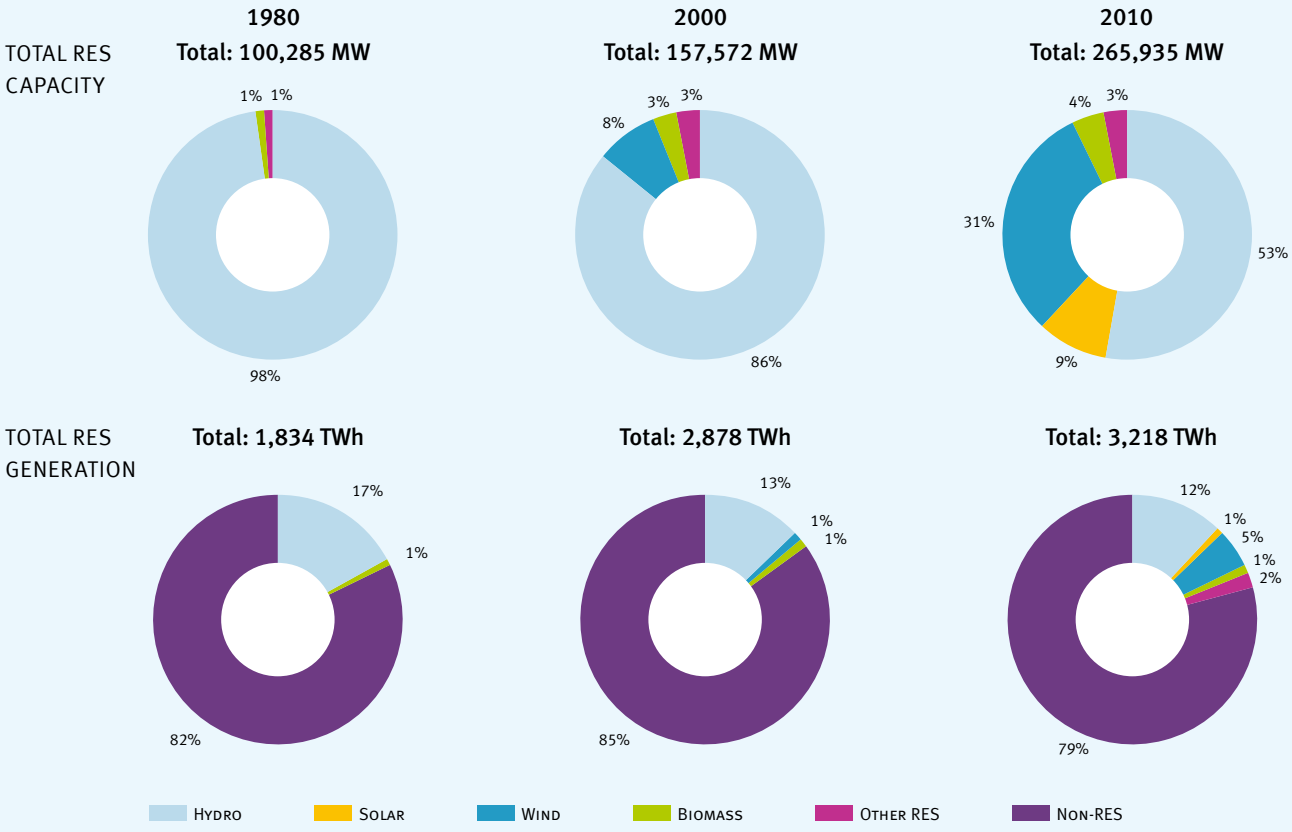
Source: EURELECTRIC

Figure 7: Total Generated Electricity from RES



Source: EURELECTRIC

Figure 8: Evolution of the share of hydro, solar, wind biomass out of total RES generation capacity and comparison with the electricity generated by RES (EU-27)



Source: EURELECTRIC

In 2010, RES other than hydro represented 47% of total RES capacity, compared to 2% in 1980 and 14% in 2000

REN (PORTUGAL)
WAVE ENERGY

On 20 October 2010, REN signed a concession contract for the pilot zone through its ENONDAS subsidiary. ENONDAS has a crucial role in creating conditions for the technological development of renewable energy generation from the sea, maintaining and equipping a space in the Atlantic Ocean dedicated to its early development and to its sustainable exploration in the future. ENONDAS is expected to support commercial exploration so Portugal can assert itself in the sea by becoming one of the leading players in the sustainable development of the sea.

This activity is expected to have a multiplier effect on national development by reviving professions and industries related to the sea. It will stimulate complementary activities like the naval industry, the electric components industry, port activities and mastery and seamanship activities. In a country where the merchant marine has nearly disappeared and where fishing struggles with growing difficulties, we believe that the new opportunities that will arise with offshore energies will contribute to boosting the sector by creating new opportunities for a declining activity.

GDF SUEZ (PORTUGAL)
PORTUGAL AS A LIVING LAB FOR RES PILOT PROJECTS

GDF SUEZ is taking advantage of Portugal's good natural solar and wave resources to test three Renewable Energy Sources (RES) experimental projects through Generg, the 42.5% Portuguese subsidiary of the Group. Generg is a strong reference in the field of renewable energy, currently holding a diversified portfolio of small hydro 33 MW), wind energy (436 MW) and solar PV (18 MW).

In addition to this portfolio, Generg is encouraging and supporting innovative RES projects, namely a wave energy technology prototype (1.2 MW) and two concentrated solar photovoltaic (CPV) pilot projects for a total of 40 kW.

Wave energy project:
the "Standpoint Project"

Officially launched in November 2009, this project comprises a prototype (3 x 400 kW) designed for "deep water" and rough sea conditions. It will be installed in the Portuguese testing zone of Peniche, 100 km north of Lisbon. This project results from a partnership between Generg, Wavebob, GL, HYDAC, Vattenfall and GDF SUEZ which supports the mooring, commissioning and O&M processes.

The global investment is estimated at around €8.1m, with €5.1m being financed by the European Union. It is currently under construction and should start functioning by 2012. Wave energy is a long-time bet of the Portuguese government which has been making efforts to create adequate conditions for private experimental pilots.

CPV technology:
more efficient than conventional PV

"The abundance of renewable energy sources as well as the Group expertise on RES technologies create relevant conditions for the development of solar and wave pilot projects in Portugal," says Antonio Gaivão, CEO GDF SUEZ Energia Portugal. The first concentrated photovoltaic technology (CPV) pilot project of a 6 x 6 kW capacity is fully operational since August 2010 and resulted from a partnership between Generg and Magpower, a Portuguese manufacturer of CPV technology.

More recently, a second CPV prototype (2 x 2 kW) started on the initiative of GDF SUEZ, in partnership with Generg and Heliotrop. It should begin working shortly. The main advantage of this technology is its higher efficiency than conventional PV (27% vs. 14%). Both pilot projects are being tested at Generg's PV power plant of Ferreira do Alentejo, 150 km southeast of Lisbon.

CPV technology in Portugal is still at an early stage of development, currently with 5 MW of total capacity rights assigned and with a national goal of 11 MW in the short term. The existing regulatory framework remunerates a FIT of 380€/MWh, over 12 years, offering very attractive conditions. Along with GDF SUEZ, several other companies have been trying to seize this opportunity.

EURELECTRIC PUBLICATION

BIOMASS 2020: OPPORTUNITIES, CHALLENGES AND SOLUTIONS (A RESAP REPORT)

Biomass is an essential part of the renewable portfolio. Unlike other sources of renewables, it can provide base load power generation, can be utilised in existing thermal plants and plays an even larger role in the heat sector – much of this in combined heat and power. Furthermore, biomass can be used as fuel in the automotive and transport sector. The EURELECTRIC report sets out a vision of the biomass usage in the energy sector in 2020, with the aim of contributing to an understanding of the policy measures needed to achieve the EU's 2020 RES target. Based on the intentions stated in the NREAPs, this report calculates that primary biomass needs for the EU power and heat sector will rise to 160mtoe in 2020 – from around 85mtoe today. Half of this increase will be possible from sources inside the EU, but only by overcoming significant challenges in supply chains, with the agricultural sector foreseen to deliver the greatest increase. The other half will likely need to be imported from outside the EU, strengthening our existing stated case for harmonised biomass sustainability criteria for solid gaseous biomass.

ELECTRABEL GDF SUEZ (BELGIUM)

100% BIOMASS-FIRED RODENHUIZE POWER STATION

Electrabel, GDF SUEZ Group, teamed up with Ackermans & van Haaren in the Max Green joint venture to invest 125 million euros in converting the Rodenhuize coal-fired power station to a full biomass unit with a capacity of 180 MW. The new unit will produce enough green electricity to supply 320,000 households, thereby avoiding CO_2 emissions of 1.2 million tonnes annually. This power plant is a world first in two ways: it's the largest conversion of this kind and it offers the best environmental results among all transformed biomass units, reducing nitrogen oxides and dust emissions by 90%. In future the partners in the venture will study other possibilities for investing jointly in new biomass projects.

Rodenhuize power station now burns wood pellets exclusively. In collaboration with Laborelec, the Flemish and Walloon regulating bodies, Electrabel has developed a monitoring system that guarantees the sustainability of the wood pellets. The system is controlled by an independent body. A third of the pellets comes from the Pacific BioEnergy production site in Prince George (British Columbia, Canada). Electrabel has made a long-term contract with this supplier to buy 225,000 tonnes of biomass per year. The pellets are brought by ship to the port of Ghent.

"This project is unique of its kind, in terms of its size, the technology used and the environmental performance," declared Electrabel CEO Sophie Dutordoir. "It will make a significant contribution towards achieving the 20-20-20 objectives set by the European Union. Furthermore it forms part of Electrabel's strategy of further expanding its diversified generating facilities, and fits in with the ambitious objectives that the company has set itself for renewable energy. The conversion of Rodenhuize to a 100% biomass unit has been achieved in collaboration with Ackermans & van Haaren. In the latter we have found a partner with the long-term vision necessary for this type of project. This conversion confirms our expertise in development, construction and operation of power stations."

TAURON (POLAND)
USE OF BIOMASS IN JAWORZNO III POWER PLANT

According to the Regulation of the Minister of Economy of 19 December 2005 on the detailed scope of duty to obtain and present for remittance certificates of origin and purchase and to purchase electrical energy and heat produced from renewable sources of energy, the Jaworzno III power plant is required to generate part of its electrical energy using renewable fuels. To meet these requirements, the plant started using biomass, first in Power Plant II and then, after installing a system for feeding biomass into the boilers of the 200 MW power units, at Power Plant III. The Jaworzno III power plant uses both forest biomass and agricultural biomass, in the form of wood chips, pellets and saw dust. The maximum biomass consumption capacity of the power plant's systems is 10% of the weight of coal in the case of Power Plant III and 30% of the weight of coal in the case of Power Plant II. The complete system was commissioned at Power Plant III in November 2008.

In 2010, the following three existing systems were upgraded at Power Plant II:

- the mechanical system used for unloading the biomass brought on dump trucks; the biomass from this system is moved to the coal lines supplying the feeders on the back walls of the boilers;
- the pneumatic system used for unloading loose biomass brought in tank trucks; the biomass from this system is dosed into the coal lines supplying the feeders on the front walls of the boilers;
- the system for unloading biomass brought in liquid form; the biomass from this system is dosed into the slime tanks and transported to the slime lances which dose slime into the furnace chambers.

At Power Plant III, biomass constituted 3.1% of all consumed fuel, i.e. 99.4 thousand tonnes. This prevented emissions of about 90.7 thousand tonnes of carbon dioxide.

In 2010, construction of a circulating fluidised-bed boiler started at Power Plant II. The boiler will be fired only with biomass. Its nominal steam output will be 201 tonnes per hour and its fuel consumption rate will be 53t/hour. According to the plans, it will be commissioned in September 2012. The operation of this boiler will allow avoiding emission of 280 thousand tonnes of CO_2, based on the assumed yearly production capacity of the new boiler (starting in 2013) equal to 360,000 MWh of electricity.

5.4 ENERGY EFFICIENCY

In the context of the Europe 2020 Strategy, the EU's Energy Efficiency Plan (*European Commission, 2011b*), launched in March 2011, proposes several measures to improve the use of energy in different sectors, such as buildings, transport, industrial equipment, power and heat generation, and also encourages the public sector and consumers to take actions and empower new technologies (special appliances, smart meters…) in order to optimise their energy consumption.

The electricity sector is promoting energy efficiency in electricity and district heating generation, transmission, distribution and retail.

EURELECTRIC PUBLICATION
"MORE IS LESS"

The Electricity Industry is committed to doing its part in delivering Energy Efficiency. In March 2011, EURELECTRIC therefore published the policy paper "More is Less: the role of electricity in Energy Efficiency", setting out policy recommendations to boost energy efficiency throughout society:

- Need to boost the market for energy efficiency services
- Need to have a more global and technologically open approach to energy efficiency
- Raise awareness among end-users
- SMEs need more reliable technical and financial support
- Foster the role of public authorities in creating demand for efficient products and services

The publication was followed by a survey among 150 electricity companies across Europe, assessing their activities in promoting energy efficiency services, the barriers they faced and the policy measures required to overcome them. The results were first presented at the EU Sustainable Energy Week in April 2011, and later at the Energy Efficiency Global Forum.

INTERNATIONAL POWER PLC. (UNITED KINGDOM)
CONDENSOR / VACUUM SYSTEM DESIGN REVIEW AND MODIFICATION

The steam turbines at Saltend CoGeneration station exhaust into conventional condensers cooled by sea water from the Humber Estuary. These condensers are extremely well sealed and whilst the liquid ring vacuum pumps are adequate for start-up, they are oversized for normal operation, which results in cavitation. This can cause damage to the pumps and associated instrumentation.

The cavitation may be eliminated by opening the vacuum pump inlet body vents. However, this causes an increase in condenser pressure, which then causes a power output reduction in the steam turbine, resulting in a 3MW loss per unit.

In an attempt to find an alternative method to eliminate the cavitation, an interstage relief valve has been installed to allow the controlled admission of air between the two stages of the pumps. If this can be reliably tested to eliminate cavitation whilst maintaining good condenser vacuum, then an appropriately sized vacuum relief valve can be permanently applied to make the pumps run smoothly, preventing the need to replace or de-rate the vacuum pumps.

This can save up to 75,000 MWh per annum by avoiding the lost power output.

In the case of distribution networks, smart grids are very innovative projects. They will provide an intelligent platform for a smooth integration of distributed generation, renewable energy sources, electric cars and plug-in (hybrid) cars into the electricity grids. This would result in a reliable infrastructure for demand side participation by customers and a higher overall system efficiency.

RWE (GERMANY)
"SMART COUNTRY" – INTELLIGENT ELECTRICITY DISTRIBUTION GRID IN RURAL AREA

For the first time in Germany, an intelligent electricity distribution grid has been set up in a rural area: in the middle of Bitburg/Prüm (Eifelkreis), RWE Deutschland and partners from industry (ABB) and science (Technische Universität Dortmund, consentec) have opened a new chapter in the history of power supply.

Under the slogan 'Smart Country', the project's technology offers an intelligent solution to the challenge of making use of solar and wind electricity while guaranteeing high security of supply. Doing so requires combining complex technology with new equipment. Why is this being done in the Eifel? With just over 50 inhabitants per square kilometre, the Eifel model region is sparsely populated. While the distribution grid is tailored to this, it has to cope with a rapid expansion of decentralised generation and shifts in consumption. In short, ideal conditions for a pilot project.

By building an intelligent grid and combining it with modern control technologies, gas storage and a decentralised power plant, Smart Country will demonstrate how to overcome a very important barrier to the often cited 'Energiewende', Germany's – and Europe's – energy revolution. In the project, particular emphasis is placed on the functions of individual components. For example, it makes use of intelligent medium-voltage substations. The distribution system transformers currently in use have an adjustable transmission ratio, but do not allow voltage regulation – these intervention possibilities are necessary in cases of strong fluctuations between decentralised generation and decentralised consumption.

Another project innovation is the first-ever use in Germany of a biogas plant as electricity storage. If decentralised generation assets feed more electricity into the grid than needed at that point in time, the biogas produced is stored in a storage tank and the combined heat and power (CHP) plant does not generate any electricity. If, by contrast, there is not enough renewable energy, we use the stored gas to generate electricity in the CHP plant. Our goal is to gain experience of low pressure storage.

Despite our enthusiasm for the technology, of course we never lose sight of our customers and consumers. It will therefore be the biggest compliment to the project if consumers do not feel the impact of all our test procedures. Because the smartest grid of all has the task of preserving for the future the high quality of supply that Germany enjoys today.

EDP (PORTUGAL)
INOVCITY

Launched in April 2010, the pilot InovCity is a project aimed at providing the electricity grid with smart equipment to boost energy efficiency, micro-generation and electrical mobility, the essential pillars of sustainable development. EDP's goal is for all Portuguese homes to be equipped with smart grid terminals.

With the new efficient terminals, Energy Box (EB), clients will be able to check their consumption pattern and control consumption habits, adapting them to the times of the day or week when the cost of energy is lowest.

This equipment operates remotely, so there is no need for EDP teams to visit or for consumers to be present for

operations such as changes in power capacity, cycles and tariffs.

Smart grids, with a range of equipment installed along the length of their extension, make it possible to control and adapt the grid's distribution capacity to consumption and energy production needs. This instantly controls the state of the entire grid, balances loads and prevents breakdowns before they occur. The grid reacts immediately to the actions of consumers and producers when, for example, they inject energy into the network or request an increase in capacity.

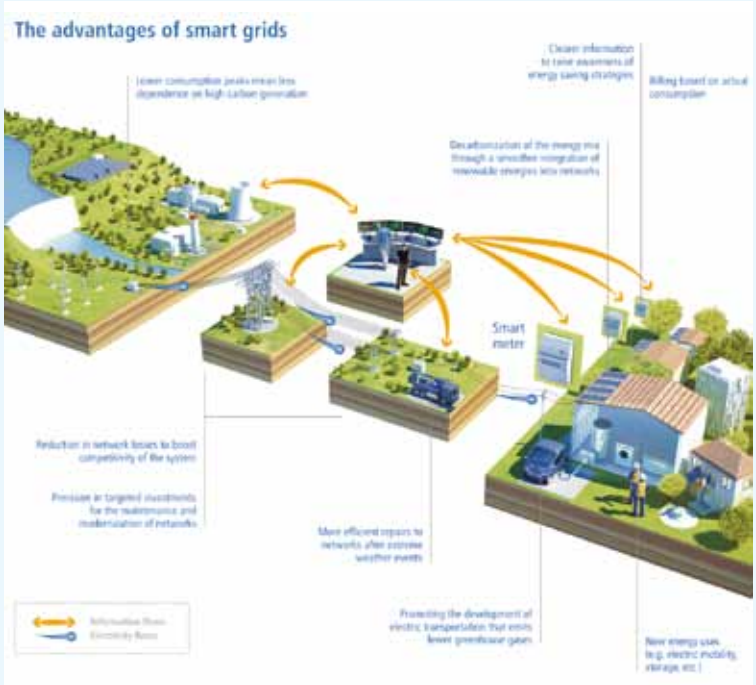
Évora is found to have the ideal characteristics in terms of customer numbers, grid characteristics and socio-economic and demographic indicators for the success of this pilot project. In the first quarter of 2011, the installation of 31,000 EB is expected to be completed, 18,000 of which were already installed at the end of 2010. Apart from Évora, 10,000 EBs are also earmarked for installation elsewhere.

EDF (FRANCE)
EXPERIMENTING WITH SMART MANAGEMENT OF A LOW-VOLTAGE NETWORK

Introduced in the PACA region, Premio is the first smart grid demonstration project on a low-voltage network in France. The objectives are to develop demand management and better integrate intermittent distributed power sources. The project is overseen by the Capenergies competitiveness cluster and co-financed by the region (50%) and EDF (40%). It involves testing technical solutions developed by several local companies and laboratories on about 50 customers (residential, schools, professionals and offices).

Premio uses an innovative control unit, the algorithms for which were developed by EDF R&D. This unit controls a wide range of installations: small generation plants using renewable energy (solar or biogas), heating systems, heat pumps, public lighting and electricity and heat storage solutions.

Premio is evidence of EDF R&D's commitment to developing smart grids. Individual smart meters are essential



components of these grids and must communicate optimally. For the Linky meter, ERDF chose power line communication (PLC) technology. EDF R&D developed a new signal modulation technique called CPL G3 to ensure that an efficient PLC technology supporting current communication standards can be used.

Electricity companies are also working on energy efficiency in buildings, supporting cooling with ground and sea water, solar heating applied for cooling, solar cells for energy, cooling through thermo-active constructions, heating/cooling with heat pumps, etc., as demonstrated by the example below.

GDF SUEZ (BELGIUM)

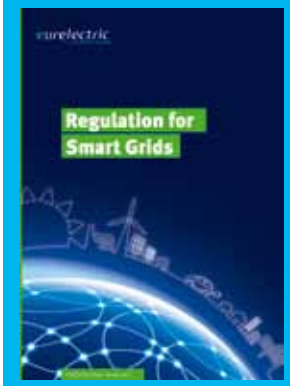
GDF SUEZ TOWER

Located in the business district of Brussels North, close to the main public transport of the Belgian capital, the GDF SUEZ Tower illustrates, by its location, facilities and equipment, the commitments of the GDF SUEZ Group towards the environment and sustainable development. Innovative techniques used in climate engineering, electrical energy, or waste and water management, are implemented by the Group's subsidiaries operating in Belgium to meet international environmental BREEAM[24] certification (level "very good") and High Quality Environmental standard. Developed in two phases, the GDF SUEZ Tower will offer 75,000 m² of office space in 2014, becoming one of the first commercial buildings in Brussels on this scale.

Finally, the involvement of end-users is crucial. Raising customers' awareness, in particular in the domestic sector, plays an important role in realising energy saving potential. Smart meters can for instance substantially empower electricity consumers to become active managers of their consumption, allowing them to better understand their consumption and to adjust their consumption on the basis of this new information. Moreover, new products such as dynamic pricing and demand-side programmes could be developed to help consumers to reduce their electricity consumption. Smart meters can also greatly contribute to a more efficient distribution grid management.

EURELECTRIC PUBLICATION

REGULATION FOR SMART GRIDS (A RESAP REPORT)



In February 2011, EURELECTRIC published a report examining the current regulatory framework across Europe for DSOs. The report argues that smarter distribution grids will be needed to integrate increasing amounts of decentralised generation, electric vehicles and heat pumps into the network and encourage consumers to actively manage their energy demand. A survey conducted among EURELECTRIC members found that: (1) sub-optimal rates of return and regulatory instability are hampering investment in smarter distribution grids; (2) the roll-out of smart meters is being delayed by a lack of clarity regarding the roles and responsibilities of individual market players; (3) regulators are taking a narrow view when evaluating cost efficiency, penalising extra expenditure on R&D or smart grid pilot projects and encouraging business-as-usual expenditure instead.

The report emphasises the need for a balanced regulatory framework that provides long-term incentives for efficient delivery on the one hand, including incentives for innovation, and on the other hand provides the necessary financial resources to allow DSOs to invest in R&D, demonstration and implementation of smart grids.

24 International assessment method for sustainable buildings.

5.5 CARBON CAPTURE AND STORAGE (CCS)

CCS is considered a key technology to prevent the release of large quantities of CO_2 into the atmosphere, from the use of fossil fuel (coal, gas and oil) in power generation and other industries. The technology covers three separate steps:

- collecting or capturing the CO_2 produced at large industrial plants using fossil fuel
- transporting to a suitable storage site, either by pipeline or shipping and
- pumping it deep underground to be securely and permanently stored away.

In 2009, the EU adopted a directive on the geological storage of carbon dioxide (*Council of the European Union, European Parliament, 2009a*). There are some provisions concerning the capture and transport phases of the CCS process, intended to ease the integration of its different steps. However, the directive focuses mainly on the regulation of the storage phase. The European Commission has taken several initiatives to ensure a coherent implementation of the CCS Directive: establishment of an Information Exchange Group to facilitate exchanges between the competent authorities; publication of four guidance documents (CO_2 storage life cycle risk management framework; characterisation of the storage complex, CO_2 stream composition, monitoring and corrective measures; criteria for transfer of responsibility to the member state; and financial security); a reporting questionnaire as required under the Directive; and the adoption of a Commission Opinion on a draft storage permit for the permanent storage of CO_2 offshore on the Dutch continental shelf.

In parallel, the EU launched a number of initiatives to support the development of CCS and the 7th Research Framework Programme focuses on, inter alia, CCS as well as other clean coal projects. In December 2009, the European Commission attributed funding to six CCS projects selected under the European Energy Programme for Recovery (EEPR). The EEPR falls under the European Economic Recovery Plan, a coordinated EU response to the economic crisis which identified the importance of energy for economic recovery. Key results from these projects and other CCS projects will be disseminated through the European Carbon Dioxide Capture and Storage Demonstration Project Network launched in autumn 2009 to support European CCS demonstration projects. Its objective is to improve the coordination between the earliest players involved in such projects. Another specific financing instrument ("NER300") will allocate funding for innovative CCS and renewable energy projects. NER300 refers to the provision in the EU ETS directive to set aside 300 million CO_2 allowances in the New Entrants Reserve of the EU ETS. These allowances will be sold on the carbon market and the money raised will be used for the selected projects.

The Electricity Industry is convinced that CCS should have an important role to play as a low-carbon technology and is closely involved in all appropriate initiatives at the EU level (e.g. Berlin Fossil Fuels Forum, Zero Emissions Platform, etc.). The future of CCS critically depends on the CCS chain being successfully demonstrated and rolled out on a large integrated commercial scale, as well as on the right policy framework and business case being in place.

TAURON (POLAND)
JAWORZNO III POWER PLANT CO_2 CAPTURE

TAURON is working on developing the technology for highly efficient "zero-emission" coal-fired power units integrated with systems to capture carbon dioxide from flue gas. Two projects are being carried out:

- pilot tests of processes of CO_2 capture from flue gas for different classes of sorbents – a mobile CO_2 capture system with appropriate flue gas processing capacity (20-100 NM3/h) will be built. The impact of different operating parameters (i.e. composition of the flue gas, temperature, flow rate) on the efficiency of the CO_2 capture process will be studied, and the impact of the desulphurisation process on the effectiveness of CO_2 removal (stability and durability of the absorbents) will be determined;
- study, research and technology projects concerning the integration of CO_2 capture systems with the coal cycles of power plants and combined heat and power plants.

The results of this work will support efforts to benefit the environment, as defined in the environmental policies.

5.6 E-MOBILITY – MAKING TRANSPORT MORE SUSTAINABLE

The Second Strategic Energy Review (*European Commission, 2008*) published by the European Commission in November 2008 showed that 23% of total CO_2 emissions come from road transport. Reducing vehicle energy intensity and emissions is thus a major challenge. That is why the electricity industry believes that electric and hybrid plug-in vehicles are an essential part of the solution to the twin challenges of reducing carbon emissions and improving energy security. They also improve air quality, particularly in urban areas, and associated health issues.

In October 2009, 49 signatories from European electricity companies, distribution system operators and national electricity sector associations signed the declaration *"Standardisation of Electric Vehicle Charging Infrastructure" (EURELECTRIC, 2009b)* advocating the development of pre-standards for vehicle charging infrastructure. This essential step will hopefully facilitate broad market penetration of electric vehicles and avoid incompatibility between the national infrastructures.

In September 2010, EURELECTRIC's Task Force Electric Vehicles published a paper on market models for the roll-out of electric vehicle public charging infrastructure (*EURELECTRIC, 2010b*). The paper identifies possible market models, taking into account three important roles within the value chain of e-mobility electricity (distribution, operation of infrastructure and retail).

EURELECTRIC is also taking part in the project consortium behind Green E-Motion, a project that aims at developing a European framework for electro-mobility. Starting in March 2011 and stretching over four years, the project will enable participants to share knowledge and experiences of on-going e-mobility demonstration projects. It will contribute to developing a marketplace for electricity vehicles, as well as advancing services, test standards and interoperability, and widening consumer awareness and acceptance.

ILLWERKE VKW (AUSTRIA)
VLOTTE – ELECTROMOBILITY VORARLBERG

In 2008, the Austrian Government's Climate and Energy Fund accepted a tender by the Vorarlberger electricity undertaking Illwerke vkw to fund a model test of electromobility in the Rheintal (a region in Vorarlberg). This project is characterised by a broad and comprehensive concept embracing all interested parties in the field of electromobility.

For 349 Euro per month, VLOTTE customers retain an electric vehicle and an extensive mobility package. Beyond the leasing of the electric vehicle, customers are entitled to freely recharge their vehicle at any public Park&Charge station in Germany, Austria, Switzerland and Liechtenstein. Furthermore, customers receive an annual season ticket for any means of public transport in Vorarlberg and free membership of the Austrian Automobile Club ÖAMTC.

During this project, the energy service provider Illwerke vkw is responsible for the extension of the infrastructure. 89 Park&Charge stations have been constructed to make sure that the eco-friendly vehicles never run out of energy. In addition, illwerke vkw is obliged to provide the amount of electric energy needed for running the vehicles of the project from additional renewable sources. As a consequence, three photovoltaic power plants and one hydropower station were constructed.

Hitherto, 350 electric vehicles are part of the VLOTTE-Project. Customers are widely spread, including private and business customers, institutions and municipalities. The high density of electric vehicles makes VLOTTE one of the biggest electromobility projects in Europe.

Since the start of the project, the vehicles have covered a distance of more than 1.5 million kilometres. This provides concrete evidence that electromobility is suitable for daily use. The project has also saved more than 240 tonnes of CO_2 emissions.

EDF (FRANCE)
ONE HUNDRED RECHARGEABLE HYBRID ELECTRIC VEHICLES

EDF and Toyota are testing approximately 100 rechargeable hybrid vehicles equipped with lithium-ion batteries and using an innovative recharging system. At the same time, Renault-Nissan and EDF have stepped up their cooperation on zero-emission electric vehicles. EDF and Renault signed a contract to develop a recharging system by 2011 ensuring secure data exchanges between recharging stations and electric vehicles. EDF also continues to work with Peugeot Société Anonyme (PSA) and Toyota on rechargeable hybrid vehicles.

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5.7 AIR QUALITY AND EMISSIONS

The main air pollutants emitted into the atmosphere in Europe are sulphur dioxide (SO_2), nitrogen oxides (NO_X), ammonia (NH_3), non-methane volatile organic compounds (NMVOC) and particulate matter (PM). These air pollutants have direct and indirect effects on ecosystems and human health.

Air pollution is a complex issue, as there are interactions and synergies between different pollutants. Some individual pollutants contribute to more than one air pollution problem: SO_2, for example, causes both PM formation and acidification problems, NO_X leads to the formation of NO_2 and ozone and to eutrophication problems.

Together with other industrial sectors, the Electricity Industry contributes to air pollution problems to a varying degree. Acidification of ecosystems and health effects of air pollution are, however, the two main issues. For this reason, the focus here will be on SO_2, NO_X and PM, the most relevant pollutants in these areas.

Sulphur dioxide (SO_2) and nitrogen oxides (NO_x)

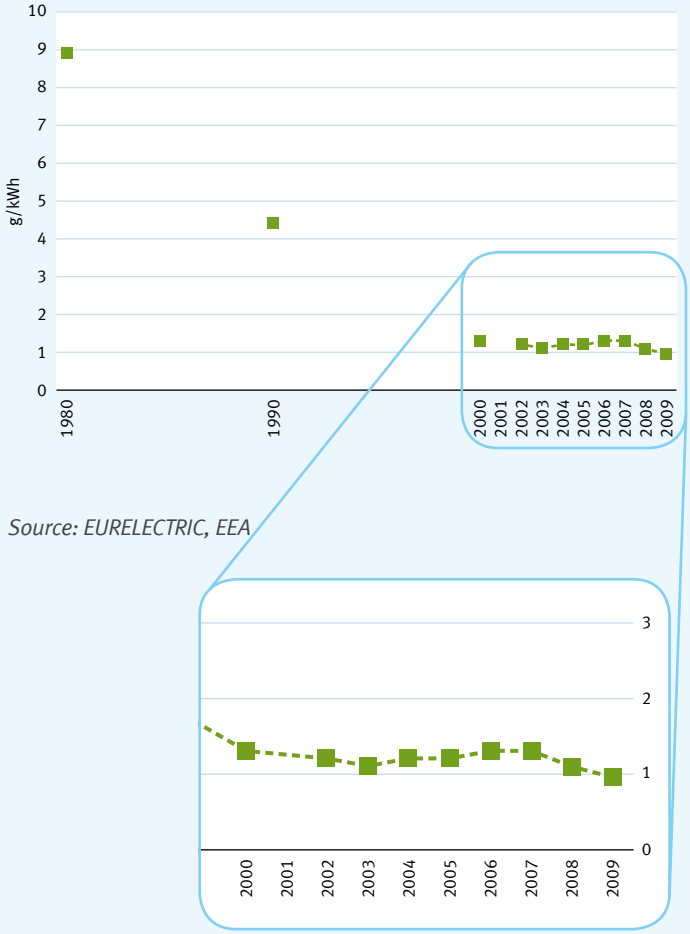
Emissions of acidifying gases have decreased significantly in most EEA-32 countries (EU-27 plus Switzerland, Norway, Liechtenstein, Iceland and Turkey). Between 1990 and 2009, NO_x and SO_2 emissions decreased by 44% and 78% respectively in the EU-27 despite increased economic activity (*EEA, 2011c*).

In the Electricity Industry, the trends are similar. As it was the case with CO_2, the decoupling of electricity production[25] and emissions continues. SO_2 and NO_x specific emissions have been significantly reduced since 1980. While electricity generation increased by 75% between 1980 and 2009 in the EU-27, electricity related SO_2 and NO_x emissions have been reduced respectively by 80% and 57% in the same period (*EURELECTRIC, 2011c – EEA, 2011c*). Figures 9 and 10 display the reductions in SO_2 and NO_x specific emissions of the Electricity Industry during the period 1980-2009. During this period, the Electricity Industry reduced its SO_2 and NO_x specific emissions from 8.9 g/kWh to 0.9 g/kWh and from 2.3 g/kWh to 0.47 g/kWh (*EURELECTRIC, 2011c – EEA, 2011c*).

25 'Public electricity and heat production' corresponds to the combustion of fossil fuels by energy industries to produce electricity or heat that will later be consumed by end users (other industries, households, services, etc.). Public utilities are defined as those undertakings whose primary activity is to supply the public. They may be in public or private ownership. This category includes emissions from own on–site use of fuel but not emissions from auto producers (undertakings which generate electricity/heat wholly or partly for their own use, as an activity which supports their primary activity). Electricity-related emissions are only a sub-set of the public electricity and heat sector comprising emissions from electricity only plants as well as the share of emissions attributable to electricity generation from CHP plants. Emissions from (district) heat only plants as well as emissions attributable to heat generation from CHP plants are usually not taken into account when calculating specific emissions from electricity generation.

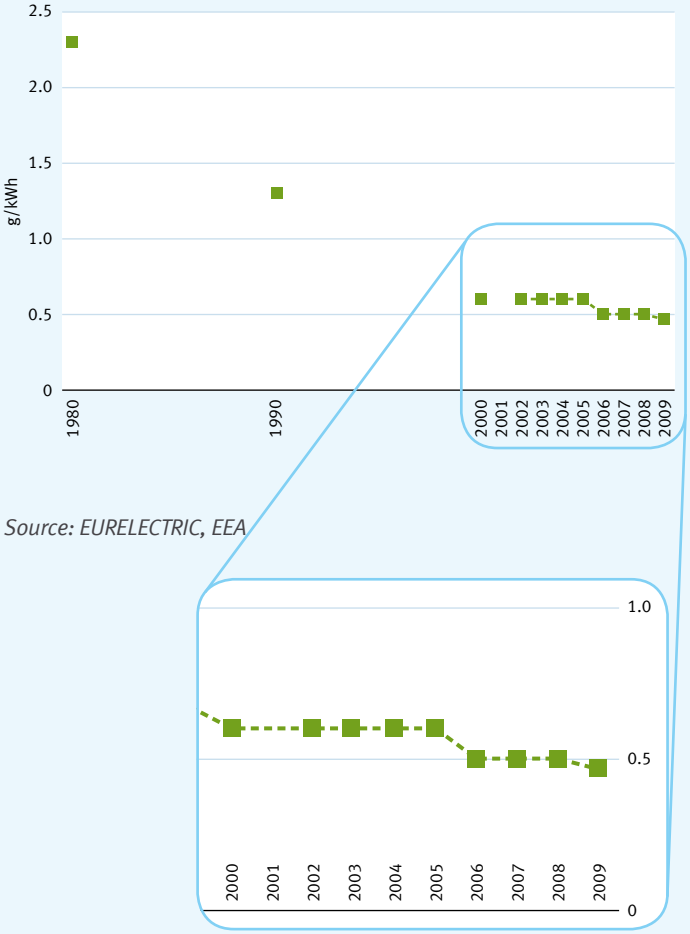
Those drastic reductions are mainly due to abatement techniques, use of low-sulphur fuels and fossil fuel switching. In the recent years decreases have slowed down, as additional reductions prove more difficult. While the impacts of the economic downturn were more pronounced in 2009 and have contributed to reduced emissions, the increased utilisation of fossil fuel plants (e.g.: load variation through the year; support of a greater share of variable RES) may explain this slowdown. However, the implementation of the EU environmental legislation and the move to a decarbonised power sector (see below) should lead to further decline in emissions from the sector.

Figure 9[26]: Specific SO_2 emissions from the European Electricity Industry – EU-27 (1980-2009)



Source: EURELECTRIC, EEA

Figure 10[26]: Specific NO_x emissions from the European Electricity Industry – EU-27 (1980-2009)



Source: EURELECTRIC, EEA

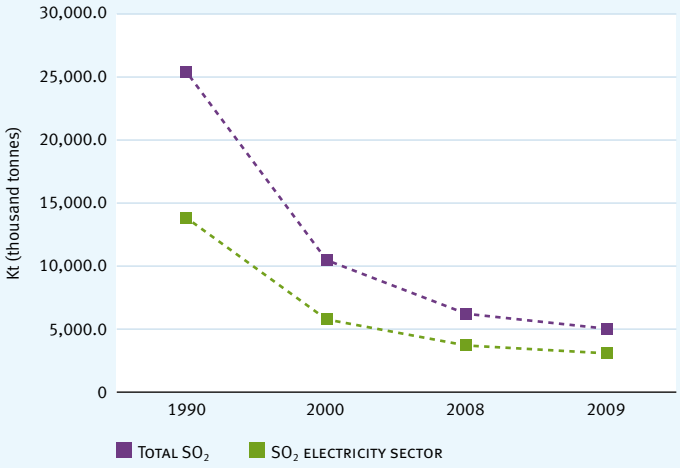
Between 1980 and 2009, the Electricity Industry reduced its SO_2 specific emissions from 8.9 g/kWh to 0.9 g/kWh (EU-27)

Between 1980 and 2009, the Electricity Industry reduced its NO_x specific emissions from 2.3 g/kWh to 0.47 g/kWh (EU-27)

26 In the few cases where yearly national emission data were not available, we used the corresponding data from the EEA for 'public electricity and heat production'. 'Public electricity and heat production' corresponds to the combustion of fossil fuels by energy industries to produce electricity or heat that will later be consumed by end users (other industries, households, services, etc.). Public utilities are defined as those under takings whose primary activity is to supply the public. They may be in public or private ownership. This category includes emissions from own on – site use of fuel but not emissions from auto producers (undertakings which generate electricity/heat wholly or partly for their own use, as an activity which supports their primary activity). Electricity-related emissions are only a sub-set of the public electricity and heat sector comprising emissions from electricity only plants as well as the share of emissions attributable to electricity generation from combined heat and power (CHP) plants. Emissions from (district) heat only plants as well as emissions attributable to heat generation from CHP plants are usually not taken into account when calculating specific emissions from electricity generation.

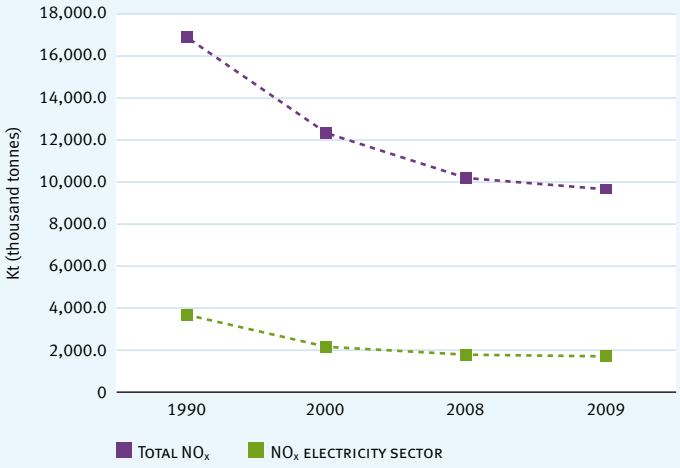
Figures 11 and 12 compare the reductions in SO_2 and NO_x emissions from the Electricity Industry with total EU emissions of these pollutants. Since 1990, the Electricity Industry has made a considerable contribution in reducing emissions of these gases. Electricity-related NOx emissions in 2009 represent about 14% of total EU-27 NO_x emissions. Electricity-related SO_2 emissions represented 59% of total EU-27 emissions in the same year (*EURELECTRIC, 2011c – EEA, 2011c*). This is illustrated in *Figures 13 and 14*, showing of the evolution of SO_2 and NO_x emissions from the Electricity Industry compared to other sectors, between 1990 and 2009.

Figure 11: Total and electricity related SO_2 emissions – EU-27 (1990-2009)



Source: EURELECTRIC, EEA

Figure 12: Total and electricity-related NO_x emissions – EU-27 (1990-2009)



Source: EURELECTRIC, EEA

Figure 13: Share of SO_2 emissions from the Electricity Industry and other sectors EU-27 (1990 and 2009)

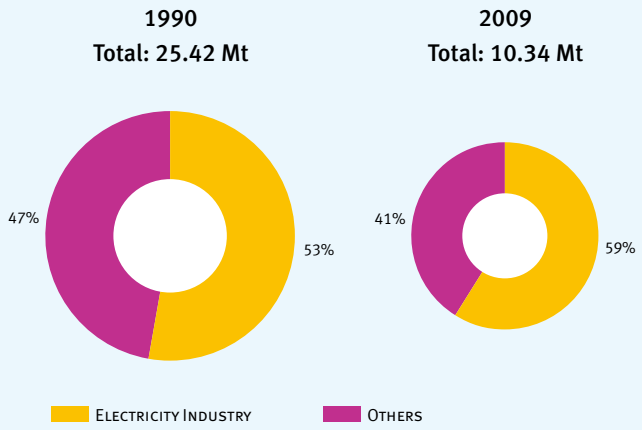
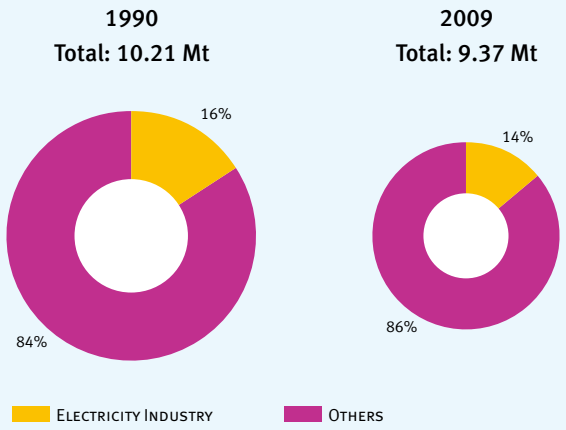


Figure 14: Share of NO_x emissions from the Electricity Industry and other sectors EU-27 (1990 and 2009)



PGE (POLAND)
MODERNISATION OF BELCHATOW POWER PLANT

In order to keep a leading position on the Polish energy market, a comprehensive modernisation of the blocks is being carried out in Bełchatów Power Plant. It is being realized in line with our Strategy for the Development of Power Generation, taking into account optimal exploitation of the company's own lignite resources and while respecting the natural environment.

The comprehensive modernisation of blocks 3 – 12 was planned for 2006-2016. The major objectives of the modernisation are:

- to extend the life of the blocks to 320.000 hours;
- to increase the modernised blocks' generation efficiency by 2-3 percentage points;
- to adapt the blocks to the requirements of the European Union concerning the emission of sulphur compound (SO_2) dust and nitrogen compound (NO_x) pollutants;
- to reduce CO_2 emissions resulting from a more efficient generation process;
- to decrease unit heat consumption;
- to improve exploitation parameters, particularly availability and downtime.

The most crucial operation aimed at improving power generation efficiency involves the modernisation of the turbine set: the high- and medium-pressure modules, where a new and highly efficient blade profile has been constructed.

Simultaneously with the modernisation of the mechanical and furnace parts of the blocks, a comprehensive modernisation of the control and measurement instruments and the automation systems, as well as of the electrical equipment, will be carried out.

The modernisation enables installed capacity increase without higher fuel consumption, and in consequence a decrease of emission factors. There is also a measurable result in NO_x and CO_2 emissions reduction. In particular CO_2 avoided emission will reach the level of 760.000 Mg/a as a consequence of improved efficiency of the generation process.

Modernisation of the boiler furnace systems includes the construction of low-emission burners, which will allow both NO_x and CO_2 emissions to be limited to 200 mg/Nm^3 of combustion gases.

The electrostatic precipitator's modernisation guarantees a level of dust concentration below 50 mg/m^3.

ENEMALTA (MALTA)
144 MW DELIMARA EXTENSION PROJECT

The new plant will improve overall efficiency, reduce the amount of fuel consumed and considerably decrease emissions. This project is moving the Corporation a step closer to the decommissioning of the Marsa Power Station which has now aged considerably. Furthermore this project will help Enemalta conform to the obligations set by the environmental directives which limit the emissions of certain pollutants into the air. The plant is a combined cycle diesel engine configuration. The prime movers of the plant consist of eight Wartsila 18V46 medium speed diesel engines operating at 500RPM. The 18V46 engine is an 18 cylinder four stroke diesel engine and is capable of operating on both heavy fuel oil and gasoil. Each engine is connected to a generator and each generator produces 17.1 MW of electricity.

Since fuel combustion produces various pollutants, in order to achieve the emission limit targets, emission abatement equipment is installed downstream of the diesel engine. A selective catalytic reducer (de-NO_x plant) to reduce nitrogen oxides is installed after each engine and a common flue gas desulfurisation unit (de-SO_x plant) and bag filters to reduce both sulphur oxides and dust will be installed after each pair of these engines. Reagents are required to be injected into the abatement equipment in order to function properly. Urea for the de-NO_x plant and sodium bicarbonate will be injected into the de-SO_x plant. While the reaction in the de-NO_x plant produces nitrogen and water, the de-SO_x plant will produce a solid greyish powdery by-product which is to be exported for treatment or dumping. Since the plant consists of a number of small units, part

load efficiency is very close to the full load figure, since operation at part load is achieved by shutting down some units, leaving the remaining units to operate at full load. The plant is also designed to operate in either base load mode or in a daily two shifting mode following load demand requirements.

The installation of this plant will result in an increase of the general efficiency of generation as well as in the corresponding reduction of CO_2 emissions.

Particulate Matter (PM)

PM is the term used for a broad class of discrete particles (liquid droplets or solids) that are suspended in the air and represent a complex mixture of organic and inorganic substances. PM can have a wide range of sizes: PM10, for instance, describes all particulate matter with a diameter of 10 microns or less. PM2.5, similarly, refers to those particles whose diameter is 2.5 microns or less. The size of the particles also determines the time they spend in the atmosphere. While sedimentation and precipitation removes PM10 from the atmosphere within a few hours of emission, PM2.5 may remain there for days or even a few weeks. PM has effects on human health, as it can reach the respiratory system and cause disease. PM2.5 is the most dangerous, as the particles are thinner and enter more easily into the respiratory tracts and lungs. PM is either emitted directly or formed in the atmosphere from precursors such as SO_x and NO_x.

Total EU-27 emissions of PM10 fell by 14% between 2000 and 2009 (*EEA, 2009c*). Total EU-27 emissions of PM2.5 fell by 20% (*EEA, 2011c*). In the electricity sector, these reductions have been enabled by the use of fuels with lower sulphur content (sulphur contributes significantly to PM emissions), by fuel switching from coal and oil to natural gas and renewables, by new built of power plants, and by deployment of ever more efficient (secondary) abatement techniques (such as electrostatic precipitators or fabric filters). The public electricity and the heat production emitted 4% of total EU-27 PM10 emissions in 2009 (*EEA, 2011c*).

Recast of the Integrated Pollution Prevention and Control (IPPC) Directive / Industrial Emissions Directive (IED)

Published in November 2010, the IED (*Council of the European Union, European Parliament, 2010*) is designed to amend the Integrated Pollution Prevention and Control (IPPC) Directive (*Council of the European Union, European Parliament, 2008a*) and to integrate six sectoral directives, including those governing large combustion plants (*Council of the European Union, European Parliament, 2001a*) and waste incineration. The IPPC approach is based on the integrated approach according to which the operating permits for industrial installations must take into account the whole environmental performance of the plant, covering *inter alia* emissions to air, water and soil, generation of waste, use of raw materials, energy efficiency, noise, prevention of accidents, and remediation after closure. The permit conditions must be based on best available techniques (BAT) and include emission limit values. BAT conclusions (documents containing information on the emission levels associated with the best available techniques) should be the reference for setting permit conditions.

The IED allows the competent authorities to set less strict emission limit values in specific cases, when an assessment shows that the achievement of emission levels associated with BAT as described in the BAT conclusions would lead to disproportionately higher costs compared to the environmental benefits due to geographical location or the local environmental conditions or the technical characteristics of the installation. As far as large combustion plants from the electricity industry are concerned, a specific chapter in the IED includes certain flexibility clauses (Transitional National Plan, limited lifetime derogation, etc.) that should ease the transition to a low-carbon economy.

The IED will replace the Large Combustion Plants Directive (*Council of the European Union, European Parliament, 2001a*) for new plants, as of 7 January 2013, and for existing plants, as of 1 January 2016.

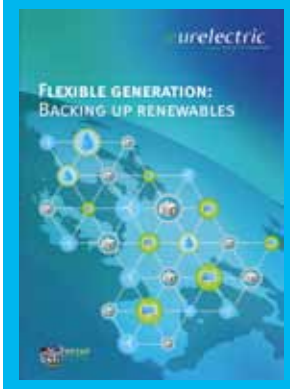
BREF on large combustion plants

To assist the licensing authorities and companies in determining BAT, the Commission organises an information exchange between national experts, industry and environmental organisations, co-ordinated by the European IPPC Bureau of the Institute for Prospective Technology Studies (IPTS) at the EU Joint Research Centre (JRC) in Seville (Spain). This results in the adoption and publication by the Commission of the BAT conclusions and BAT reference documents (the so-called BREFs, *Best Available Techniques Reference Documents*).

In February 2011, the European Commission launched the revision of the BREF on large combustion plants, in a process expected to last until 2013-2014. The role of BREFs has been considerably strengthened by the IED: they are now the main reference documents used by national authorities when issuing operating permits for industrial installations. A group of power industry experts from EURELECTRIC and power plant association VGB Powertech has been preparing the power sector's contribution and will be strongly involved in the revision process. For the Electricity Industry, it is crucial that this updated BREF properly represents best available techniques and associated emission levels in the electricity sector to reflect the changes associated with the objectives of decarbonisation and most notably the increasing share of variable renewable energy sources.

EURELECTRIC PUBLICATION

FLEXIBLE GENERATION: BACKING UP RENEWABLES (A RESAP REPORT)



As part of its RESAP, whose results were released in November 2011, EURELECTRIC experts addressed the future role of flexible generation in backing up the RES take-off. Supporting a greater share of variable RES requires a major adaptation across the entire energy system, with flexible and back-up generation needed to make up for wind and solar power when these sources cannot deliver. The resulting report shows that different power generation technologies have different degrees of technical flexibility, with hydropower being the most responsive to variable RES swings, followed by natural gas-fired plants and coal plants. Nuclear plants are also technically capable of having dispatched flexibility. In addition to technical flexibility, commercial and environmental considerations must be taken into consideration to determine the plant's degree of responsiveness. One of the issues arising from increased variable RES generation is the existence of trade-offs associated with the use of conventional plants to back up variable RES. When the wind is not blowing or the sun is not shining, gas-, coal-, and oil-fired plants are dispatched (alongside other renewables and nuclear) to supply the needed electricity and to maintain the safety requirements of the electrical grids. This releases both carbon dioxide and atmospheric pollutants such as NO_x, SO_2 and dust which would not be emitted by RES plants if they had operated. In this regard, the effect of part loading (i.e. the operation of a power plant at a level lower than its maximum technical capability) on the efficiency and hence emissions of conventional thermal power plants is often neglected. The relationship between the efficiency of power plants and the related emissions needs careful consideration and clarification.

Review of the EU Air Policy

In June 2011, the European Commission organised the first meeting of its newly established Stakeholder Expert Group to oversee the review of the EU's air policy. This review process will culminate in 2013, DG Environment's proclaimed Air Quality Year. EURELECTRIC is represented in the expert group which brings together a wide range of stakeholders, including member states, NGOs, international organisations, third countries, and other EU institutions and Commission services.

Some legislative reviews are already expected in 2013, in particular of the ambient air quality and cleaner air for Europe directive (*Council of the European Union, European Parliament, 2008b*) and of the NECD (*Council of the European Union, European Parliament, 2001b*), although the latter has been postponed since 2008. The current NECD established emissions ceilings for 2010 and a review is expected to set ceilings for 2020 – or even 2025 or 2030 given the adoption timeline now foreseen.

Before addressing the review of the NECD, the EU is deeply involved in the revision of the Gothenburg Protocol with a view to broadening the participation to countries of Eastern Europe, the Caucasus and Central Asia. The revised Protocol is expected to be signed by the end of 2012. It would establish 2020 ceilings for sulphur dioxide (SO_2), nitrogen oxides (NO_x), volatile organic compounds and ammonia and introduce a ceiling for PM 2.5.

The EU's focus on streamlining and reviewing its air quality policy goes back to 2001 when the European Commission launched its Clean Air for Europe (CAFE) programme with the objective of integrating all EU air quality policies. As a stakeholder, EURELECTRIC was deeply involved in this programme which led to the adoption in 2005 of the Thematic Strategy on Air Pollution (TSAP), the first in a series of "thematic strategies" under the EU's Sixth Environmental Action Programme. A public consultation took place over the summer of 2011.

The EU electricity generation sector has reduced its emissions of air pollutants significantly over the last 20 years. As a consequence of the move to a decarbonised electricity sector it is expected that future emissions from the sector will continue to decline. A recent EURELECTRIC study (*EURELECTRIC, 2009c*) has estimated that power plant emissions of SO_2 will fall by a further 90% between 2000 and 2050, and NO_x by a further 62% over the same period.

As a consequence, the challenging issue for air quality policy has become to improve urban air quality, principally driven by the emissions of transport, and household emissions and trade/commerce/services. It is recognised that the full benefits of the decarbonisation of electricity supply for society will only be realised with electrification of transport and domestic heating. This electrification process will clearly by itself contribute to the improvement of urban air quality.

For these reasons it is vital that developments in EU air quality policy are assessed in a framework which is consistent with EU energy, climate, resource-efficiency and transport policy developments, and that they work with, and not against, the process of moving to a low-carbon electricity sector.

5.8 RESIDUES FROM ELECTRICITY GENERATION – ENVIRONMENTAL BENEFITS AND APPLICATIONS

Coal combustion products (CCPs) are produced in coal-fired power stations which burn finely ground coal in a fully controlled process. Coal contains several mineral components that, depending on the combustion and capture techniques utilised, can be removed and re-used in other applications, notably in building construction and civil engineering. The main CCPs from coal combustion are: fly ash, bottom ash, boiler slag from fluidised bed combustion ash, and, where abatement equipment is fitted, as a result of dry or wet flue gas desulphurisation, semi-dry absorption product and flue gas desulphurisation gypsum.

In the majority of cases, CCPs are used as a replacement for naturally occurring resources, thereby removing the need to quarry or mine these resources. CCPs also avoid the energy demand and emissions to the atmosphere associated with the manufacturing process of the replaced products.

CCPs are widely used in the building and construction industry, including as an cement-replacing addition in concrete and as an aggregate or binder in road construction. They can also be used as mineral fillers and as fertilisers.

In 2009, approximately 52kt of CCPs were produced in the EU-15 (all sectors), of which approximately 27kt were re-used in the manufacturing of cement, concrete, bricks and other construction materials (*ECOBA, 2011*). Fly ash represented the greatest share of total CCP production, with 34kt produced in 2009 in the EU-15 (*ECOBA, 2012*). Within the EU-15, the utilisation of fly ash in the construction industry is currently around 44%, around 45% for bottom ash and 88% for boiler slag (*ECOBA, 2012*).

Fly Ash

Fly ash is the most abundant CCP in Europe. It is obtained by electrostatic or mechanical precipitation of dust-like particles from the flue gases of furnaces fired with coal or lignite at 1,100 to 1,400°C. Fly ash is a fine powder which is mainly composed of spherical glassy particles.

Fly ash has some unique properties useful to a wide range of industries such as civil engineering and building construction. When fly ash is used as a concrete addition, it reacts with calcium hydroxide from cement hydration and forms stable hydrates of calcium silicate and calcium aluminate. The resulting concrete is not only stronger and more durable, but also less permeable. Recent projects to rely on fly ash concrete include dams, power stations, offshore platforms, highways, airports, commercial and residential buildings, bridges, pipelines, silos and the Channel Tunnel linking France and the UK.

Figure 15 shows the final use of fly ash in the period 2000-2009 in the EU-15.

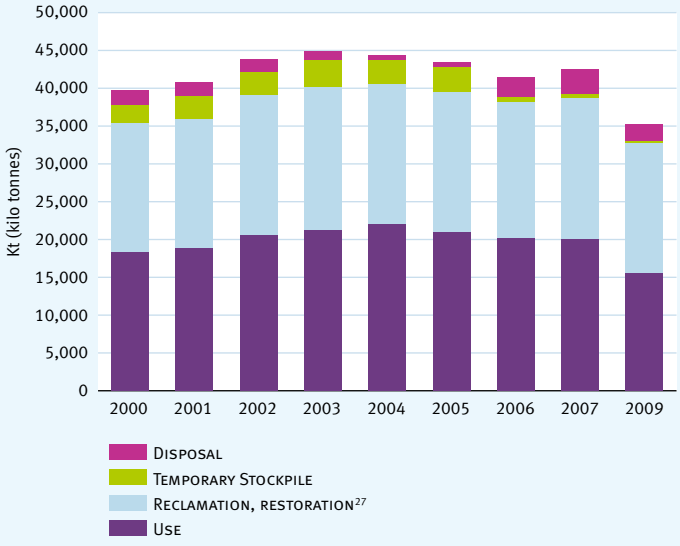
Biomass ash

Biomass is an essential part of the renewable portfolio. Primary demand for biomass for every production will increase by 2 - 5 times from current levels by 2020.

Experiences in type and amount of solid biomass pure combustion or co-combustion vary across Europe. In some countries, pure biomass combustion is increasing and could become the sole process.

The biomass is combusted in pulverised, circulating fluidized bed (CFB) boilers (all subtypes), bubbling fluidized bed (BFB) boilers as well as in grate-firing boilers but the quality of ashes varies and can't be compared to the composition and well known ranges of coal ashes. In some regions of Europe the use of biomass ash as fertilizer is common as the biomass used is local wood but acceptance of imported biomass could be an issue. The Electricity Industry is committed to working further on biomass ash and to sharing experience in different countries.

Figure 15: Final Use of Fly Ash – EU-15 (2000-2009)



Source: ECOBA

27 Reclamation and/or restoration of open cast mining.

Flue gas desulphurisation (FGD) gypsum

FGD gypsum is a natural gypsum-like product, which is obtained by wet desulphurisation of flue gas and special treatment of the absorbed products. It is the second most abundant CCP. Within the EU-15 in 2009, 11kt of FGD gypsum were produced, with a utilisation of currently around 76% (*ECOBA, 2012*). *Figure 16* below shows the final use of GDP gypsum:

The Waste Framework Directive

The Waste Framework Directive (*Council of the European Union, European Parliament, 2008d*) provides a general framework for the management of waste across the EU. It incorporates into a single instrument provisions on hazardous waste and waste oils and includes two new recycling and recovery targets to be achieved by 2020: 50% preparing for re-use and recycling of certain waste materials from households and other origins similar to households, and 70% preparing for re-use, recycling and other recovery of construction and demolition waste.

The directive lays down some basic waste management principles. Waste should be managed without endangering human health and harming the environment, without causing a nuisance, and without adversely affecting the countryside or places of special interest. Waste legislation and policy of EU member states should be based on a waste management hierarchy: prevention, re-use, recycling, recovery and disposal. The directive introduces the "polluter pays principle" and the "extended producer responsibility", which makes manufacturers, importers and retailers accountable for their products and packaging throughout their lives. It also defines when waste ceases to be waste and becomes a secondary raw material (so called end-of-waste criteria), and how to distinguish between waste and by-products.

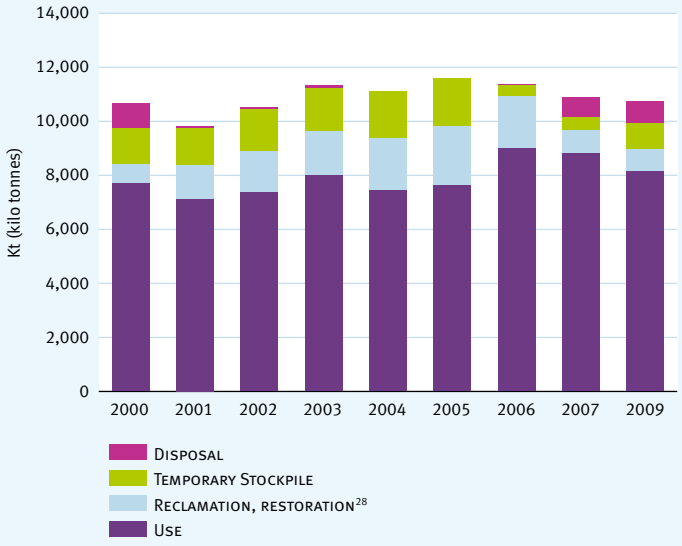
The European Electricity Industry considers that CCPs used directly from the power station or after short periods of suitable storage are not 'waste' as defined in the Waste Framework Directive. Such use of CCPs is consistent with the aims of the directive and, in particular, with the waste hierarchy set out in Article 4, which puts waste prevention above options such as re-use, recycling and recovery. In each case where they are utilised, their further use is certain, they are suitable for use in their existing form and without undergoing any further processing other than normal industrial practice, and their use meets all of the relevant product, environmental and health standards applicable to that use. Therefore, CCPs going directly from the power station that produced them or from an associated production process to an end-user in a form which is suitable for immediate use are excellent examples of by-products as defined in Article 5 of the Directive.

Power plant by-products such as FGD gypsum, fly ash and boiler slag which are placed on the market are covered by REACH (*Council of the European Union, European Parliament, 2006b*). REACH gives greater responsibility to industry to manage the risks from chemicals and to provide safety information on the substances. Manufacturers and importers are required to gather information on the properties of their produced substances and to register the information in a central database run by the European Chemicals Agency.

Annex III of the Waste Framework Directive features a list of properties that can make waste hazardous, and Decision 2000/532/EC therefore establishes a list of wastes and a classification system for wastes, including a distinction between hazardous and non-hazardous wastes.

As part of the on-going review of the list of wastes, several proposals have been made to more closely align these definitions of hazardous wastes with those appearing in other EU legislation. This process might then result in a review of the hazard statements and concentration limits relating to the hazardous properties defined in Annex III to the Waste Framework Directive. EURELECTRIC is particularly concerned that the current classification of ashes from combustion fuels should not be impacted by the review, as there is

Figure 16: Final Use of FGD Gypsum - EU-15 (2000-2009)



Source: ECOBA

28 Reclamation and/or restoration of open cast mining.

a risk that such waste could be classified as hazardous due to its calcium oxide (CaO)/calcium hydroxide $Ca(OH)_2$ content (calcium oxide is also known as quicklime and calcium hydroxide as hydrated lime).

For many years EURELECTRIC has put a lot of effort into ensuring that coal fly ash and other combustion products are appropriately labelled and classified under various EU decisions and directives. Combustion products are put to a variety of uses across Europe and in many cases are a more than adequate replacement for primary aggregate. EURELECTRIC and its members have also assessed coal ash during the recent preparation of the REACH registration documents and concluded that it was a non-hazardous material for classification and labelling purposes. Any reclassification of some or all coal fly ashes as hazardous in the list of wastes would prevent established users of the materials from using them beneficially. As a result, there would be a greater use of primary materials, which goes against the positive steps taken by the Commission and many member states to encourage the use of by-products and wastes, in line with the objectives of the Roadmap to a Resource Efficient Europe. There would also be an increase in the amount of coal fly ash sent to landfill.

TAURON (POLAND)
WASTE FROM THE ENERGY GENERATION PROCESS

1994 was the year of the final commissioning at the Jaworzno III Power Plant and the Jaworzno II Power Plant of the system for the pneumatic transport of ashes from the electrostatic precipitators with a tank truck loading functionality. The systems made it possible to abandon transport of ashes in hydrated form to the 'wet' landfill in Mysłowice-Dziec´kowice. At the same time, the ash and slag previously deposited at the landfill were removed. The entire ash and slag produced at the power plant is now used commercially, among other things by depositing it in underground mine headings.

This has also made it possible to implement the next step of the environmental programme, the rehabilitation of section 2 of the landfill. In order to achieve the best results, the surface of the ashes was covered with a 30cm thick layer of waste rock which dramatically reduced the hazard of secondary dusting from the landfill. On

this surface, a 10cm thick layer of topsoil was distributed. This has made the surface of the landfill more porous, which enabled access of oxygen and conservation of mineral fertilizers and moisture. The surface was then covered with vegetation by hydroseeding, using sewer sludge from a wastewater treatment plant. The works in the entire second section of the landfill, with a surface area of 64.5ha, were completed in 1995. In 2006, the Jaworzno III Power Plant obtained the CE certificate of conformance with the PN-EN 450-1 standard for fly ash to be used in the production of concrete. Fly ash meeting the requirements of this standard can be used in the construction sector as a material for the production of concrete. In order to meet all the requirements of the standard, a Fly Ash Production Quality System was elaborated and implemented at the Jaworzno III Power Plant. Due to the need to ensure continuous sales of fly ash, in October 2009, the power plant obtained the CE certificate of compliance for fly ash for concrete, taking into account the co-firing of biomass.

Another project implemented at the power plant was the construction of a slag sediment trap located at the plant. The upgrade of the current slag removal system increased the effectiveness of slag recovery and the clarified water is returned to the water circuit. The recovered slag is used for commercial purposes. The new system was commissioned in November 2008.

5.9 SUSTAINABLE WATER MANAGEMENT

The WFD (*Council of the European Union, European Parliament, 2000*) establishes a legal framework to protect and restore clean water across Europe and ensure its long-term, sustainable use. The directive establishes an approach for water management based on river basins, the natural geographical and hydrological units, crossing regional and national boundaries. It sets specific deadlines for member states to protect aquatic ecosystems. The directive addresses inland surface waters, transitional waters, coastal waters and groundwater. It allows for public participation in planning and foresees the use of economic approaches, including the recovery of the cost of water services.

The WFD also provides a framework for integrating a number of other thematic pieces of water legislation and relevant measures taken to protect water, for instance

under nature conservation legislation. Coordination is also required between the WFD, the implementation of the Floods Directive (*Council of the European Union, European Parliament, 2007*), and the MSFD (*Council of the European Union, European Parliament, 2008c*).

The default objective for all waters should be Good Ecological Status (GES) by 2015. The definition of ecological status is based on the quality and quantity of aquatic flora and fish, which vary across the EU. Quality elements such as the availability of nutrients, salinity, temperature and chemical pollution have to be monitored while morphological elements such as water flow or structure of river beds are also part of what is used to define ecological status. The WFD sets a less ambitious objective, Good Ecological Potential (GEP), for artificial and "heavily modified" bodies of water such as canals and reservoirs, or industrial ports. Member states can apply exemptions from the objective of reaching GES for a number of reasons: delay achievement of the objectives to 2021, or at the latest 2027, because of technical infeasibility, disproportionate costs or natural conditions that make achievement by 2015 impossible; lower objectives if the water body is so affected by human activity, or because of its natural condition, that achieving the objectives would be unfeasible or disproportionately expensive; temporary derogation because of unforeseen or exceptional events such as floods or droughts; new modification to water bodies if there is an overriding public interest and provided that all measures are taken to mitigate adverse effects.

Initially, the WFD was conceived as giving a prominent role to economic approaches in its implementation in order to identify the measures that could reach the WFD objectives at lowest costs and to assess whether the costs of measures may be considered disproportionate. Member states also have to ensure that cost recovery for water services is achieved, including the environmental and resource costs of water services. EURELECTRIC shares the concerns that national implementation has neglected socio-economic assessments, cost-benefit analysis of proposed measures and a broader consideration of various water use and water services.

VERBUND (AUSTRIA)
EU-LIFE+ PROJECT TRAISEN

Hydro power plant (HPP) Altenwörth on the river Danube in Lower Austria, the biggest run-of-river HPP in Austria, was erected in 1976. As a consequence of this project the estuary of the river Traisen in Lower Austria, a tributary to the river Danube, had to be moved downstream of the new hydro power plant. A new linear channel structure through the existing riparian zone of approximately 7.5 km length was constructed. This regulated channel structure reduced the risk of floods but deteriorated the dotation of the riparian forest and the habitat situation for fish.

To improve this ecologically insufficient situation VERBUND Hydro Power AG developed together with the regional government of Lower Austria and other partners a project for renaturation of the river Traisen channel structure. The project idea started in 2009. It includes the complete new construction of a meandering river structure of approximately 12.5 km length within the existing riparian forest. Existing small streams and oxbow lakes will be connected with the new river bed. The new river bed will have free space to develop own structures depending on the discharge of the river Traisen. The fish population will get new migration possibilities between the river Danube and the Traisen for the first time in 35 years. An area of about 820,000 m² will be flooded regularly creating new natural habitats in the riparian forest.

LIFE+ Traisen is co-financed by the European LIFE+ programme. The duration of the project is six years. The environmental impact assessment is nearly finished and the operation is expected to start in early 2012. Costs will be approximately 12.8 million Euro. Honouring VERBUND Hydro Power AG's efforts to improve the ecological condition along our rivers, the LIFE+ Project Traisen has been awarded the main prize of the "Neptun Water Award 2011".

ENEL (BULGARIA)
MARITZA EAST POWER PLANT

In order to meet its commitment with local authorities around the Maritza East power plant, Enel has cleaned the Sokolitsa river bed, removing the sediment deposited and the plants grown in the area close to the Obruchishte village (municipality of Galabovo).

The lake Rozov Kladenetz and the Sokolitza river area (1,265 ha) surrounding the plant, as well as their habitats, fauna (especially avian) and flora are also designated as protected. Talks are being held with local authorities to develop a conservation scheme, which is likely to put emphasis on water management and greater reuse of liquid releases. Particular attention is paid to water consumption (efficient water management system) and to water releases (chemical, physical and biological treatments) with a view to mitigating their impacts on the lacustrine ecosystem.

Finally, under a restoration project authorised by local authorities, Enel completed the replanting of the asbestos landfill (sealing, revegetation and seeding of autochthonous herbaceous species). A belt of 10,000 trees was planted around the second ash settling tank.

EURELECTRIC PARTICIPATES IN THE 6TH WORLD WATER FORUM
SUSTAINABLE HYDROPOWER

The World Water Forum is the world's largest meeting on water issues. It has been organised every three years since 1997, when it was launched by the World Water Council, an international multi-stakeholder platform established in 1996 by water experts and international organisations to counter growing concerns on water issues in the global community.

At the sixth World Water Forum in Marseille, France, on 12-17 March 2012, delegates from around the globe met to discuss the many challenges associated with international water issues – including the links between water and energy. A EURELECTRIC session, chaired by Secretary General Hans ten Berge, highlighted the sustainable hydropower challenge. After presentations by EURELECTRIC's WG Hydro chair Karin Seelos (Statkraft) and by Elena Bizina (RusHYDRO), further panel discussions took place with Peter Gammeltoft (European Commission), Sergiy Moroz (WWF), Xavier Ursat (EDF-France) and members of the audience.

Panellists agreed on a dialogue based on mutual respect and recognition of the problems in integrating RES objectives and ecological considerations. The power sector was keen to stress that hydropower must be considered on a par with other RES options. The remaining hydropower potential in the EU may be limited compared to other areas in the world, but it still has a particular role to play in supporting variable RES and grid balancing.

Panellists also agreed that environmental economics need to be improved in the implementation of the Water Framework Directive, and that strategic pre-planning is particularly important. Hydromorphological aspects are crucial for hydropower and further R&D needs to be carried out, although solutions are necessarily site-specific. Further work is also needed to assess the role of hydropower in climate change adaptation, as the impact of climate change on water flow will vary from one country to another.

The interconnection between water and energy was also emphasised in the ministerial declaration adopted on 13 March. Ministers and Heads of Delegations stressed the need to "address water and energy policies coherently and in harmony with natural water cycles to foster the sustainable and efficient use of water." They also "acknowledged hydro-power, consistent with sustainable development principles, as a viable renewable source of energy for many urban and rural areas and promote the production of 'more energy per drop'. Investment in sustainable multipurpose water storage, the utilization of wastewater as a source of renewable energy as well as the use of renewable energy, such as solar and wind, in water supply and sanitation, need to be promoted."

http://www.worldwaterforum6.org/en/

6 SPECIAL FEATURE: BIODIVERSITY

TOWARD A BETTER INTEGRATION OF BIODIVERSITY ISSUES IN ECONOMIC SECTORS

The Convention on Biological Diversity (CBD) (*UNEP, 1992*) defines biological diversity as *"the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems."* Biodiversity is essential for life on Earth as it it the basis for resilient ecosystems. Ecosystems are essential for clean air and water, resilient soil and regulated climate. They provide raw materials, resources and food. They are essential to the development of our societies. Human activities such as road construction, urban development, intensive agriculture and industrial activities have an impact on this fragile balance. Because life depends on biodiversity, the preservation of the ecosystem must be integrated into all human activities. The CBD sets the framework for global actions. Following this UN Convention, EU governments adopted the Habitats Directive (*Council of the European Union, 1992*) to protect the most threatened habitats and species across Europe, as a complement to the Birds Directive adopted in 1979 (Council of the European Union, European Parliament, *2009d*). A vast network of protected areas, currently covering 26,000 sites, was created in 1992 under the *Natura 2000* programme, in order to meet the requirements of these two directives.

In June 2001, the EU Heads of State and Government agreed to halt the decline of biodiversity in the EU by 2010 and to restore habitats and natural systems. One year later, the parties to the CDB also agreed to achieve a significant reduction of the current rate of biodiversity loss by 2010, recognising the rapid degradation of ecosystems and habitats. These are further endangered by an overexploitation of natural resources (e.g. for food, for energy, for urban development), damaging ecosystems both on land and in waters, threatening species and habitats with extinction. Indeed, the first global audit of the world's ecosystems conducted in 2005 by the *Millenium Ecosystem Assessment*[29] painted an alarming picture. It described an unprecedented loss of biodiversity and ecosystem due to human activities. In particular:

- More land was converted to cropland in the 30 years after 1950 than in the 150 years between 1700 and 1850.
- The distribution of species on Earth is becoming more homogenous.
- Some 10 to 30% of mammal, bird, and amphibian species are threatened with extinction.
- Genetic diversity has declined globally, particularly among cultivated species.

More recently, the *Economics of Ecosystem and Biodiversity* (TEEB) initiative, launched at the 2007 meeting of the G8+5 environment ministers in Potsdam, valued the cost of policy inaction by 2050. It assessed that the loss of welfare from the cumulative loss of ecosystem services could be equivalent to 7% of projected global GDP.

In 2010, the UN's declared International Year of Biodiversity, the time had come to acknowledge that the 2010 targets had not been achieved. International experts pointed out the inefficiency of recent strategies, which lacked proper integration of biodiversity related issues into the different economic sectors. The EU also recognised the need to prioritise the protection of ecosystems in all policies, including agriculture, fisheries, energy, and regional development.

Therefore, 2010 was the occasion to reassess the situation and an opportunity to set new milestones and targets. Companies affirmed their commitment to better integrate biodiversity issues into their strategies with the adoption of a *Business Engagement* during the 10th Conference of the Parties to the CBD in Nagoya. The private sector thereby affirmed its willingness to actively contribute to the new Strategic Plan for Biodiversity with ambitious targets to improve the protection of biodiversity.

In May 2011, the European Commission published a communication on the new European strategy for biodiversity (*European Commission, 2011e*), to *"halt the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restoring them in so far as feasible, while stepping up the EU contribution to averting global biodiversity loss."* The strategy is built around six mutually supportive targets: full implementation of the Birds and Habitats Directives; maintain and restore ecosystems and their services; increase the contribution of agriculture and forestry to maintain and enhance biodiversity; ensure the sustainable use of fisheries resources; combat invading alien species; help avert biodiversity loss. Although the strategy is not legally binding *per se*, it sets certain obligations through different sectoral policies such as agriculture, fishery, protection of soils and waters.

The 2020 European strategy for biodiversity represents a complete break with the previous one: the EU does not limit the concept of biodiversity to the protection of given species and hotspots, but considers more broadly the concept of ecosystems and ecosystem services, fostering the installation of green infrastructures to restore degraded ecosystems.

29 http://www.maweb.org/en/index.aspx.

THE ELECTRICITY INDUSTRY AND THE PROTECTION OF BIODIVERSITY

The Electricity Industry has an impact on biodiversity and natural landscapes, through its generation, supply and transmission/distribution activities. Nevertheless, the sector is working hard to minimise the impacts on species and habitats through careful planning and mitigation measures. Most electricity companies have incorporated biodiversity into their sites' environmental management system and conduct education programmes on biodiversity for their employees. The Electricity Industry is also involved in many projects – European and international – designed to sustain biodiversity, through partnerships with numerous organisations, universities and research centres to make the best decisions in mitigating their impact and to conserve, protect and restore biodiversity.

Biodiversity as a part of environmental strategy

In the framework of the *Business and Biodiversity Initiative*, many electricity companies have included biodiversity as an important part of their global environmental strategy. Indeed, biodiversity cannot be treated in isolation, but needs to be a part of a larger vision. The commitment of electricity companies includes:

- ensuring the inclusion of biodiversity issues in all activities;
- identifying the impacts of the company's activity on biodiversity, assessing the risks and taking measures to minimise negative impacts and foster activities with positive impacts;
- involving all employees, suppliers and service providers in this field;
- forming partnerships with organisations in order to make the best decisions on mitigating impacts;
- supporting nature conservation initiatives that help minimise and offset the impacts of companies' activities.

ENBW (GERMANY)
AMPHIBIAN PROTECTION PROGRAMME "STIMULI FOR DIVERSITY"

The varied and attractive natural landscape of Baden-Württemberg with its rich plant and animal life has many unique features, but – despite wide-ranging and committed efforts in the field of nature conservation and partial successes in many areas – numerous red-listed species and valuable habitats are still under threat. As a result, the state government decided in 2007 to draw up a biodiversity action plan (www.aktionsplanbiologische-vielfalt.de) to safeguard biodiversity in Baden-Württemberg.

EnBW Energie Baden-Württemberg AG supports this action plan and in 2011 initiated the EnBW amphibian protection programme "Stimuli for Diversity" together with the Baden-Württemberg State Institute for the Environment, Measurements and Nature Conservation (LUBW).

EnBW is committed to the preservation of biodiversity as an integral part of its environmental protection activities and has been actively promoting nature conservation and species protection in Baden-Württemberg for many years. To date, these activities have been primarily focused on local activities – generally in connection with the various EnBW operating locations. Through the EnBW

amphibian protection programme, EnBW is for the first time supporting projects throughout the whole of Baden-Württemberg, not just linked to specific locations, with the aim of protecting amphibian species in its home state.

The EnBW amphibian protection programme is the first and to date only support programme implemented by a company within the framework of the state of "biodiversity" action plan that promotes not only a single species but an entire group of species. The funded measures are designed to improve the habitats of local amphibian species throughout the state and promote the positive medium to long-term development of the amphibian population.

In 2011, a total of 46 support applications were received for the improvement of the habitats of the following amphibian species: yellow-bellied toads, European green toads, tree frogs, spring frogs, spadefoot toads, natterjack toads, moor frogs and great-crested newts.

A committee made up of amphibian experts selected 16 projects and implemented these projects in the autumn of 2011. The supported projects are spread across the whole of Baden-Württemberg and mainly comprise:

- the creation of small and very small ponds for yellow-bellied toads, European green toads and natterjack toads
- the creation of sun-exposed standing waters with flat water zones for moor frogs
- the upgrading of terrestrial habitats in the vicinity of spawning waters (e.g. creation of new or maintenance of existing hedges and reed beds for tree frogs)
- the creation of stepping-stone habitats for population networking

The EnBW amphibian protection programme "Stimuli for Diversity" is an excellent example of how active cooperation with authorities, municipalities and nature conservation associations can make an important contribution to preserving biodiversity. Due to the great success of the scheme and the excellent response in 2011, tenders will once again be invited for the programme in 2012.

30 http://ec.europa.eu/environment/biodiversity/business/index_en.html

EDISON (ITALY)
BIODIVERSITY STRATEGY

In 2010, continuing a programme started in 2009, Edison developed a method to analyse the sensitivity of its operating sites in terms of biodiversity issues. The method used, developed at a national scale, was based on three types of data: soil use, protected areas and distribution of vertebrate species.

These three types of information, taken from official databases and scientific publications, were organised into a geographic database that included, in addition to these data, the location of its operating sites.

The database thus created was used to develop a ranking of the operating sites, in terms of their sensitivity for biodiversity issues, by applying a three-step process :

1. Define two areas of study (1 km and 2 km radius) and analyse the three types of data collected in each area;
2. Identify, for each area of study and each site, three different key indicators:
   Soil use: type of soil use within a study area and the corresponding percentage
   Protected areas: percentage of protected areas within the study area;
   Vertebrate species: identify the species that exist in each study area and develop an overall indicator representing the interest in preserving the vertebrate species, obtained as the sum of the conservation indices of the different species present in the study zone.
3. Combine this information into a single biodiversity sensitivity index for each site.

A summary data sheet describing the results of the analyses and listing indicator data, useful for developing a ranking of operating sites, was prepared for each site and valued based on the biodiversity indicators mentioned above. This project represents another step forward in the process of achieving awareness of the impact that the Group's activities could have on the territory and constitutes a milestone in the development of a Preliminary Corporate Biodiversity Action Plan (PCBAP). The Action Plan that will be developed in 2011 will include the definition of clear and realistic objectives to manage and protect biodiversity and the requirement that biodiversity protection be gradually incorporated into the environmental management system adopted at the operating sites.

APG (AUSTRIA)
SUSTAINABLE ROUTE MANAGEMENT

Maintaining power line routes poses ecological, economic and social demands. It includes measures to maintain the routes, to improve the habitat for flora and fauna, to expand and care for the biotopes and special promotion of sociocultural projects in the surrounding areas of the grid systems. The purpose of ecological route maintenance is to minimise or completely avoid interfering with the landscape and with the balance of nature. Additionally it aims to use the potential for nature and species protection. The research project "sustainable route management" has defined guidelines for route maintenance for the entire transmission grid – some 3,500 kilometres in length that includes around 6,700 kilometres of lines. The defined development options provide a basis for negotiations with regard to maintaining the line routes

and for decisions regarding measures to be taken in cooperation with the landowners. Firstly, the guidelines provide a general depiction of natural protection and forestry priorities (habitats, species, biotope mixes, etc.) along the routes. Secondly, they outline ecologically precious biotopes crossed by the route that need special care or attention as part of route maintenance. Thirdly, they estimate the potential for route maintenance for select nature conservation goals (i.e. designing the forest borders, ecological mast base design for the open landscape).

Partnerships with research centres

In order to better understand how biodiversity is affected by electricity generation and distribution, electricity companies have established many partnerships with universities and research centres. For instance, Mälarenergi (Sweden) is financing a three-year research project on the consequences for wildlife in the regulated watercourse, a project covering mapping, inventory, measures and follow-up and run by the Swedish University of Agricultural Science in Skinnskatteberg.

John Törnblom, PhD in aquatic ecology, is the principal researcher: "We will work around eleven hydropower stations that Mälarenergi has in Hedströmmen and start mapping the areas around power plants, for example by measuring the depth and examining the bottoms. We will also make an inventory of the species in the water through electrofishing, when electricity in the water stuns the fish so it can be taken up, weighed and measured and then released again. We want to crack the code for how to get viable self-reproducing trout and catalyse the reproduction of the freshwater pearl mussel. Trout need three habitats with different characteristics to become viable – a spawning environment, growing environment and wintering sites."

Enel is also strongly involved abroad in partnerships with research centres: in Panama for instance, Enel is working with the Smithsonian Tropical Research Institute and the National Conservancy Association on the preservation of Fortuna Forest.

Networks: Protecting birds against collisions and electrocution

Transmission and distribution infrastructure can be dangerous for birds, impacting their flight, perching and nesting habits. As it can threaten some endangered bird species, electricity companies are working hard on ways to protect birds from collisions and electrocution, while assuring the good functioning of lines.

REN (PORTUGAL)
ACTIONS TO PROTECT BIRDS

Evaluation of bird anti-collision devices (partnership with Portuguese NGO QUERCUS)

REN is concerned about the coexistence of birds and overhead electric lines, given the possibility of birds colliding with the cables of very high voltage overhead lines. Anti-collision signalling devices are used in the electricity transmission lines that pass through sensitive locations.

These devices are bird-saving spirals or anti-collision spirals Bird Flight Diverters (BFD) and are set up in guard cables with the purpose of making them more visible to birds. In addition, some experiences have been made with new devices called Firefly Bird Flappers (FBF).

LIFE + Project (partnership with LPN – Nature Protection League)

One of the main threats to steppe bird species, like the bustard, the little bustard and the lesser krestrel, results from the collision with power lines. With the Life+ Project, REN has accepted responsibility for preventing and mitigating the impacts of this threat, as far as possible, and is convinced that it will be able to:

- Learn more about the impacts of electricity transmission;
- Learn more about the dynamics of bird movements and identify the most important areas for conservation;
- Take action to minimise and offset negative impacts;
- Help increase the population of steppe birds.

According to the most recent progress report, the project is achieving defined environmental goals, since it is positively contributing to the preservation of the three targeted species by signalling electricity lines, setting up and signalling fences, installing drinking fountains and providing environmental education.

ERDF (FRANCE)
PROTECTION OF BONELLI'S EAGLES

The Bonelli's eagle is now the most endangered bird of prey in France. With less than 30 pairs nesting in the Mediterranean cliffs, primarily in the South East (including a dozen in Languedoc-Roussillon), the species has declined by 40% over the past 60 years. Statistical studies concerning the real impact of electrical threats on birdlife are therefore necessary.

This large raptor (with a wingspan of 150-170cm) is affected by the changing landscapes (reforestation of scrubland, urbanisation, etc.) and the shooting by poachers mainly for large individuals. According to data on endangered species, electrocution is the leading cause of unnatural death, especially among juveniles, when they are still unfamiliar with their territory. The species is sedentary: once we know its territory, it is possible to reduce the impact of power lines.

Based on this fact, and aware of the lack of precise information on the threats to these birds, the LPO (Ligue pour la protection des oiseaux, a French NGO for bird protection) and its partners ERDF and RTE (Réseau de Transport d'Electricité, the French company for electricity transport) launched a national action plan on 16 April 2011. The objectives are to protect the entire population of Bonelli's eagles by installing protective facilities on all nesting sites, to train technicians' corporate network to the problem of Bonelli's eagles as they need to know to ask the ad-hoc adjustments at the option of rehabilitation networks, to study well-defined territories on the risks posed by facilities and people; to organize the operational phase of the plan including looking for dedicated funding.

Despite significant constraints, the ERDF program was established in 2011. In total, the ERDF program for the Safety of Bonelli's eagle in 2011 amounted to 375 treated supports. To this figure must be added the equipment by natural replacement of faulty or obsolete equipment.

ČEZ DISTRIBUCE CO. (CZECH REPUBLIC)
BIRD'S PROTECTION

If a bird sitting on an electricity pylon touches the electric conductor a flash-over occurs. The birds will be killed or at least wounded. Even if they receive skilled veterinary care, their survival rate is low. A similar problem occurs when flying birds collide with a conductor, which happens particularly at night.

Studies show that the most endangered birds are raptors, but accidents with owls and white storks are common too. The birds often belong to protected species. Last year alone almost 500 birds wounded by electric conductors were accepted by the national net of rescue stations.

ČEZ Distribuce Co., the operator of high-voltage 22-35 kV lines, is making considerable efforts to protect birds. These efforts go beyond legal obligations.

It has consulted environmentalists for a long time, as shown by the 2007 cooperation agreement with ornithologists. According to this agreement,

ČEZ Distribuce Co. will invest 4 million euro in bird protection – not only on new or reconstructed transmission lines, but also on existing ones.

In addition, ČEZ Distribuce Co. monitors transmission lines on the migrational routes of birds, to prevent bird kill most effectively.

For new high-voltage lines safe supporting points are preferred, which do not allow birds to sit fatally close to conductors. For additional protection on existing lines various plastic elements are used. The cost per electricity pylon ranges from 80 to 320 euro. Considering that ČEZ Distribuce Co. is responsible for about 50,000 km of high-voltage lines with hundreds of thousands of pylons, the cost of protection equipment of the whole high-voltage grid will amount to billions of euros.

MAVIR (HUNGARY)

SAKER FALCON AND GREAT BUSTARD PROTECTION PROGRAMS ALONGSIDE THE TRANSMISSION NETWORK

Many endangered, even critically endangered species of birds find their home in man-made nests put up by MAVIR on high-voltage towers of the transmission network which accommodate not only Hooded Crows and Common Ravens but also a great number of Common Kestrels and Saker Falcons. One of our biggest birds of prey, the highly protected Saker Falcon, is of the highest importance for ornithologists besides Common Kestrel. As far as we know, at present more than 250 Saker Falcons are nesting on MAVIR's towers which make up more than half of their populations according

to the estimates of specialists. Thus by now the Saker Falcon has escaped from its 'on the verge of extinction' status thanks to the breed born in tower-mounted man-made nests. Why do these birds prefer our towers? Possibly because in the flat areas where they are erected they provide the birds with ideal points to watch their hunting range and also they eliminate the risk of predators which could otherwise stalk their nestlings up in the trees.

In the framework of the LIFE program a man-made nest near Csákvár has been observed by camera since the hatching period of 2011 and photo traps were placed in the case of three other man-made nests. Anybody who was interested could follow on social networks the life of two nestlings of Common Kestrel pair finding home in the camera-observed nest until the young ones left the nest.

ENEL (ITALY)

INVOLVEMENT IN LATIN AMERICA TO PRESERVE BIODIVERSITY

ENEL is involved in many projects of biodiversity protection in Latin America. For instance, in Panama, Enel Latin America is working jointly with the Smithsonian Tropical Research Institute and the National Conservancy Association on the administration of 19,500 ha of Fortuna forest reserve, a national protected area with important animal species (large mammals, birds, reptiles, etc.) and plant species. Actions consist in the surveillance and patrolling of critical areas to prevent damage to and crimes against flora and fauna; communication with local communities, authorities and representatives (through meetings and brochures) on the most significant features of the area, bans and national legislation on resource management in the reserve; periodical bathymetric surveys to determine the level of siltation of the basin; organization of research activities (starting with biodiversity monitoring in the Fortuna site) with the involvement of national and international institutes. These activities identified, among others, the presence of near-threatened species, such as the jaguar.

ENEL is also working in Mexico on the El Gallo hydro plant to restock fish in the basin serving the plant, jointly with local anglers' communities and institutions, and in Chili (Atacama desert), on a project of conservation of Incas' crops under agreements with local communities which are aimed at creating new development opportunities and improving their quality of life.

Sustainable hydropower

Hydropower is a complex question for biodiversity. The WFD establishes that waters should achieve good ecological status by 2015. It can therefore be considered as legislation protecting biodiversity. But the full picture is more complex. Improving the environment for aquatic species must be reconciled with people's need for energy and the need to increase the share of renewable energy sources, as stated in the Renewable Energy Directive. Hydropower is indeed a very advantageous renewable energy source, which also provides stable supply and balance in the grid through storage reservoirs and regulating river flows. However, hydropower exploitation potentially conflicts with migration and spawning of some fish species. Well aware of the ecological disturbances, electricity companies involved in hydropower are actively working on many projects to reintroduce natural habitats for fish species and reduce the impact of their activity on biodiversity.

ENEL (SLOVAKIA)

CONSERVATION OF THE RAINBOW TROUT

In Slovakia, Enel is actively working on the conservation of the stream network and of the Rainbow Trout at the High Tatras national park. The project is aimed at removing human threats to the survival of this species, by purchasing and releasing 90% of the fry needed for its conservation, constantly monitoring and regularly cleaning up the streams.

STATKRAFT (NORWAY)

SUSTAINABLE SALMON MANAGEMENT AND HYDROPOWER

As a result of the increasing focus on the value of biological diversity and healthy ecosystems, as well as the large public interest in salmon conservation and management, the Norwegian electricity industry has strongly focused on R&D aiming at combining these interests with optimum power production. The Alta river, located far north in Norway, is a world-famous salmon river, which was licensed for power production in 1978. Statkraft, the largest electricity producer in Norway, holds the concession for regulating the river, and has prior to, and since, launching the power production in 1987 adopted a broad approach to knowledge-based optimisation of the natural ecosystem while also producing 655 GWh of renewable electricity. Programmes and practical measures have been developed in dialogue with the Norwegian Water Resources and Energy Directorate (NVE), as well as with local interests.

Environmental surveys and measures:

- Statkraft has conducted surveys of freshwater biology, birds of prey and hydrology since the 1970s, while the bird of prey surveys were terminated in 1999.
- The scale and focus of the surveys have varied somewhat, but during the entire period, the salmon's lifecycle and ice conditions in the river have been key issues.
- The salmon surveys have been scientific in nature, and a large number of scientific papers about the Alta salmon have been published.
- Catch and release was introduced in 1997, and has since become more widespread.
- The fish hatchery in Talvik was built by Statkraft to ensure that the Alta River can be restocked with Alta salmon smolt if the natural level of smolt production should fail. This has not been necessary, and trial restocking of smolt from the Talvik facility is terminated.
- Statkraft has been ordered to set up a water management committee to operate during the winter period. The committee is made up of representatives from the FinnmarkCounty Governor's Office, Statkraft, Alta Salmon Fishing Association (ALI) and an ice expert from the NVE. The committee is chaired by Statkraft.

MÄLARENERGI (SWEDEN)

HYDROPOWER PLANTS CREATE HABITAT FOR FISH AND OTHER AQUATIC SPECIES

At Kallstena hydropower plant on the river Hedströmmen fish species such as asp, European bullhead (Cottus gobio), eel and trout are affected by the water flow around the plant. A fish-way will be built and two possible solutions have been developed: a vertical slot fish ladder or a bypass channel where the water is led in a loop around the power plant.

From a conservation standpoint, a bypass channel is preferable, explains Ms Alm, water manager at the County Board. A bypass channel is most similar to a natural aquatic environment. It works better for more species, and if done really well, fish can also swim in the channel. A fish ladder is difficult to construct so it can work for all fish, she says.

Mälarenergi have decided to go for a bypass channel but the plant will be somewhat more difficult to regulate as a result. A bypass channel also requires Mälarenergi to buy land from another landowner. Negotiations have been initiated.

The project is funded by the Swedish Society for Nature Conservation's environmental fund, which stems from the sale of environmentally labelled electricity.

Spilling water is another measure that has been tested for a year at three power stations: Skinnskatteberg power station on the Hedströmmen river, Ramna power station on the Kolbäcksån river and Grind Berga power station in Arboga. Spilling means that Mälarenergi agrees to release a certain amount of water into the dry riverbed, provided that there is water. Most hydropower plants have been entitled to dry up the land if the water is needed for electricity generation. The target is to increase the stock of trout, get the freshwater pearl mussels in and safeguard spawning environment for the asp.

For Mälarenergi, this means reduced revenues, as it releases water that would otherwise go into the turbines for electricity generation. The riverbed in these places has not been completely drained out before, but there has not been a constant flow of water throughout the year, which will be the case now.

A follow-up will be made, hopefully showing a functioning reproduction of trout, says Ms Alm.

TABLES AND FIGURES INDEX

ANNEX: NUMBER AND MARKET SHARES OF COMPANIES IN THE ELECTRICITY SECTOR

	GENERATION*		TRANSMISSION	DISTRIBUTION	SUPPLY*	
	NUMBER	MARKET SHARE	NUMBER	NUMBER	NUMBER	MARKET SHARE
AT	6		3	138	6	
BE						
BG						
CY						
CZ	1	62	1	3	3	95
DE	4	70	4	910	3	43
DK						
EE	1	95	1	38	1	88
ES						
FI			1	88		
FR			1			
GB						
GR	1	88,9	1	1	1	99,47
HU	6	72	1	6	6	46
IE	4	81	1	1	5	98
IT	5	65	1	144	3	59
LT	2	77	1	2	3	94
LU						
LV	2	69	1	11	2	99
MT	1	100	0	1	1	100
NL	4	55	1	10	3	68
PL	7	70,66	1	33	6	100
PT	3	64,8	1	3	1	88,6
RO						
SE	3	78,8	1	170		
SI						
SK						
CH						
NO	5	60	1	158	5	50
TR	4	53	1	21	4	53
AL						
BA	3	99,48	1	4	5	89,87
HR	1	95	1	1	1	100
MK						
MD						
ME						
RS	1	99	1	1	1	100

Notes:

- **Figure are the best estimates**
- **Generation:** only companies with 5% or more of the electricity domestic output
- **Transmission:** TSOs – Transmission System Operators
- **Distribution:** Distribution companies
- **Supply:** companies selling electricity to end-users (only companies with 5% or more of the total electricity sold to final customers

The remainder is met by other generation or supply companies. Any assessment of the market situation must also take net imports into consideration.

Power Statistics 2011

* *Includes entities which have a share equal or greater to 5%.*

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REFERENCES

PRINT SOURCES

ABB, AREVA, EnBW, E.on, RWE, SIEMENS, Solvay Fluor und Derivate, 2003. *"SF_6 – GIS – Technology for Power Distribution – Medium Voltage"* More information: www.solvay-fluor.com

ECOBA, 2012. *"Production and Utilisation of CCPs in 2009 in Europe (EU-15)"*

European Environment Agency, 2011a. *"Annual European Community greenhouse gas inventory 1990-2009 and inventory report 2011"*

European Environment Agency, 2011b. *"Greenhouse gas emission trends and projections in Europe 2009: Tracking progress towards Kyoto targets"*

European Environment Agency, 2011c. *"European Community emission inventory report 1990-2009 under the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP)"*

EURELECTRIC, 2003. *"EURELECTRIC Environmental Guidelines"*

EURELECTRIC, 2004. *"Roadmap on Sustainable Development: How to Incorporate Sustainable Development into EURELECTRIC Activities"*

EURELECTRIC, 2009a. *"Climate Change, Electricity Markets, Supply Security: A Declaration by European Electricity Sector Chief Executives"*

EURELECTRIC, 2009b. *"Standardisation of electric vehicle charging infrastructure – Declaration by the European Electricity Industry"*

EURELECTRIC, 2009c. *"Power Choices: Pathway to Carbon-Neutral Electricity Sector in Europe by 2050"*

EURELECTRIC, 2010a. *"Financial situation of the Electricity Industry – A view to the future challenges"*

EURELECTRIC, 2010b. *"Market models for the roll-out of electric vehicle public charging infrastructure"*

EURELECTRIC, 2011a. *"More is less: the role of electricity in Energy Efficiency"*

EURELECTRIC, 2011b. *"RESAP – Renewable Action Plan"*

EURELECTRIC, 2011c. *"Statistics & Prospects for the European electricity sector (1980-2000, 2008, 2009, 2010-2030) 37th Edition Power Statistics 2011"*

EURELECTRIC, 2012a. *"Energy Roadmap 2050. A EURELECTRIC Response Paper"*

EURELECTRIC, 2012b. *"Energy Wisdom Programme: Report 2002-2013 Edition"*

EURELECTRIC, EPSU, EMCEF, 2010. *"Statement on Smart Meters"*

EURELECTRIC, EPSU, EMCEF, 2011. *"Towards a low-carbon electricity sector: employment effects and opportunities for social partners"*

EURELECTRIC, EPSU, EMCEF, 2011. *"Security and Safety in the nuclear industry"*

European Commission, 2011a. *"EU Roadmap to a resource efficient Europe"*

European Commission, 2011b. *"Communication COM(2011) 109 – Energy Efficiency Plan 2011"*

European Commission, 2011c. *"Communication COM(2011) 112 – Roadmap for moving to a low-carbon economy in 2050"*

European Commission, 2011d. *"Proposal for a Council Directive amending Directive 2003/96/EC restructuring the Community framework for the taxation of energy products and electricity' (COM (2011) 169)"*

European Commission, 2011e. *"Communication COM(2011) 244 – Our life insurance, our natural capital: an EU biodiversity strategy to 2020"*

European Commission, 2011f. *Proposal for a Directive on energy efficiency and repealing Directives 2004/8/EC and 2006/32/EC (COM(2011) 370)*

European Commission, 2011g. *"Communication COM(2011) 885 – Energy Roadmap 2050"*

European fuel Poverty and Energy Efficiency (EPEE), 2009. *"WP2-D5: Diagnosis of causes and consequences of fuel poverty in Belgium, France, Italy, Spain and in the UK"*

Council of the European Union, European Parliament, 2000. *"Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy"*

Council of the European Union, European Parliament, 2001a. *"Directive 2001/80/EC of the European Parliament and of the Council of 23 October 2001 on the Limitation of Emissions of Certain Pollutants into the Air from Large Combustion Plants"*

Council of the European Union, European Parliament, 2001b. *"Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on National Emission Ceilings for Certain Atmospheric Pollutants"*

Council of the European Union, European Parliament, 2003. *"Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 Establishing a Scheme for Greenhouse Gas Emission Allowance Trading within the Community and Amending Council Directive 96/61/EC"*

Council of the European Union, European Parliament, 2004. *"Directive 2004/101/EC of the European Parliament and of the Council of 27 October 2004 Amending Directive 2003/87/EC Establishing a Scheme for Greenhouse Gas Emission Allowance Trading within the Community, in Respect of the Kyoto Protocol's Project Mechanisms"*

Council of the European Union, European Parliament 2006a. *"Regulation (EC) No 842/2006 of the European Parliament and of the Council of 17 May 2006 on certain fluorinated greenhouse gases"*

Council of the European Union, European Parliament, 2006b. *"Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration. Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC.93/67/EEC. 93/105/EC and 2000/21/EC"*

Council of the European Union, European Parliament, 2007. *"Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks"*

Council of the European Union, European Parliament, 2008a. *"Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control" (codified)*

Council of the European Union, European Parliament, 2008b. *"Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe"*

Council of the European Union, European Parliament, 2008c. *"Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy"*

Council of the European Union, European Parliament, 2008d. *"Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives"*

Council of the European Union, European Parliament, 2009a. *"Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006"*

Council of the European Union, European Parliament, 2009b. *"Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC"*

Council of the European Union, European Parliament, 2009c. *"Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community"*

Council of the European Union, European Parliament, 2009d. *"Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (codified)"*

Council of the European Union, European Parliament, 2010. *"Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control)"*

Council of the European Union, 1992. *"Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora"*

Council of the European Union, 2003. *"Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity"*

ICF International, 2008. *"Analysis on the recovery of Fluorinated Greenhouse Gases in EU-27 in the period 2004-2007 and determination of options for further progress"*

International Energy Agency, 2011. *"World Energy Outlook 2011"*

T&D Europe, 2009. *"SF6 switchgear End of Life Flowchart"*

United Nations Economic Commission for Europe, 1979. *"Convention on Long-range Transboundary Air Pollution"*

United Nations Economic Commission for Europe, 1999. *"Gothenburg Protocol to Abate Acidification. Eutrophication and Ground-level Ozone"*

United Nations Environment Programme, 1992a. *"United Nations Framework Convention on Climate Change"*

United Nations Environment Programme, 1992b. *"Convention on Biological Diversity"*

ELECTRONIC SOURCES

European Coal Combustion Products Association (ECOBA)
http://www.ecoba.org

European Environment Agency (EEA)
http://www.eea.europa.eu

EUROSTAT
http://epp.eurostat.ec.europa.eu

Union of the Electricity Industry – EURELECTRIC
http://www.eurelectric.org

EUR-Lex. Access to European Union law
http://eur-lex.europa.eu/en/index.htm

Europa, official website of the European Union
http://europa.eu/

European Mine, Chemical and Energy Workers' Federation (EMCEF)
http://www.emcef.org

European Federation of Public Services Union (EPSU)
http://www.epsu.org

United Nations Economic Commission for Europe
http://www.unece.org/

United Nations Framework Convention on Climate Change (UNFCCC)
http://www.unfccc.int

Sustainable Energy for All – A framework of actions
http://www.sustainableenergyforall.org/

GLOSSARY: PREFIXES, UNITS AND ABBREVIATIONS USED IN THIS REPORT

PREFIXES

m	milli = 10^{-3}
k	kilo = 10^{3}
M	mega = 10^{6}
G	giga = 10^{9}
T	tera = 10^{12}

UNITS

m	metre, metric distance unit
s	second, metric time unit
g	gram, metric weight unit
N	Newton, metric force unit (1 N = 1 kg*m/s^{2})
J	Joule, metric energy unit (1 J = 1 N*m)
W	Watt, metric power unit (1 Watt = 1 J/s)
t	tonne or metric ton (1 t = 10^{6} g)
kWh	kilowatt-hour, energy unit commonly used in electricity measurements (1 kWh = 3.6*10^{6} J)
toe	tonne of oil equivalent (1 toe = 11630 MWh)

ABBREVIATIONS

BA	bottom ash
BFB	bubbling fluidized bed
BS	boiler slag
CAFE	Clean Air For Europe
CaO	calcium oxide
$Ca(OH)_2$	calcium hydroxide
CBD	Convention on Biological Diversity
CCGT	combined cycle gas turbine
CCP	coal combustion product
CCS	carbon capture & storage
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CFB	Circulating fluidized bed
CFC	chlorofluorocarbon
CH_4	methane
CHP	combined heat and power
CIER	Regional Energy Integration Commission of Latin America
CLRTAP	Convention on Long-range Tansboundary Air Pollution
CO_2	carbon dioxide
COP	Conference of Parties
CSR	Corporate Social Responsibility
DSO	Distribution System Operator
EC	European Commission
ECOBA	European Coal Combustion Products Association
EEA	European Environment Agency
EEA-32	EEA member countries: EU-27, Iceland, Liechtenstein, Norway, Switzerland and Turkey
EIA	environmental impact assessment
EMAS	Eco-Management and Audit Scheme
EMCEF	European Mine, Chemical and Energy Workers' Federation
EMS	environmental management system
EPER	European Pollutant Emission Register
EPSU	European Federation of Public Services Union
ERU	Emission Reduction Unit
ETS	Emissions Trading Scheme
EU	European Union
EU-10	Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia.
EU-15	Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and UK
EU-25	EU-15 and EU-10
EU-27	EU-25, Bulgaria and Romania
ETS	Emission Trading Scheme
FA	fly ash
FBC	fluidised bed combustion
FGD	flue gas desulphurisation
FYROM	Former Yugoslav Republic of Macedonia
GDP	Gross Domestic Product
GEP	Good Ecological Potential
GES	Good Ecological Status
GHG	greenhouse gas
GWP	global warming potential
HCFC	hydrochlorofluorocarbon
HFC	hydrofluorocarbon

HPP	hydro power plant
H&S	health and safety
IEA	International Energy Agency
IEP	International Electricity Partnership
IPCC	Intergovernmental Panel on Climate Change
IPPC	integrated pollution prevention and control
IPTS	Institute for Prospective Technology Studies
ISO	International Organization for Standardization
JI	Joint Implementation
JRC	Joint Research Centre
LCA	life-cycle assessment
LCP	large combustion plant
MS	member states
MSFD	Marine Strategy Framework Directive
NAP	National Allocation Plan
NECD	National Emission Ceilings Directive
NH_3	ammonia
NMVOC	non-methane volatile organic compounds
NO_x	nitrogen oxides
NREAPs	National Renewable Energy Action Plans
NPP	nuclear power plant
ODS	ozone depleting substances
OECD	Organisation for Economic Cooperation and Development
PFC	perfluorocarbon
PM10	particulate matter whose particles are 10 micrometres or less
PM2.5	particulate matter whose particles are 2.5 micrometres or less
RES	renewable energy sources
RESAP	Renewable Energy Sources Action Plan
R&D	research and development
RD&D	research, development and deployment
RSD	Roadmap for Sustainable Development
SD	sustainable development
SDA	semi-dry absorption
SO_2	sulphur dioxide
SO_x	sulphur oxides
TSOs	Transmission System Operators
UN	United Nations
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WFD	Water Framework Directive
WG	Working Group

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