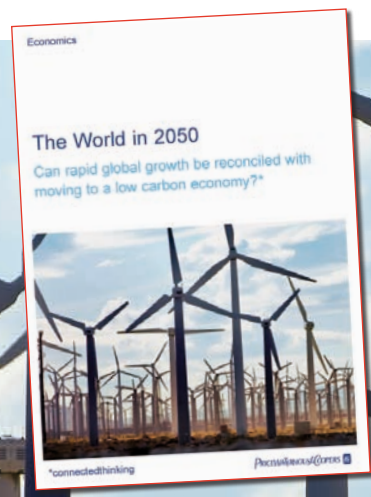
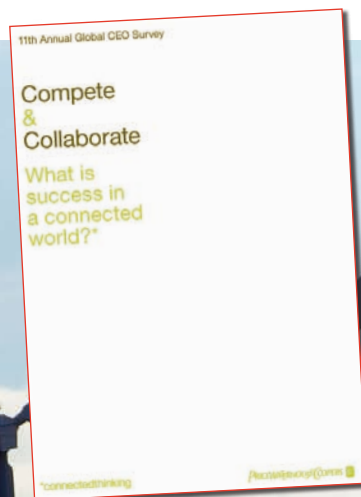


Climate Change and Electricity

The European Carbon Factor

Comparison of CO₂ emissions of Europe's leading electrical utilities

> New update
Includes the 2008 version of 2050 forecasts and the opinion of 1150 CEOs on climate change.



November 2008

PRICEWATERHOUSECOOPERS 

Report drawn up by PricewaterhouseCoopers

Sustainable Development collection

About PricewaterhouseCoopers

Member of the global auditing and consulting network PricewaterhouseCoopers International Limited. PricewaterhouseCoopers Advisory (www.pwc.fr/advisory) is the first firm to offer a full spectrum of skills to help companies and organisations boost their performance for the long term by working with them in 4 key areas : growth strategy management, organisational improvements, cost and risk control and human resources management.

Our main strength lies in the diversity of our workforce's backgrounds and experience, which includes 750 consultants in France at 25 regional facilities and 22,000 people in 149 countries. This multidisciplinary approach means we can offer solutions adapted to the challenges companies are facing.

In an effort to address the challenges of sustainable development, PricewaterhouseCoopers Advisory has created the Sustainable Business Services department. Its mission is to improve the economic, social and environmental performance of companies and raise awareness among stakeholders. The SBS network is present in over 40 countries (including China, India, Russia, Brazil, etc.) and is active worldwide in sustainable development strategy, supply chain consulting, due diligence, climate change and sustainable development reporting.

PricewaterhouseCoopers also serves its customers by focusing on economic sectors to better understand each one's specific challenges. Our energy sector team has 3,100 specialists worldwide, 300 of whom are partners. PricewaterhouseCoopers's specialised team in France designs customised solutions to solve the problems of players in the energy sector.

Enerpresse

Over the last thirty years, Enerpresse has become the reference for French-speaking professionals in the energy industry, sector-based research and preventing the impacts of climate change. Thanks to its specialised editorial team and international network of correspondents, Enerpresse can provide a daily selection of the latest news from the French, European and international energy sectors. Enerpresse also publishes in-depth reports for all French-speaking members of the energy community on the challenges, industry players, markets and technologies that make it one of the most dynamic sectors in today's economy.

CO₂ production and emissions from major European electrical utilities

More work is needed between now and 2050

While the European directive to reduce CO₂ emissions was revised and made stricter in 2007, the combined emissions of Europe's top 22 electrical utilities were 800 Mt CO₂, or an increase of 23 Mt CO₂ versus 2006 (+3 %) and 46 Mt CO₂ compared to 2001 (+6 %). In other words, the rise in CO₂ emissions observed during 2007 equals the total rise in emissions seen over the 5 previous years.

Two factors have caused this increase. One, electricity generation for the 22 groups reviewed rose 32 TWh in 2007 compared to 2006, or an increase of 1.5 %.

Two, the European Carbon Factor¹ was 373 kg CO₂/MWh in 2007, or a rise of 5.3 kg CO₂/MWh compared to 2006 (+1.4 %).

These 22 companies generate 59 % of the emissions in Europe's Power & Heat sector (27 countries).

The top ten companies generate 50 % of the emissions in Europe's Power & Heat sector (27 countries). Seven of them have kept their emissions at the same level and the others experienced a rise.

The top 5 emitters are :	The 5 best carbon factors :	The 5 highest carbon factors :
RWE (DE, UK) : 147 MtCO ₂ , stable	Statkraft (NO) : 5 kg CO ₂ /MWh stable	DEI (GR) : 984 kg CO ₂ /MWh, stable
EDF (FR, UK, DE, IT) : 94 MtCO ₂ , stable	Fortum (FI, SE) : 64 kg CO ₂ /MWh, - 40 %	Nuon (NL) : 856 kg CO ₂ /MWh, stable
E.ON (DE, UK) : 87 MtCO ₂ , 10 % rise	Verbund (AT) : 120 kg CO ₂ /MWh, - 9 %	RWE (DE, UK) : 848 kg CO ₂ /MWh, +10 %
Vattenfall (DE, SE, FI) : 74 MtCO ₂ , stable	British Energy (UK) : 134 kg CO ₂ /MWh, +12 %	Drax (UK) : 831 kg CO ₂ /MWh, stable
Endesa (ES, PT, IT, FR) : 64 MtCO ₂ , stable	EDF (FR, UK, DE, IT) : 145 kg CO ₂ /MWh, stable	CEZ (CZ) : 635 kg CO ₂ /MWh, +15 %

The 3 electrical utilities with the highest emissions increase in 2007:

CEZ : increase of 10.5 MtCO₂, or +29 % due to a rise in electricity generation of 8TWh (+13 %), including 5TWh with change to energy mix (in Central Europe, less nuclear and renewables and more coal, gas and combined cycle) and 3TWh with coal plants (takeover of Varna plant in Bulgaria).

E.ON : increase of 7.6 MtCO₂, or +10 % due to a rise in electricity generation of 29TWh (+16 %) and change in energy mix (less nuclear and much more gas and oil).

RWE : increase of 4.7 MtCO₂, or +3 % due to a revision of the energy mix, most importantly with a reduction in nuclear (nuclear portion in Germany reduced by 15 %).

The 3 electrical utilities with the highest emissions reduction in 2007:

Dong : reduction of 3.3 MtCO₂, or -28 % due to generation reduction of 5.8TWh (-23 %) and improved carbon factor (increase in electricity generated from renewable sources in overall electricity generated, or 16 % versus 12 %).

Fortum : reduction of 2.5 MtCO₂, or -43 % due to a reduction in thermal generation of 3TWh (caused by relatively low spot prices) and slight increase of nuclear and hydro-electric portion, hence a net improvement to the carbon factor (from 107 to 64).

Enel : reduction of 1.8 MtCO₂, or -4 % due to a drop in production of 9.7TWh (-9 %).

Still Far from the Long-Term Objectives to Reduce Emissions

To stabilise the concentration of CO₂ in the atmosphere to a level that prevents what are potentially the most severe impacts on climate change, global CO₂ emissions will need to be cut in half by 2050 compared to 2006 levels and reduced 80 % in the G7 countries.

The decline in the European carbon factor for the electrical utilities observed in 2007 proves there is still much work to be done before these objectives are reached.

¹ The carbon factor (or emissions factor) is determined by dividing the total CO₂ emissions by the total energy production. It is expressed in kg CO₂/MWh



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1. Context, Objectives and Limits of the Study

1.1 The Reorganisation of the European CO₂ Market and the Post-Kyoto Talks

In November 2007, PricewaterhouseCoopers and Enerpresse published the sixth edition of the European Carbon Factor. The goal was to identify and provide comprehensive information on the CO₂ emissions² of Europe's leading electricity facilities, in light of the introduction of European directive 2003/87/EC (emission trading scheme - or "ETS" - directive) establishing a CO₂ emissions trading scheme.

In the current context of the global "post-Kyoto" negotiations aimed to culminate with the Copenhagen conference at the end of 2009, the European Union has completed its regulatory scheme.

In 2007, the new European National Allocation Plans (NAP2) were issued for 2008 to 2012 and finalised in consideration of the learning curve from the preceding period. This analysis resulted in a 9%³ drop in the allowances allocated to the energy sector compared to 2005-2007.

Furthermore, for the period after 2012 the Commission advised ending free allowance allocation for the electricity sector, since this sector has the option of passing on the CO₂ cost increase to customers.

In the longer term, the European Union set an objective at the European Council in March 2007 for an overall reduction of its greenhouse gas emissions by 20% between now and 2020 compared to 1990 levels. This objective will be raised to 30% if a global agreement is reached.

1.2 The Purpose of this Study

The purpose of this study is to identify, consolidate, harmonise and present exhaustive data on the CO₂ emissions of Europe's leading energy producers and analyse the main variations in data between 2001 and 2007.

1.3 The Limits of the Study

We do not provide comments or opinions on energy prices or the impact of CO₂ in the assessment of the companies included in this study.

2. Methodology & Sources

2.1 Data Collection in Europe

Most companies have posted data directly on their Internet sites, in their annual reports and/or in their Environment/Sustainable Development reports. This transparency of information is due to the new financial and book value of CO₂ emissions since the introduction of the emission trading scheme in 2005.

Each energy producer provides information relating to installed capacity, production volume and sales achieved. For companies that do not directly report the emissions generated by the electricity they produce, we have calculated the level of emissions by multiplying production figures (per fuel type) by the specific carbon factors given in the tables in the GhG protocol⁴.

For companies that produce both electricity and steam, the overall CO₂ emissions have been allocated to electricity, in proportion to the amount of electrical production in the total energy production.

We know that some data may be approximate, especially those calculated by extrapolation. However, we are assuming that the error margin is less than 10%.

The recent mergers and takeovers within the energy sector may result in data redundancy if they are not mentioned in the environmental reports. Furthermore, companies differ from each other in the way they present this information in their environmental reports.

² PFor simplification, the analysis focuses on CO₂ since electricity producers do not emit many other greenhouse gases.

³ Source : PwC calculation from 27 NAPs

⁴ Source www.ghgprotocol.org

2.2 Coverage

The total greenhouse gas emissions of the European Union (EU27) in 2005 amounted to approximately 5.2 Gt (incl. 425 Gt of CO₂), about 1.3 Gt of which are imputable to the production of power and heat⁵.

In 2007, total electricity production in Europe rose to 3,183 TWh⁶, 67.5% of which is produced by the 22 companies covered by this study.

The total volume of emissions analysed in this study is 800 Mt CO₂/year, accounting for around 53% of the emissions generated by the European energy sector (EU27).

2.3 Scope

In an effort to fine-tune the results, we have only analysed :

- strictly European emissions (by excluding emissions from subsidiaries outside Europe);
- emissions only attributable to electricity production (we did not include emissions from other subsidiaries in multi-sector groups)

Wherever possible, we have also omitted emissions attributable to heat production.

When consolidated data on emissions were missing, we had to add figures for recently acquired companies. To do this, we used the “control-based” consolidation method, rather than the “partial integration” method, as recommended in the GHG Protocol⁷.

EDF holds 50% of the Edison Group (voting rights). However, we incorporated all of EDF’s data, as we have been doing for EnBW for many years, since the purpose of this study is to look at overall emissions. Consequently, we re-consolidated EDF’s historical data.

All the consolidation methods are given in Annex D.

This year, we removed Essent and Viesgo from the scope of the study due to lack of transparency of the data on electricity production (for informational purposes, Essent’s CO₂ emissions related to electricity production amounts to 14,625,000 tonnes and Viesgo’s is 4,200,000 tonnes).

⁵ European Environment Agency, 2007 study for the year 2005.

⁶ Source: Eurelectric, 2007 study for the year 2006

⁷ For further details: www.ghgprotocol.org

The data for E.ON is questionable due to lack of details on the carbon factor for subsidiaries in Scandinavian countries, which significantly impact the group’s results.

To remain consistent with the reporting from previous years, we excluded data on production facilities that do not belong to RWE, yet which RWE uses on an as-needed basis⁸.

2.4 Data Published

2.4.1 European Analysis (22 companies)

We have analysed Europe’s top 22 electricity producers using the following criteria:

- Production (in TWh). Note: we took into account the electricity generated, as opposed to the electricity sold, which factors in trading activities.
- Emissions (in t CO₂/year) in terms of electricity generated
- Carbon Factor (in kg CO₂/MWh produced)
- Major trends in the carbon factor and CO₂ emissions

2.4.2 Recalculation of Historic Data

We have updated and recalculated the historical data on production and emissions for some companies to account for the latest published data.

⁸ Or 36.3 TWh from coal plants in Germany, which have a carbon factor of 900 kg CO₂/MWh (data taken from Facts & Figures 2008 report by RWE, and consistent with a study conducted by PricewaterhouseCoopers in 2007 that for this type of plant indicates a range of 818 kg CO₂/MWh to 1184 kg CO₂/MWh: (see http://www.dongenergy.com/EN/Responsibility/Climate/CO2_benchmark.htm)

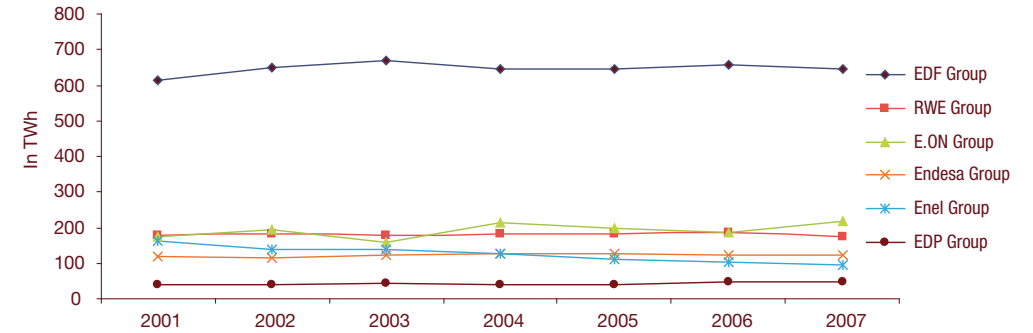
3. Results for 2001-2007

3.1 Production – 2007 Data

Production for the companies increased 32.2 TWh, or +1.5% from 2006 to 2007. Eight companies generate 51% of electricity in Europe 27 and the top 22 produce 67.5%.

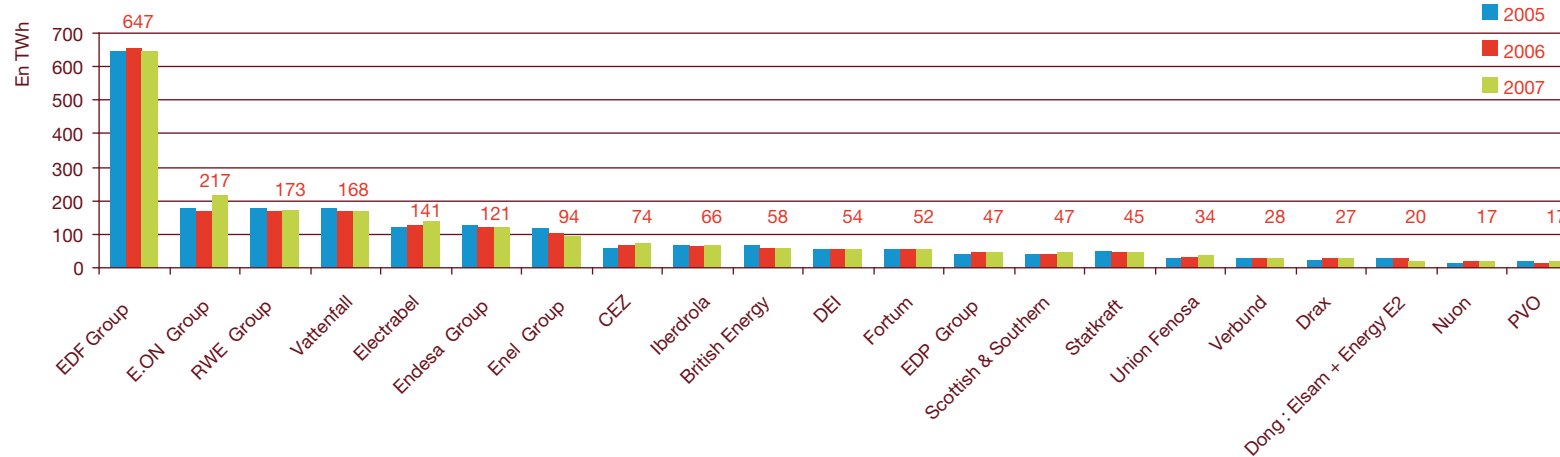
EDF⁹ alone accounts for 20% of Europe’s production.

Electric production in Europe 2001- 2007 (for the top 6 groups)



Electricity production in Europe 2005- 2007

(for all companies on the panel)



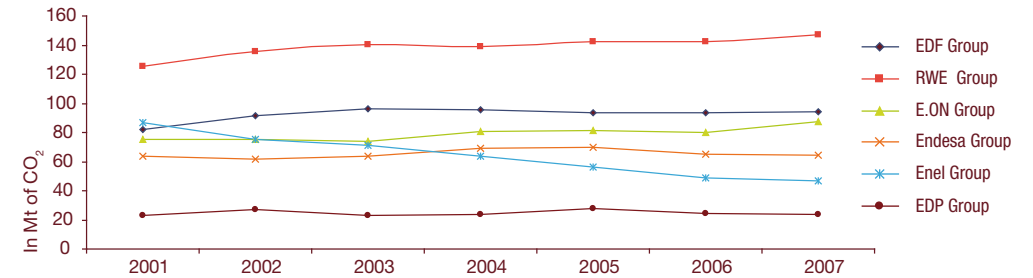
⁹ Note: all the EDF data in this report were obtained by adding 100% EDF France, 100% EDF Energy (United Kingdom), 100% EnBW (Germany) and 100% Edison-Edipower (Italy) - see Annex C.

3.2 Emissions – 2007 data

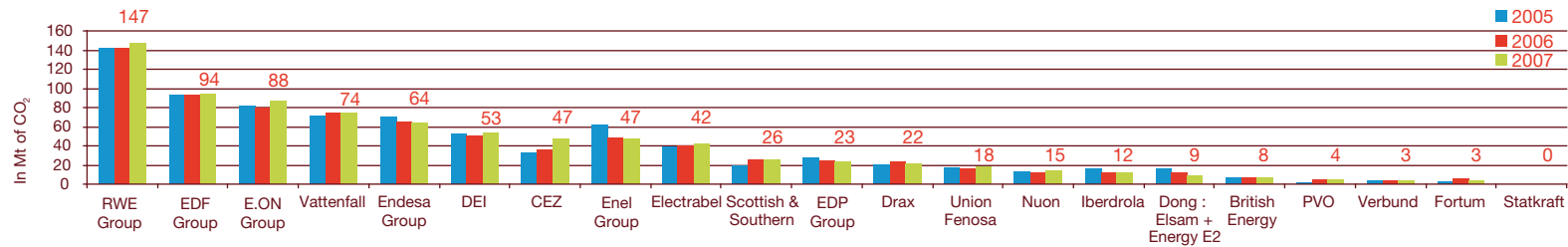
The pro-forma emissions for the panel of companies increased 23.1 Mt CO₂ between 2006 and 2007. Ten companies are responsible for 50% of the sector's emissions for the EU27.

RWE is the biggest emitter in Europe with 147 Mt CO₂, which exceeds emissions from the next biggest emitter (the EDF Group) by 56%. E.ON and Vattenfall are not far behind.

CO₂ emissions in Europe 2001-2007



CO₂ emissions in Europe 2005-2007



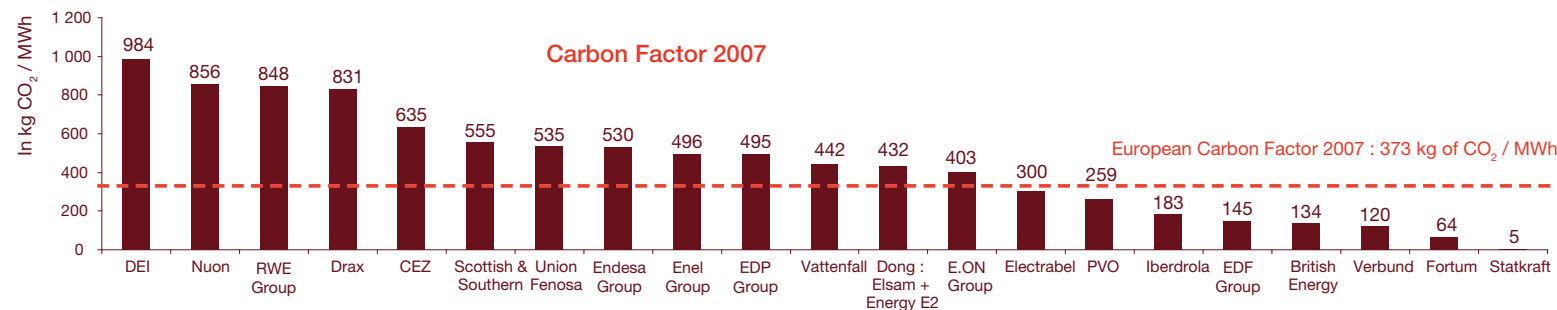
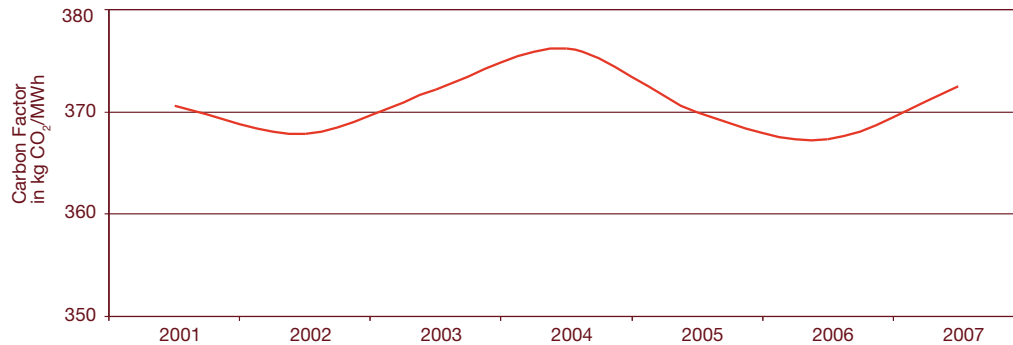
3.3 Carbon Factor

The average European carbon factor was 373 kg CO₂/MWh in 2007 vs. 367 kg CO₂/MWh in 2006, or an increase of 5.3 kg CO₂/MWh (+1.4%). This annual increase is the highest ever recorded since 2002.

The carbon factor of some companies is lower than the European carbon factor. This is due largely to their energy mix, which consists mainly of hydro-electric and/or nuclear power. These companies are: Statkraft, EDF, Fortum, British Energy, Verbund, Iberdrola, PVO and Electrabel.

The other companies exceeded the European Carbon Factor. Some of them recorded a significant increase or decrease in 2007, compared with 2006:

Changes in Carbon Factor



The most marked increases in the Carbon Factor in 2007 vs. 2006:

RWE: recorded an increase in the Carbon Factor of 77 kg CO₂/MWh or +10% due to a reduction of use of nuclear.

CEZ: recorded an increase in the Carbon Factor of 82 kg CO₂/MWh or +15% due to a change in the energy mix (less use of nuclear and renewable energies in Central Europe and more use of coal, gas and combined cycle) and production in Bulgaria of an additional 3 TWh from coal (takeover of the Varna plant).

The most marked reductions in the Carbon Factor in 2007 vs. 2006:

Scottish & Southern: recorded a reduction in the Carbon Factor of 67 kg CO₂/MWh or -11% due to a shift in the energy mix towards more renewable energies and gas.

Fortum: recorded a reduction in the Carbon Factor of 43 kg CO₂/MWh or 40% due to a drop in fossil fuel energy production of 3 TWh (caused by the relatively low spot prices) and a slight increase in nuclear and hydro-electric.

We have noted that the companies that had sharp increases in their Carbon Factor could already have recorded the inverse trend in the previous Carbon Factor study.

The peak in 2004 was caused by bad weather conditions that led to a very sharp reduction in the Carbon Factor for Spanish companies (Iberdrola, EDP, Endesa, Enel, Union Fenosa).

3.4 Major Trends in CO₂ Emissions for 2006-2007

The companies record varying CO₂ emissions levels from year to year. We attempted to recognize the major trends during the course of 2007

The most marked emissions increases from 2006 to 2007:

CEZ: increase of 10.5 MtCO₂, or +29% due to a rise in electricity production of 8TWh (+13%), including 5TWh of a change in the energy mix (less use of nuclear and renewable energies in Central Europe and more use of coal, gas and combined cycle) and 3 TWh from coal plants (takeover of the Varna plant in Bulgaria).

E.ON: increase of 7.6 MtCO₂, or +10% due to a rise in electricity production of 29TWh (+16%) and change in energy mix (less nuclear and much more gas and oil).

RWE: increase of 4.7 MtCO₂, or +3% due to a shake-up of the energy mix, mostly with less use of nuclear (nuclear in Germany down 15%).

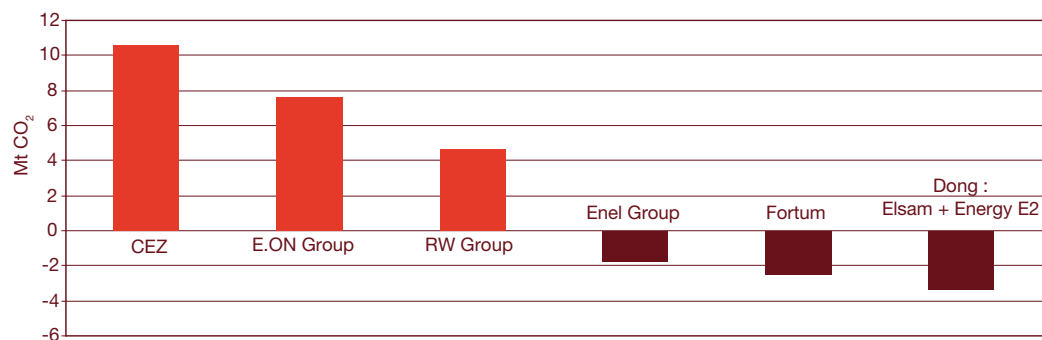
The most marked emissions reductions from 2006 to 2007:

Dong: reduction of 3.3 MtCO₂, or -28% due to a drop in production of 5.8TWh (-23%) and improved carbon factor (thanks to the increase of electricity generated from renewable sources in the total electricity production, or 16% vs. 12%).

Fortum: reduction of 2.5 MtCO₂, or -43% due to lowering thermal production by 3TWh (caused by the relatively low spot prices) and a slight increase in nuclear and hydro-electric, hence a net improvement of the carbon factor (from 107 to 64).

Enel: reduction of 1.8 MtCO₂, or -4% due to a reduction of 9.7TWh in production (-9%).

Major trends in CO₂ emissions between 2006 and 2007



4. Updated Projections for Emissions Leading up to 2050

4.1 Context

In September 2006, PwC Macroeconomics (London) published a report¹⁰ that presented various scenarios for CO₂ emissions leading up to 2050. The conclusions of this report were presented in the November 2006 edition of the “Climate Change and Electricity” study, which was updated in July 2008. We included the major new findings here.

Like in the September 2006 edition, PwC Macroeconomics bases its study on a business-as-usual scenario¹¹, where the assumptions are that:

- the energy mix remains unchanged in every country between 2008 and 2050;
- carbon storage technologies are not used.

This baseline scenario is then compared to alternative scenarios.

Compared to 2006, PwC Macroeconomics considers that the challenges of climate change are even bigger, mostly because the growth projections for China and India have been revised up. Therefore, the growth projections were revised up with the average annual global economic growth estimated at 3.4% (vs. 3.2% in the original study) and an estimated 2% growth in consumption of primary energy (vs. 1.6 % in the original study).

Table 1
projections for economic growth and growth in consumption of primary energy in the baseline scenario¹²

	GDP growth projection (from now to 2050)		Growth projection for primary energy consumption (from now to 2050)	
	Annual	Combined in 2050	Annual	Combined in 2050
Updated projections (July 2008 report)	3,4 %	325 %	2 %	140 %
Original projections (September 2006 report)	3,2 %	306 %	1,6 %	112 %

The financial crisis of autumn 2008 was not accounted for when estimating the consumption projections by 2050.

¹⁰ “The World in 2050 :implications of global growth for carbon emissions and climate change policy”

¹¹ This baseline scenario (business as usual) is not the most probable scenario, especially given the current context of rising prices for fossil fuel energies, but it provides a baseline for comparing possible scenarios

¹² Source : World Bank and BP pour 2006, PwC estimate

4.2. Emissions Projections Revised Upward

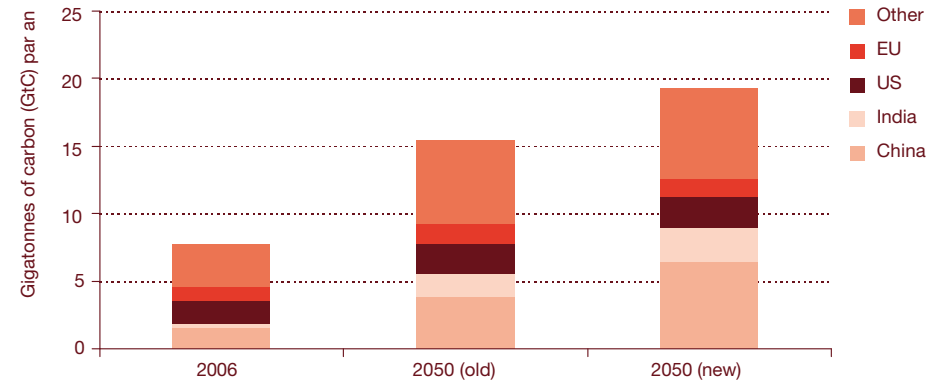
These new growth projections imply revising the CO₂ emissions projections in the baseline scenario upward. Carbon emissions in 2050 are now estimated at around 19 GtC/year versus a little over 15 GtC/year in the previous version. (In 2006, emissions were slightly below 8 GtC). In this updated baseline scenario, China and India alone would represent 45% of global CO₂ emissions by 2050.

If we look at the source of these emissions, we see that the strongest growth is coming from the energy sectors (which rises from around 25% of total emissions in 2006 to nearly 30% in 2050) and transport. Generally, the projections forecast a significant increase of CO₂ emissions across all sectors.

Gigatonnes of Carbon (GtC) per year

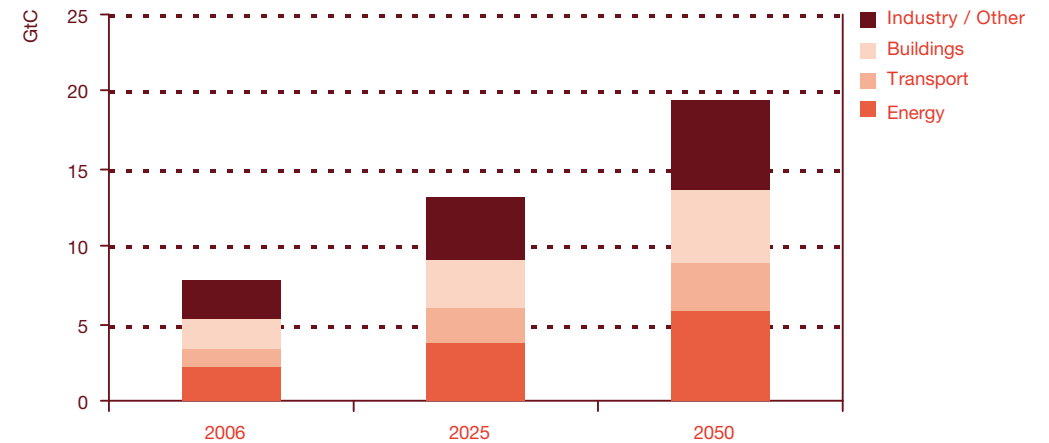
Global carbon emissions by economic area in the baseline scenario

(old and new model)



Source : PwC model projections for BAO scenarios from 2006 report (old) and 2008 report (new)

Global carbon emissions by sector in the baseline scenario



Source : BP & AIE for 2006, PwC model estimates and projections (CO₂ emissions from energy use only)

4.3. Possible Scenarios for Reductions

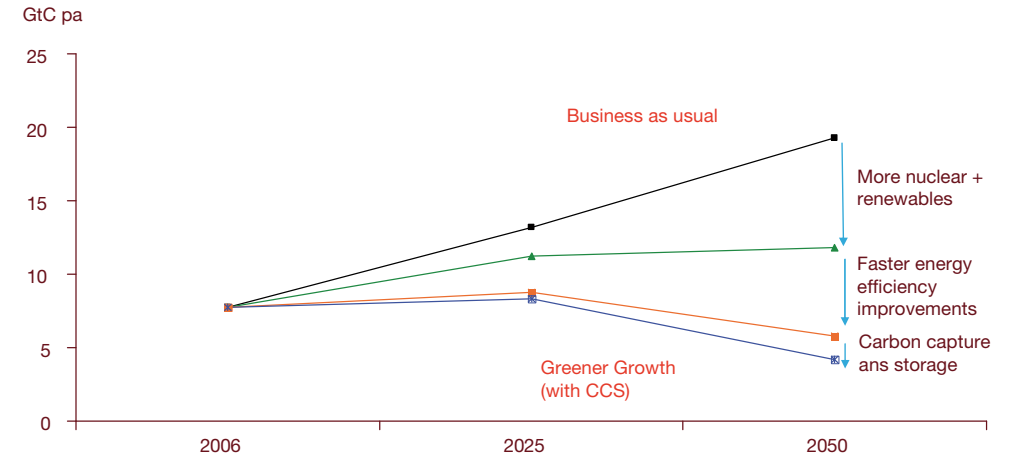
It should be noted that global CO₂ emissions are currently twice as high as the oceans and biomass can absorb. To be able to stabilise CO₂ levels in the atmosphere at between 400 and 475 ppm¹³ and prevent the potentially more severe effects of climate change, CO₂ emissions will have to be cut in half compared to 2006 levels

To reach this objective and account for the new growth hypotheses by 2050, PwC Macroeconomics provided a new scenario called “Greener Growth + Carbon Capture and Storage”. In effect, the original scenario “Green Growth + Carbon Capture and Storage (CCS)” would no longer have met the requirements of CO₂ levels under 450 ppm by 2050. This new scenario implies:

- reducing the energy intensity by 1.5%/year¹⁴, versus 1% in the original scenario;
- making renewable energies and nuclear 50% of the global primary energy production, versus 30% in the original scenario.

Furthermore, like the original scenario, the new one accounts for the use of CO₂ capture technology.

Projected scenarios for CO₂ emissions by 2050



Source : PwC model projections

13 ppm: parts per million, a unit of measure used here to measure the CO₂ concentration in the atmosphere

14 Energy intensity is a measure of an economy's energy efficiency. It is calculated by determining the ratio of energy consumption to production (measured by the Gross Domestic Product).

To achieve the objectives of the “Greener Growth + CCS” scenario, all large countries will have to make reductions. In particular:

- by 2050, the G7 countries¹⁵ will have to reduce their emissions by 80% compared to 2006 levels;
- the E7 countries¹⁶ will have to slow down the growth of their emissions by 2020. After this time, these countries will have to begin reducing their emissions at an increased rate to achieve a level of emissions in 2050 that is slightly lower than 2006 levels.

Achieving the “Greener Growth + CCS” scenario is an ambitious objective, but it is technologically feasible. The following table summarises the technologies directly related to electricity production that are already known and have to be developed to reach the objective of stabilising emissions at 450 ppm:

Many studies have attempted to estimate investment costs across all sectors to stabilise CO₂ levels at between 400 and 475 ppm. The estimates say between 0 and 5% of global GDP needs to be invested by 2050, with an average of around 2 to 3% of GDP¹⁷.

In addition to these investments, PwC Macroeconomics stresses the importance of:

- a mutually accepted distribution by all parties, cooperation between developed and developing countries,
- establishing a global pricing system for carbon,
- additional investments to develop new technologies and transfer them to developing countries

Technologies in the power generation sector that can contribute to reaching the reduction objective by 2050 - Pacala-Socolow (2004) and IEA (2006)

Option	Changes required to reduce emissions by 1 GtC	Likelihood of achieving this change (PwC assessment)
Energy efficiency		
More efficient fossil fuel power plants	Improve projected efficiency of coal-fired plants from projected 40% (32% today) to 60%	High/Medium: more could be done
Improve energy mix		
Switch power plants from coal to gas	Replace 1400 GW of coal plants with gas	Medium: higher gas prices and security of supply concerns have impacted gas development
Nuclear power	Add 700 GW capacity Medium/Low: technical limitations; local environmental concerns; costs if offshore. (twice current levels)	High/medium: costs have fallen but still concerns about safety, waste management, decommissioning costs and terrorism risks
Wind power	Add 2 million 1-MW-Peak windmills (50 times current capacity)	Medium/Low: technical limitations; local environmental concerns; costs if offshore.
Solar power	Add 2000 GW-peak PV (700 times current capacity)	Low: huge increase needed
Carbon capture and storage		
Storage of carbon captured at baseload power plants	Install CCS at 800GW of coal plants (or 1600GW gas plants)	Medium: requires very large rise in carbon storage capacity

¹⁵ G7 : United States, Japan, Germany, United Kingdom, France, Italy and Canada

¹⁶ E7: China, India, Brazil, Russia, Mexico, Indonesia and Turkey

¹⁷ These figures would be compared to the cost of not taking action on climate change. Only the Stern report proposes a potential cost of 5 to 20% of global GDP if nothing is done. However, PwC Macroeconomics has reservations about this type of assessment.

5. Climate Change as Seen by Corporate Leaders in 2007

In 2008, PricewaterhouseCoopers published the 11th edition of the “Annual Global CEO Survey” study, which presents the results of a survey of 1,150 corporate leaders in 50 countries¹⁸. We are including here the major findings of this study related to climate change.

When asked which major risk factors are likely to affect their company’s growth, the leaders first and foremost mentioned the lack of crucial skills and recovery of the global economy. Climate change only ranked 10th (out of 14), which suggests that most corporate leaders do not see climate change as a serious threat in the medium term.

At the same time, we noted that nearly 30% of the industry leaders surveyed view climate change as an opportunity to reduce their costs, develop new “green” products or believe their effort fighting climate change will provide them intangible benefits (better image/reputation, attract new talent).

Nevertheless, we noted that more than half the corporate leaders in Asia expressed fears related to shortages in natural resources (67%), climate change (59%) and pandemic risks (53%). These fears may be caused by projections from experts stressing the heightened risk in this region.

When asked more specifically about their vision of climate change management, the vast majority of the CEOs called for more leadership from governments.

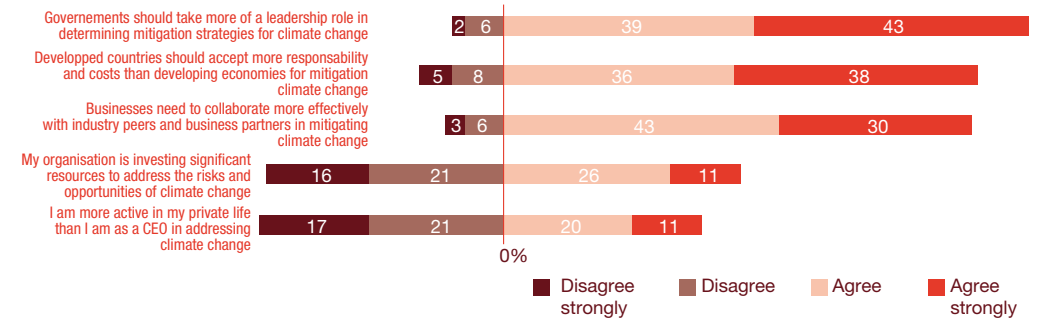
Similarly, most leaders surveyed emphasised the need for better collaboration between businesses in fighting climate change.

Lastly, there was a near consensus on the need for developed countries to take a stronger stand than developing countries.

¹⁸ The number of CEOs surveyed was determined in proportion to a country’s GDP in 2004.

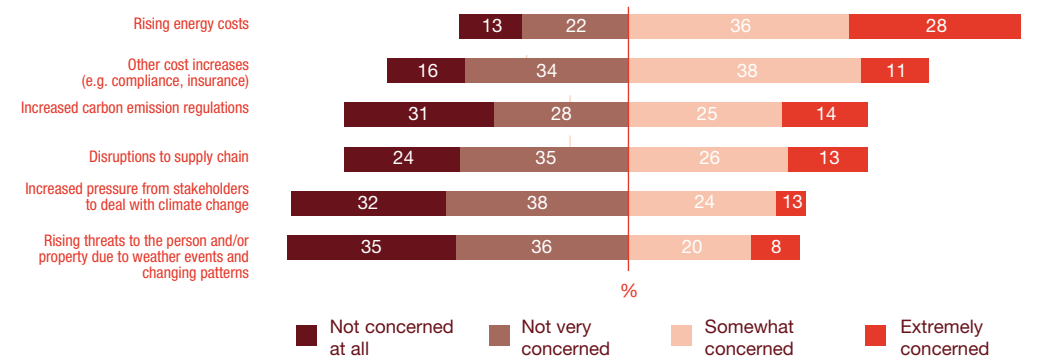
To what extent do you agree or disagree with each of the following

(Base: all respondents 1150 participants)



Source : PricewaterhouseCoopers, 11^e sondage annuel des CEO, 2008

How concerned, if at all, are you about each of these potential threats that could impact on the growth of your business? (Base: All respondents 1,150)



Source : PricewaterhouseCoopers 11th Annual Global CEO Survey 2008



Annexe A

Data per company

		2001			2002			2003			2004			2005			2006			2007		
Country	Company	Production (TWh)	Emission (kt CO ₂)	kg CO ₂ /MWh	Production (TWh)	Emission (kt CO ₂)	kg CO ₂ /MWh	Production (TWh)	Emission (kt CO ₂)	kg CO ₂ /MWh	Production (TWh)	Emission (kt CO ₂)	kg CO ₂ /MWh	Production (TWh)	Emission (kt CO ₂)	kg CO ₂ /MWh	Production (TWh)	Emission (kt CO ₂)	kg CO ₂ /MWh	Production (TWh)	Emission (kt CO ₂)	kg CO ₂ /MWh
Fr/Uk/Ger	Groupe EDF	614	82 117	134	650	91 348	141	669	96 341	144	647	95 736	148	647	93 516	145	655	93 346	142	647	94 088	145
Ger/Uk	Groupe RWE	179	125 250	700	184	135 500	738	179	140 500	787	183	139 100	761	182	142 400	784	185	142 400	771	173	147 060	848
Swe/Ger/Uk	Vattenfall	180	70 989	394	166	68 283	411	160	71 471	448	174	69 971	403	175	71 769	410	165	74 500	450	168	74 100	442
Ger/Uk	Groupe E.ON	175	75 337	429	193	75 393	391	159	73 841	465	162	80 466	374	197	81 500	414	188	79 900	426	217	87 500	403
Spa/It/Fr	Groupe Endesa	118	63 523	538	114	61 786	542	121	64 026	529	126	69 429	550	126	69 998	557	122	65 388	535	121	64 072	530
It/Spa	Groupe Enel	162	87 000	537	137	75 000	547	144	71 468	496	132	63 408	518	119	62 200	521	104	48 500	490	94	46 723	496
Belg/Hol/Fr/It/Port/Pol	Electrabel	106	39 361	371	115	44 481	387	130	41 587	320	125	40 825	327	123	39 361	319	129	40 403	314	141	42 309	300
Uk	British Energy	75	6 724	90	70	5 398	78	73	7 100	98	67	7 155	106	68	7 215	105	58	6 980	120	58	7 823	134
Spa	Iberdrola	58	8 560	148	56	13 550	242	64	7 465	117	66	11 899	179	66	15 966	241	61	12 713	208	66	12 065	183
Czech rep.	CEZ	52	37 198	715	54	34 700	643	61	35 526	582	62	35 707	575	60	33 300	555	66	36 261	553	74	46 854	635
Greece	DEI	48	52 086	1 084	49	51 345	1 050	52	52 409	1 004	53	53 288	1 015	53	52 592	994	52	50 483	969	54	53 040	984
Finland	Fortum	41	11 400	278	48	7 000	146	53	9 143	172	56	7 929	143	52	1 994	38	54	5 821	107	52	3 341	64
Nor/Swe/Fin	Statkraft	38	0	0	49	0	0	42	0	0	34	0	0	49	0	0	46	0	0	45	229	5
Port/Spa	Groupe EDP	41	23 255	573	39	26 899	690	43	23 249	536	39	23 894	614	40	27 800	522	47	24 476	522	47	23 422	495
Uk	Scottish & Southern	23	11 855	525	19	9 347	487	23	12 239	531	23	12 185	524	39	18 900	486	41	25 210	622	47	25 880	555
Spa	Union Fenosa	26	14 525	559	24	16 380	683	26	15 098	584	27	16 539	612	29	16 487	572	31	15 822	514	34	18 203	535
Austria	Verbund	28	3 146	111	35	3 654	105	28	5 000	178	30	4 437	149	29	3 810	131	28	3 701	132	28	3 407	120
Uk	Drax	22	18 735	852	19	16 350	840	26	21 642	833	25	20 519	838	25	20 519	830	27	22 765	840	27	22 160	831
Denmark	Dong : Elsam + Energy E2	29	17 830	615	30	17 530	584	36	21 470	591	29	15 766	552	29	15 766	552	26	11 875	464	20	8 547	432
Fin/Swe	PVO	19	4 900	258	16	6 000	375	18	6 074	337	18	4 950	280	13	1 672	126	18	4 731	264	17	4 402	259
Holland	Nuon	NC	NC	NC	NC	NC	NC	18	14 738	837	19	15 021	799	16	13 926	849	14	11 744	851	17	14 894	856
Total		2 034	753 790	371	2 066	759 943	368	2 124	790 387	372	2 095	788 222	376	2 137	790 691	370	2 116	777 019	367,3	2 148	800 120	372,5

Annexe B

Consolidated Results

		2001			2002			2003			2004			2005			2006			2007		
Country	Company	Production (TWh)	Emission (t CO ₂)	kg CO ₂ /MWh	Production (TWh)	Emission (t CO ₂)	kg CO ₂ /MWh	Production (TWh)	Emission (t CO ₂)	kg CO ₂ /MWh	Production (TWh)	Emission (t CO ₂)	kg CO ₂ /MWh	Production (TWh)	Emission (t CO ₂)	kg CO ₂ /MWh	Production (TWh)	Emission (t CO ₂)	kg CO ₂ /MWh	Production (TWh)	Emission (t CO ₂)	kg CO ₂ /MWh
France	EDF-France	477	17 344 000	36	509	23 690 000	47	513	22 893 000	45	487	20 470 800	42	494	23 707 200	48	491	19 632 000	40	483	20 523 250	43
UK	EDF Energy	12	7 800 000	650	20	15 754 611	772	23	17 460 000	776	25	20 477 828	812	23	18 480 300	807	25	20 777 200	818	26	21 060 450	826
Germany	EnBW	63	15 145 777	462	65	16 766 516	488	75	20 858 100	277	73	19 229 245	263	74	17 811 200	242	75	18 050 900	241	74	17 713 500	241
Italy	Edison Group	62	41 826 772	675	56	35 136 900	624	57	35 130 236	613	61	35 557 800	583	58	33 517 268	576	64	37 321 840	580	65	34 699 257	531
	Edison	23	15 189 772	660	35	20 589 000	588	36	21 136 136	587	36	20 648 000	580	33	22 135 218	663	39	21 407 916	542	41	22 015 791	531
	Edipower	39	26 637 000	683	21	14 547 900	683	21	13 994 100	657	25	14 909 800	587	23	11 382 050	539	25	13 477 806	542	24	12 775 117	531
	Groupe EDF	614	82 116 549	134	650	91 348 027	141	669	96 341 336	144	647	95 735 673	148	647	93 515 968	145	655	93 345 822	142	647	94 088 108	145
Germany	RWE	148	105 000 000	709	149	114 000 000	765	141	113 000 000	803	149	116 000 000	779	149	120 000 000	808	148	117 700 000	794	176	158 000 000	897
UK	RWE UK	31	20 250 000	653	35	21 500 000	623	38	27 500 000	726	34	23 100 000	681	33	22 700 000	680	37	24 700 000	677	34	22 000 000	651
	Groupe RWE	179	125 250 000	700	184	135 500 000	738	179	140 500 000	787	183	139 100 000	761	182	142 700 000	784	185	142 400 000	771	173	147 060 000	848
Centrale Europe	E.ON	142	55 800 000	393	156	52 260 000	335	123	47 158 200	383	127	52 215 190	410	130	53 200 000	410	132	54 000 000	410	136	57 100 000	420
UK	E.ON UK	33	19 536 822	584	37	23 132 702	632	36	26 683 000	743	35	25 086 000	719	37	28 000 000	750	36	25 500 000	710	41	30 000 000	730
Nordic		0	0	0	0	0	0	0	0	0	53	3 164 557	60	30	300 000	10	20	400 000	20	40	400 000	10
	Groupe E.ON	175	75 336 822	429	193	75 392 702	391	159	73 841 200	465	215	80 465 747	374	197	81 500 000	414	188	79 900 000	426	217	87 500 000	403
Spain Portugal	Endesa	95	48 000 000	506	91	45 400 000	500	94	44 039 000	470	96	48 509 253	507	94	50 323 438	538	89	44 492 808	501	91	45 529 000	500
Italy	Endesa Italia	18	10 018 000	570	18	10 881 620	620	18	10 919 000	610	21	11 484 000	550	23	11 681 000	500	25	13 307 240	530	22	11 707 170	530
France	SNET	6	5 504 599	971	6	5 504 599	971	9	9 068 000	956	10	9 435 315	985	9	7 993 880	920	8	7 588 160	920	8	6 835 840	880
	Groupe Endesa	118	63 522 599	538	114	61 786 219	542	121	64 026 000	529	126	69 428 568	550	126	69 998 318	557	122	65 388 208	535	121	64 072 010	530
	Vattenfall	180	70 988 805	394	166	68 282 636	411	160	71 471 000	448	174	69 971 000	403	175	71 768 500	410	165	74 500 000	450	168	74 100 000	442
	Electrabel	106	39 361 000	371	115	44 481 000	387	130	41 587 000	320	125	40 825 000	327	123	39 361 000	319	129	40 403 000	314	141	42 309 000	300
Italy	Enel	162	87 000 000	537	137	75 000 000	547	138	71 467 560	518	126	63 408 000	503	112	56 200 000	501	104	48 500 000	467	94	46 723 200	496
	Groupe Enel	162	87 000 000	537	137	75 000 000	547	138	71 467 560	518	126	63 408 000	518	112	56 200 000	521	104	48 500 000	490	94	46 723 200	496
Portugal	EDP P	28	12 600 000	450	25	15 025 600	601	29	11 400 000	400	26	12 051 710	465	25	14 880 000	590	NC	12 701 000	NC	NC	NC	NC
Spain	Hydrocantabrico	13	10 655 101	846	14	11 873 600	848	15	11 849 000	935	13	11 842 000	913	15	12 920 000	873	NC	11 775 000	NC	NC	NC	NC
	Groupe EDP	41	23 255 101	573	39	26 899 200	690	43	23 249 000	536	39	23 893 710	614	40	27 800 000	695	47	24 476 000	522	47	23 422 000	495

Annexe D

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The report "The World in 2050: Can rapid global growth be reconciled with moving to a low carbon economy?" can be downloaded at:
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The report "The World in 2050: implications of global growth for carbon emissions and climate change policy" can be downloaded at: www.pwc.fr/the_world_in_2050.html.

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