



## I Countries where new units are under construction or about to be built

### Bulgaria

To compensate for the loss of generating capacity due to the closure of Kozloduy's units 3 and 4, Bulgaria plans to build a 2000 megawatts nuclear power plant (NPP) at Belene by 2015-2016. On 3 September 2008, construction of Belene NPP was officially launched, but the project has suffered delays due to difficulties to finance the construction. The construction could resume in spring thanks to an agreement between Russia and Bulgaria.

#### Closure

The country had to shut down Kozloduy's units 3 and 4 on 31 December 2006 before entering the EU. Before the closure of units 3 and 4, Bulgaria covered 60% of the power deficit in southeast Europe. The shut down of units 3 and 4 at Kozloduy resulted in a general decrease in the region's generating capacity. Kozloduy NPP's units 3 and 4 generated around 12% of Bulgaria's total electricity production. To replace the energy produced by the units, more coal will have to be burnt in thermal power plants, which will increase the emissions of greenhouse gases. It will be more difficult for Bulgaria to meet its Kyoto requirements.

#### New Build at Belene

Construction of a 2000 megawatt NPP (two Russian-designed VVER-1000 pressurised water reactor units) in Belene

Vendor Atomstroyexport, a Russian company, won the bid to build the new NPP in November 2006.

Operator The National Electric Company (NEK)

Estimated cost: 3.99 billion €

Financing The Belene NPP project has suffered delays due to difficulties to finance the construction. BNP Paribas won a bid in May 2007 to grant, together with 25 other partners, a €250 million loan for the first year of the construction, but cancelled later its loan. A strategic investor should provide up to half of the funding, but Electrabel and then RWE pulled out in 2009. NEK is also expected to apply for a Euratom loan. In November 2007, the Socialist-led government decided to provide a state guarantee for the loan that will be taken up by the state-run utility, NEK. The Euratom loan would probably amount to € 300 million. If the application is successful, it will be the first EURATOM loan to be granted inside the European Union (EU) in 20 years. The National Electric Company (NEK) will also seek a loan from the European Investment Bank. The government announced in fall 2009 that it would reduce NEK's stake from 51% to 20%-30% and is now seeking new investors. Ten companies have submitted expressions of interest and the strategic investor is expected to be selected by the end of 2010.

History Construction of the Belene facility began in 1987, but was suspended in 1991 following pressure from environmental groups.

Goals The new plant will generate power for domestic consumption and secure the country's position as a regional power exporter.

On 7 December 2007, the European Commission (EC) announced that it had approved Bulgarian National Electric Company NEK's project to construct two Russian-designed VVER-1000 pressurised water reactor units at Belene. On 3 September 2008, construction of Belene NPP was officially launched, but the project has suffered delays due to difficulties to finance the construction.

## Finland

In 2002, the Finnish government gave permission for the building of a new NPP unit, Olkiluoto 3. The new unit is being built for TVO by AREVA NP (which is delivering the reactor plant) and Siemens (which is delivering the turbine plant) and is an EPR (European Nuclear Pressurised Water Reactor). The original commissioning date of the third reactor was set to 2009, but later the commissioning deadline was moved to summer 2013. Fortum, TVO and Fennovoima, have submitted applications for a decision-in-principle on the construction of new reactors. On 21 April 2010, Mauri Pekkarinen, Finland's Minister of Economic Affairs, announced that the Finnish government had given its "preliminary permission" to the Finnish utility TVO and to Fennovoima (a consortium including German utility E.ON AG) to build two more nuclear reactors in Finland. On 1 July, the Finnish parliament voted with a clear majority (120-72 and 121-71) in favour of the applications submitted by TVO and Fennovoima for the construction of two more nuclear reactors in Finland.

### **Governmental policy**

Finland has clearly opted for nuclear energy as part of the solution to tackle the issues of security of supply and climate change. In 2002, the Finnish government gave permission for the building of a new NPP unit, Olkiluoto 3.

### **Olkiluoto 3**

Vendor Areva NP and Siemens are building the new unit for TVO

Operator TVO

Reactor Type The reactor will be a 1600 MWe EPR (European Nuclear Pressurised Water Reactor) and will make use of the most advanced technology available.

Start of construction September 2005

Expected start of operation It is due to start commercial operation in 2013.

Fuel supply Areva has been awarded a contract by TVO for the supply of uranium and fuel fabrication services for the future EPR.

Cost TVO estimates the cost of the EPR to be around €3 billion.

EC's approval In 2004, the European Commission gave a positive opinion under the EURATOM treaty on the construction of the country's fifth nuclear power reactor. It judged that Finland's fund for spent nuclear fuel management would be sufficient to cover liabilities and that the project would help combat global warming and provide the necessary amount of electricity.

Decommissioning The decommissioning funds set aside to cover future liabilities are owned and managed by the State Nuclear Waste Management Fund and are independent of the operators.

Waste management After the Finnish Nuclear Energy Act was amended in 1994 so that all nuclear waste produced in Finland must be disposed of in Finland; Olkiluoto has been determined to become the site of disposal of Finnish nuclear waste. Currently, a joint venture company Posiva Oy is constructing an underground characterisation facility (ONKALO) at Eurajoki, Finland, close to the Olkiluoto plant. When complete, this facility will handle the final disposal of nuclear fuel for both TVO (60%) and Fortum (40%). The deep geological repository will be contained in two billion-year-old igneous rock, 500 meters below the surface. It is expected the facility will commence operations in 2020.

## **Recent developments**

In March 2007, Finnish power companies Teollisuuden Voima Oy (TVO) and Fortum said that they would carry out separate environmental impact assessments (EIA) that could lead to building two additional units – one each at their respective nuclear plants of Olkiluoto and Loviisa. In February 2008, the EIA for the possible construction of a fourth reactor at Olkiluoto NPP was submitted to the Ministry of employment and energy. In April 2008, the one for the possible construction of a reactor at Loviisa was also sent to the Ministry. In January 2008, Fennovoima (a new Finnish energy company that aims at constructing a new 1,500–2,500 MW nuclear power plant in Finland) launched an EIA in Kristinestad, Pyhäjoki, Ruotsinpyhtää and Simo for the potential building of a NPP. The EIA report was submitted to the Ministry of employment and economy in October 2008. Fortum, TVO and Fennovoima, have submitted applications for a decision-in-principle on the construction of the new reactors. On 21 April 2010, Mauri Pekkarinen, Finland's Minister of Economic Affairs, announced that the Finnish government has given its "preliminary permission" to the Finnish utility TVO and to Fennovoima (a consortium including German utility E.ON AG) to build two more nuclear reactors in Finland. If the decision is rubber-stamped by the Finnish parliament later in the year, the two reactors, when built, would bring the total reactor fleet in Finland to six.

## France

The EDF board approved in May 2006 the building of a European pressurised reactor (EPR) at a site near Flamanville, in Normandy and in April 2007, a governmental decree gave the final authorisation. The unit, which is currently under construction, is expected to be completed by 2014. The French Presidency announced on 30 January 2009 that the construction of a European pressurised water reactor (EPR) will begin at Penly in 2012 and will be connected to the grid in 2017.

A law on radioactive waste management and a law on transparency and security in the nuclear field were passed in June 2006, following a public debate on the subject.

The international consortium of ITER announced at the end of June 2005 that France would be the site of the world's first large-scale, sustainable nuclear fusion reactor in Cadarache.

## **Governmental policy**

France is the world's largest nuclear power generator on a per capita basis and ranks second in total installed nuclear capacity, behind the United States. In the 1970's, the French government began promoting nuclear power to reduce its reliance on energy imports. In 2009, France's 58 nuclear reactors generated around 75% of the country's electricity. French nuclear power is efficient and cheap. Consequently, French electricity tariffs are the cheapest in Europe.

### **Flamanville 3:**

EDF announced in November 2004 that it would build an EPR unit, at a site near Flamanville.

Vendor Areva NP has set up a partnership with Siemens, Germany

Operator Electricité de France (EDF)

Reactor type The European Pressurized Reactor (EPR) is a third-generation reactor, designed to be safer, more efficient, and less susceptible to a terrorist attack than existing reactor models.

Each EPR reactor should produce around 1600 megawatts (MW) of electricity, compared with the 900 MW that most second-generation reactors currently generate. In 2005, EDF announced plans to build at least one EPR a year, starting in 2020.

New project's approval The EDF board approved in May 2006 building a European pressurised reactor (EPR) at a site near Flamanville, in Normandy and in April 2007, a governmental decree gave the final authorisation.

Start of construction December 2006

Expected Start of operation 2014

Estimated cost €3, 3 billion

Waste management A new law on radioactive waste management was passed during the second semester 2006, following a public debate on the subject. It provides a legislative framework for the management of radioactive waste and defines the rules that utilities must comply with to secure funds for decommissioning and waste management in the long-term.

### **New build**

The French Presidency announced on 30 January 2009 that the construction of a European pressurised water reactor (EPR) will begin at Penly, on the Channel coast near Dieppe, in 2012 and will be connected to the grid in 2017.

### **ITER**

The international consortium of ITER announced at the end of June 2005 that France would be the site of the world's first large-scale, sustainable nuclear fusion reactor in Cadarache, a project that many scientists see as crucial to solving the world's future energy needs.

## Lithuania

The Lithuanian government confirmed plans in December 2006 to build a new nuclear power by 2018 in a new national energy strategy. On 8 December 2009, Lithuania's government officially launched a call for tender for strategic investors. The potential investors had to send their bids by 29 January 2010 and the negotiations should be finalized by the end of 2010. In April 2009, the Ministry of Environment of the Republic of Lithuania, after evaluating the Environmental Impact Assessment (EIA) report, adopted a resolution allowing the construction of the new Visaginas NPP. Lithuania adopted on 6 October 2010 an updated version of its energy strategy that aims to ensure security of supply and improve the competitiveness of the country's economy while reducing GHG emissions and increasing energy efficiency. To reach these goals, the construction of the Visaginas nuclear power plant (NPP) is earmarked as one of the key elements. The new plant should come into commercial operation by 2018/2020.

### **Closure**

Bowing to EU pressure, Lithuania's parliament agreed, in October 1999, to close one of Ignalina's two reactors by 2005. The European Commission (EC) also required Lithuania to shut the second reactor by 2009. It was one of the requirements of the accession treaty of Lithuania. The first reactor at the Ignalina NPP was shut down on 31 December 2004 and the second on 31 December 2009.

Decommissioning The decommissioning funds for the shut down of Ignalina 1 and 2 are managed by the State, independently of the plant operator.

Concerns The energy production decrease, combined with economic growth and a rise in power demand, will result in a negative power balance and energy shortages. The portion of electricity generated by Ignalina NPP will have to be replaced primarily by electricity produced at gas-fired power plants. This will significantly increase CO2 emissions. Natural gas and oil are imported from Russia. When the Ignalina NPP is closed, the main primary energy source will be natural gas. This implies that Lithuania will become heavily dependent upon Russian for natural gas imports.

Ignalina employees will lose their jobs and have a limited chance of switching to another kind of work or of moving home to find work elsewhere.

### **New build**

**Approval of the plant** On 27 February 2006, the three Baltic States (Lithuania, Latvia, and Estonia) agreed on the joint construction of a NPP in Lithuania by 2015. The Lithuanian government confirmed plans in December 2006 to build a new nuclear power plant by 2015 in a new national energy strategy. On 28 June 2007, Lithuania's parliament adopted a law on building a new nuclear power plant. Lithuania adopted on 6 October 2010 an updated version of its energy strategy that aims to ensure security of supply and improve the competitiveness of the country's economy while reducing GHG emissions and increasing energy efficiency. To reach these goals, the construction of the Visaginas nuclear power plant (NPP) is earmarked as one of the key elements.

**Co-operation** On 2 February 2007, Poland and Lithuania signed a co-operation agreement for the building of a nuclear power plant (NPP) in Ignalina. Poland will hold a 22% share in the joint venture. This cooperation agreement has not been confirmed.

**Utilities** The energy companies of Lithuania, Latvia and Estonia (Lietuvos Energija, Eesti Energia and Latvenergo) have signed a memorandum of agreement on the arrangements for the building of the nuclear facility. This agreement has not been confirmed.

**Capacity of the new plant** 3,200 MWe

**Estimated Cost** €5-6 billion

**Financing** The creation of the national investor—LEO LT—was agreed between the Government of Lithuania and NDX Energija on 20 December 2007 to raise funds for the construction of the plant, but it was liquidated in September 2009. On 8 December 2009, Lithuania's government officially launched a call for tender for strategic investors. The potential investors had to send their bids by 29 January 2010 and the negotiations should be finalised by the end of 2010.

**EIA** In 2007, Lietuvos Energija AB started the environmental impact assessment for the new nuclear power plant in Lithuania. This evaluates the impacts of the new nuclear power plant of up to 3400 MWe at Ignalina and takes into consideration all commercially available and technically feasible reactor types. In April 2009, the Ministry of Environment of the Republic of Lithuania, after evaluating the Environmental Impact Assessment (EIA) report, adopted a resolution allowing the construction of the new Visaginas NPP.

## **Romania**

The second reactor of Cernavoda Nuclear Power Plant (NPP) in Romania was inaugurated by the Prime Minister, Calin Popescu-Tariceanu on 5 October 2007. Meanwhile he announced that the government intends to build a second nuclear power plant and to complete Cernavoda 3 and 4 in order to secure Romania's energy supply.

### **History of Cernavoda NPP**

The first nuclear unit at the Cernavoda NPP is a PHWR CANDU 6 type model, designed by Atomic Energy of Canada Ltd (AECL). In the late 1970s, a five-unit nuclear power plant was planned at Cernavoda. However, a lack of financial resources and a drop in power demand after 1990 resulted in the suspension of construction work on the last four units, and efforts were refocused instead on building Unit 1. Unit 1 began operating in 1996. Romania is required to shut down its obsolete thermal power plants to comply with the EU environmental standards. Cernavoda will replace the production of the thermal units and contribute to the reduction of CO<sub>2</sub> emissions.

### **Completion of Cernavoda-2**

It came into commercial operation in October 2007. The Prime Minister, Calin Popescu-Tariceanu inaugurated it on 5 October.

Financing In 2000, the government decided that completion of Cernavoda-2 was a high priority and provided some €60 million for the construction project. Further finance was provided in 2002-03, with a €382.5 million package announced by the government that included €218 million from Canada. In 2004, a €223.5 million Euratom loan was approved by the European Commission for completion of Unit 2, including safety upgrades. The construction of Cernavoda's Unit 2 was resumed in March 2003.

Reactor type A PHWR CANDU 6 type model, designed by Atomic Energy of Canada Ltd (AECL)

Capacity 650 MWe

Vendor The unit was built by AECL-Ansaldo-SNN S.A. management team

Operator Nuclearelectrica

Total cost of the project About €777 million.

### **Construction of Cernavoda-3 and 4**

Governmental approval On 20 June 2007, the government approved a strategy to select investors for the construction of Cernavoda's units 3 and 4.

Expected start of completion 2017

Companies On 5 November 2007, binding offers from six companies (Arcelo-Mittal of Romania; CEZ of the Czech Republic; Electrabel of Belgium; Enel of Italy; Iberdrola of Spain; RWE of Germany) for the completion and commissioning of units three and four of Romania's Cernavoda nuclear power plant were accepted. EnergoNuclear was formed in March 2009 to undertake the construction, commissioning and operation of the new Cernavoda units. The company is 51 percent owned by Romanian-utility Nuclearelectrica, along with joint venture partners Czech utility CEZ, France's GDF-Suez, Italy's Enel, Germany's RWE Power, Spain's Iberdrola and steel producer ArcelorMittal. However, in January 2011, GDF-Suez, RWE and Iberdrola decided to pull out of the project due to economic and market uncertainties. On 8 March 2010, Canada and Romania have signed a contract for services related to completion of units 3 and 4 at Romania's Cernavoda nuclear power plant.

Operator Nuclearelectrica

Estimated cost The investment is estimated to €2.2 billion.

Nuclear fuel SNN S.A. has also a manufacturing license for producing CANDU 6 nuclear fuel elements and can provide the fuel production capacity required to meet demand from two Cernavoda units.

### **Future developments**

The Prime Minister also announced that the government intends to build a second nuclear power plant. The Minister of Economy has been asked to find a location where the new plant could be built and several surveys have already been carried out. The potential locations of the new NPP are either along the Olt river, in Faragas or in Moldova.

## Slovakia

The Mochovce NPP has two VVER 440 type V-213 reactors in operation and two uncompleted reactors. In February 2007, Slovakia's Prime Minister, Robert Fico and Enel's general director Fulvio Conti announced that Italy's Enel, majority owner of Slovakia's dominant power producer, Slovenske Elektrarne, will complete the third and fourth units of the nuclear power plant at Mochovce, southern Slovakia by 2013. On 3 November 2008, Prime Minister Fico and Fulvio Conti announced that construction of units 3 & 4 at Mochovce had begun. The two new reactors will have a capacity of 440 MWe each and are due to be completed in 2012 and 2013 respectively. In December 2008, the Slovak government chose Czech utility CEZ as its strategic partner in proposals to construct the fifth reactor of the Bohunice NPP by 2020.

### **The Bohunice NPP**

It has three reactors in operation and two reactors are being decommissioned.

Operator: Slovenské elektrárne

Reactor type: Its two V-1 s units are equipped with Russian VVER reactors (of the older V-230 model).

Capacity: 440 MWe

Start of operation: 1984 and 1985

Upgrade: They were upgraded from 1991 to 2000, which brought them up to international safety standards, thereby fulfilling all the Slovak nuclear regulatory authority's (UJD SR) requirements. The UJD SR was created in 1993. It is the independent regulatory body for licensing, safety, waste management and safeguards.

Closure The Slovak government is due to decommission the Bohunice NPP's two oldest reactors as part of the energy chapter of Slovakia's accession treaty with the EU. Bohunice's unit 1 was shut down on 31 December 2006, and the second reactor was closed on 31 December 2008. Moreover, for environmental reasons, Slovakia may have to shut down parts of two thermal power plants at Novaky and Vojany. Meanwhile, electricity consumption is rising by 3% a year, which could result in power shortages in the country.

Decommissioning The EU will provide funds to help to support projects linked to the closure both of the Bohunice V-1 nuclear power reactors.

New build In December 2008 the Slovak government chose Czech utility CEZ as its strategic partner in proposals to construct the fifth reactor of the Bohunice NPP. The new unit should begin to produce electricity in 2020. While CEZ will be the strategic partner, the state will retain a controlling interest.

### **The Mochovce NPP**

It has two VVER 440 type V-213 reactors in operation and two yet-to-be-completed reactors.

Operator Slovenské elektrárne

Capacity 440 MWe

Start of operation: 1998 and 1999

New build In February 2007, Slovakia's Prime Minister, Robert Fico and Enel's general director Fulvio Conti announced that Italy's Enel, majority owner of Slovakia's dominant power producer, Slovenské elektrárne, will complete the third and fourth units of the nuclear power plant at Mochovce, southern Slovakia by 2013. The European Commission gave on 15 July, its conditional approval for the completion of units 3 and 4 at Mochovce. Construction of the two units began on 3 November 2008.

## II Countries where new build projects are in the pipeline

### Czech Republic

In July 2008, CEZ asked the Environment Ministry to conduct an environmental impact study for the potential construction of two extra units at its Temelin NPP. The study should take about two and a half years. In July 2009, the Czech government adopted a so-called strategy document – 'Policy of territorial development' – that sets out conditions to be met for key infrastructure projects such as power plants. The document notes proposals to extend Temelin and Dukovany and mentions six possible sites for the long-term storage of radioactive waste. In August 2009, an open tender process was launched for the construction of two additional reactor units at the Temelin NPP. The successful supplier is expected to be selected by 2012.

#### Governmental policy

According to the Czech Republic's State Energy Policy, which was launched in March 2004, coal will remain the country's primary energy source in the coming decades, despite the increased use of natural gas and nuclear energy. The Minister of Trade and Industry announced in May 2005 that the building of new nuclear units was being considered. However, in January 2007, the new coalition government (Civic Democratic Party, Christian Democratic Party and Greens) declared that no new nuclear unit would be constructed for the next 4 years. CEZ recently asked the Environment Ministry to conduct an environmental impact study for the potential construction of two extra units at its Temelin NPP. The study should take about two and a half years and the current government is likely to be replaced by a new one by then. The favourite option is building two new blocks at the power group's 2000 MW nuclear plant in Temelin.

#### The construction of the Temelin NPP

The building of a fourth unit NPP began in 1987, but was questioned by the "velvet revolution" of November 1989. In 1990, plans to construct units 3 and 4 were abandoned, and work on units 1 and 2 slowed down. In January 1993, Czechoslovakia split into two separate states: the Czech Republic and Slovakia. The Czech Republic approved the completion of the two units at Temelin, but decided that a major modification to the design was required to improve its safety and reliability.

Vendor A contract was signed with Westinghouse.

Reactor Type There are now two VVER-1000 units that satisfy all the Western safety standards.

Start of operation Temelin's units 1 and 2 became fully operational on 11 October 2004.

Political issue However, the commissioning of the NPP took much longer than usual, not only because of technical problems, but also because of Austria's reluctance to have a NPP near its border. This issue was addressed by a bilateral agreement signed under the auspices of the European Union, referred to as the Melk Agreement.

Public acceptance Around 77 % of Czechs support the extension of Temelin NPP according to a recent survey by the statistical agency STEM carried out in March 2009.

**New Build:** In July 2008, CEZ asked the Environment Ministry to conduct an environmental impact study for the potential construction of two extra units at its Temelin NPP. The study should take about two and a half years. In July 2009, the Czech government adopted a so-called strategy document – ‘Policy of territorial development’ – that sets out conditions to be met for key infrastructure projects such as power plants. The document notes proposals to extend Temelin and Dukovany and mentions six possible sites for the long-term storage of radioactive waste. In August 2009, an open tender process was launched for the construction of two additional reactor units at the Temelin NPP. In February 2010, CEZ announced that the three bidders complied with qualification requirements: Westinghouse Electric Corporation with its AP1000 reactor unit; Areva with its European Pressurised Water Reactor (EPR1600); and a consortium comprising of Skoda, Atomstroyexport and Gidropress with the MIR (Modernised International Reactor) 1200 unit. The supplier is expected to be selected by 2012.

## Hungary

Hungary's former Prime Minister, Ferenc Gyurcsany, announced on 16 February 2009 a proposal to double the capacity of the country's sole nuclear power plant (NPP), which is located at Paks, about 120km south of Budapest, by the Danube river. The Members of Parliament overwhelmingly approved it on 31 March 2009 with 330 votes in favour, six against and ten abstentions. The new reactors should be completed by 2025.

The country has only one nuclear power plant, Paksi Atomerőmű Rt., which has four Russian-made reactors that entered commercial operation between 1983 and 1987; and generates about 2000MW of electricity. The Hungarian Power Company (MVM), together with its parent company State Asset Management Ltd, owns the NPP. Nuclear power accounts for around 37% of total electricity production (source IAEA), whereas gas and coal generate respectively 35% and 20% of the country's electricity.

### **Lifetime extension**

In September 2005, the Hungarian government approved in principle the expansion of the life span of the country's NPP by 20 years. In November, the Hungarian parliament gave the final approval. The four reactors were designed to have a lifetime of 30 years. A 2001 review concluded that there were no technical or safety constraints to prevent such a lifetime extension from being granted.

**Estimated cost** The cost of the project will be \$900 million, which will be financed by cash flow and invested primarily in engineering work up to 2030.

### **New Build**

Former Prime Minister, Ferenc Gyurcsany, announced on 16 February 2009 a proposal to double the capacity of the country's NPP. The proposal was included among other measures aimed at fighting the current economic crisis. The Members of Parliament overwhelmingly approved it on 31 March. The approval of the Parliament is required before any further step is taken with 330 votes in favour, six against and ten abstentions.

**Estimated cost** Two new units could be added to the current plant. Each 1000 MW nuclear reactor would cost around 600-900 billion forints (2-3 billion €).

**Expected start of construction** The commissioning, planning and implementation of the construction project is expected to take a minimum of six years. Therefore, the overall period leading to construction will be at least 11 years. The new reactors should be completed by 2025.

## Italy

In May 2008, the right wing party won the general elections. The Industry Minister, Claudio Scajola, declared on 22 May that the new government plans to restart the country's nuclear power program and to start building the first NPP by 2013. The Italian Senate adopted on 10 July 2009 a bill bringing to an end a ban on the use of nuclear energy that had been in place since 1987. However in January 2011, the constitutional court ruled that a referendum could be held to decide on nuclear new build.

### **Phase out policy**

Italy had one of the earliest nuclear energy programmes in Europe with a total installed net capacity of 1 423 MWe at four sites: Garigliano, Latina, Caorso and Trino. The country shut down all its nuclear power plants following a referendum in 1987 during which voters rejected a series of measures to promote nuclear technology. Nersa, the joint venture operating the 1 200 MW Superphenix reactor at Creys-Malville, in which Enel held 33% stake, was dissolved after the definitive closure of the reactor in 1998. Today Italy has no nuclear reactor operating on its own soil, but it relies on imports of nuclear electricity from its neighbours. Italy, which has few domestic energy resources, is the world's largest electricity importer. Electricity prices in Italy are heavily dependent on oil and gas imports, which are some 45% higher than the European average.

### **Recent developments**

Nicolas Sarkozy, the French President and Silvio Berlusconi, the Italian Prime Minister signed on 24 February 2009 an agreement which paves the way for the building of nuclear power plants (NPP) in Italy, using French technology and the participation of ENEL, Italian Electricity Utility, in the construction of NPPs in France.

The Italian Senate adopted on 10 July a bill bringing to an end a ban on the use of nuclear energy that had been in place since 1987. The announcement paves the way for the building of nuclear power plants (NPPs) in Italy. Under the new law, the government will have six months to select potential sites for new nuclear power plants. The new law covers a large range of areas including nuclear safety, licensing, research, potential sites' selection and decommissioning. However in January 2011, the constitutional court ruled that a referendum could be held to decide on nuclear new build.

### **Energy company**

ENEL's subsidiary, Slovenske Elektrarne, operates nuclear reactors in Slovakia and expects to complete two new nuclear power units in this country. In the framework of the Italian-French agreement, Fulvio Conti, the CEO of Enel and Pierre Gadonneix, the Chairman of EDF, signed two Memoranda of Understanding to study the feasibility of constructing at least four EPR units to be built in Italy and to extend Enel's participation in the French nuclear programme. The first EPR reactor in Italy should come into operation by 2018. On 3 August 2009 Enel and Electricité de France (EDF) announced the creation of a joint venture named 'Sviluppo Nucleare Italia' to develop feasibility studies for the construction of at least four advanced third generation EPR units.

ENEL, which had already acquired a 12.5% share in May 2005 in the first European Pressurised Reactor (EPR) being built in France at Flamanville (Normandy) by EDF, intends to purchase another 12.5% share in France's second EPR to be constructed at Penly.

## The Netherlands

In January 2006, the Dutch government decided to prolong the life of the country's sole nuclear power plant for another twenty years, to 2033. In February 2006, the Dutch Environment Ministry Mr van Geel said the Netherlands could not exclude the construction of a second nuclear power plant. The government is to decide on a solution for waste management by 2016, before a new plant becomes operational. On 17 February, the Economics Minister, Maxim Verhagen, sent a letter to the parliament allowing the construction of a new nuclear unit to begin in the south in 2015.

### **Reversal of phase-out policy**

Country's sole operational NPP The Borssele PWR (Pressurised Water Reactor) NPP  
Reactor type 450-megawatt (480 MW gross) pressurised water reactor (PWR) unit

Vendor Siemens

Operator EPZ

Start of operation in 1971.

Lifetime extension Decisions taken by the Dutch government and the Parliament to build new NPPs were suspended twice. In 1986, the government abandoned its plan to expand the number of NPPs following the Chernobyl accident. The Dutch government and the electricity producers agreed, in December 1994, that the Borssele NPP should be shut down at the end of 2003. However, in February 2000, the State Council cancelled the time limit of 31 December 2003 and there was no longer a time limit specified in the license for the Borssele NPP. In June 2005, the ruling coalition reversed its previous policy of closing down the country's only remaining nuclear power reactor by 2013. In January 2006, the Dutch government decided to prolong the life of the country's sole nuclear power plant for another twenty years, to 2033.

Explanation The main reason for this decision is to ensure security of supply and curb greenhouse gas emissions. The change is based on a Christian Democratic Alliance report on sustainable energy that was supported by the VVD. All parties in the governing coalition now agree that the Borssele NPP must remain operational.

### **New build**

The government is to decide on a solution for waste management by 2016, before a new plant becomes operational. On 17 February, the Economics Minister, Maxim Verhagen, sent a letter to the parliament allowing the construction of a new nuclear unit to begin in the south in 2015. The letter indicates that one of the two companies, Delta NV and Energy Holding BV that are willing to build the reactor, will be granted a license, provided it complies with safety requirements and does not require public subsidies. It will be up to the operator to decide whether it wants to reprocess its waste and financial resources for decommissioning will have to be available even before the construction starts. The new unit could start producing electricity by 2019/2020.

## Poland

In January 2005, Poland's Council of Ministers approved a policy document entitled Energy Policy up to 2025, which mentioned for the first time in 15 years the possibility of building a nuclear power plant in Poland. It is planned to have the country's first nuclear power plant in operation by 2021 or 2022. The Polish Prime Minister, Donald Tusk, announced on 13 January 2009 that Poland had "adopted a Resolution on nuclear energy...and that by 2020 electricity will be generated by one or two nuclear power plants." Hanna Trojanowska, Government Commissioner for nuclear energy, announced on 16 March the results of a survey carried out by a panel of experts on the siting of future nuclear power plants (NPP) in Poland. The survey identified Zarnowiec, located on the Baltic Sea 40 km from Gdansk, as the best location for the first NPP to be built in the country by 2020.

### **History of nuclear power**

Though Poland relies traditionally on coal to meet its energy needs, in the early 70's the Polish government decided to build nuclear power plants. The site for the first nuclear power plant was selected and an agreement on co-operation in the field of nuclear power was signed between Poland and the Soviet Union. For the first Polish nuclear power plant, in Zarnowiec, four VVER-440-213 Soviet-design units were chosen. The construction work started in 1984. However, Soviet technology was perceived as being technically unreliable, which was later confirmed by the Chernobyl catastrophe. Therefore, when Poland gained its independence, the government decided to stop the construction of the Zarnowiec NPP. In recent years, Poland has experienced significant economic growth and electricity consumption is expected to rise by 80-93% by 2025. Coal is still the major energy source in Poland and many coal-fired power plants have been in operation for over 30 years and need to be modernised or decommissioned.

### **New build**

Though coal remains the main energy source in Poland and things will not change, a major shift in the Polish energy policy has occurred. In January 2005, Poland's Council of Ministers approved a policy document entitled Energy Policy up to 2025, which mentioned for the first time in 15 years the possibility of building a nuclear power plant in Poland. The Polish Prime Minister, Donald Tusk, announced on 13 January 2009 that Poland had "adopted a Resolution on nuclear energy...and that by 2020 electricity will be generated by one or two nuclear power plants."

Location Hanna Trojanowska, Government Commissioner for nuclear energy, announced on 16 March the results of a survey carried out by a panel of experts on the siting of future nuclear power plants (NPP) in Poland. The survey identified Zarnowiec, located on the Baltic Sea 40 km from Gdansk, as the best location for the first NPP to be built in the country by 2020.

Expected start of operation It is planned to have the country's first nuclear power plant in operation by 2020.

Goals Nuclear power aims to help Poland meet its increased electricity demand, reduce its greenhouse gas emissions, and ensure security of supply.

Financing Any nuclear new build should, in the first instance, be funded by private money. If by 2010 no investor is found, the government may consider allocating public funds. Northern Poland (Pomorze), which currently lacks an energy network, will probably be chosen as the location for the first nuclear power plant.

## Slovenia

On 20 November 2009, the Economy Minister, Matej Lahovnik, announced that the planned second reactor at the Krsko Nuclear Power Plant (NEK) would be completed between 2020 and 2025. On 14 January 2010, the Slovenian utility, GEN-energija, sent an application to the Economy Ministry for a permit to build a second unit at the Krsko Nuclear Power Plant (NPP), Slovenia's sole nuclear site. The utility plans to build a generation III PWR reactor with a capacity from 1100MW to 1600MW.

### **Governmental policy**

In Slovenia, the nuclear phase-out policy has been abandoned. Indeed, it appears very difficult for Slovenia to ensure security of supply and to meet its Kyoto targets without nuclear power. Nuclear energy accounts for 40% of total electricity production and energy consumption is rising. In 2004, a resolution was adopted by the government in its National Energy Program that states that the nuclear option must be kept open. The government that was elected in 2004 is in favour of nuclear energy and no party in the Parliament is against it. Efforts continue to be made to increase energy efficiency. The nuclear option is part of the new National Energy Programme that will be debated in the National Assembly in spring 2010.

### **The Krsko NPP**

It was built in 1983, together with Croatia, at a time when both countries were part of the former Yugoslavia.

The agreement that was signed on 19 December 2001 and ratified on 25 February 2003 specified that Slovenia and Croatia are equal co-owners of Krsko and that they have shared the costs of operating and production since July 2002.

Operator GEN energija (merger between Power plant Krško (NEK), Thermal power plant Brestanica (TEB) and the so called power plants "Savske elektrarne Ljubljana" (SEL).

Reactor type A Pressurised Light Water Reactor (PWR) unit

Capacity 696 MWe

Closure Krško NPP is due to be shut down by 2023, but the government is considering extending its lifetime.

### **New Build**

In 2006, a package of Slovenian National Development Projects was adopted by the government. It includes also a project of "Building a second NPP at Krško site" as an option. Efforts continue to be made to increase energy efficiency. On 20 November 2009, the Economy Minister, Matej Lahovnik, announced that the planned second reactor at the Krsko Nuclear Power Plant (NEK) would be completed between 2020 and 2025. On 14 January 2010, the Slovenian utility, GEN-energija, sent an application to the Economy Ministry for a permit to build a second unit at the Krsko Nuclear Power Plant (NPP), Slovenia's sole nuclear site. The utility plans to build a generation III PWR reactor with a capacity from 1100MW to 1600MW. Technical studies have shown that the construction of the new unit is justified by economic, security of supply and environmental considerations. The new unit, which is planned to be completed between 2020 and 2025, will replace the current one that generates around 40% of the country's total electricity

production. The Parliament's decision on the new unit expected later this year should not pose any problem, since nuclear has been uncontroversial in the country for quite some time and no parliamentary party opposes it.

## Sweden

On 5 February 2009, the Swedish government announced in a statement that it intends to reverse the country's long-standing ban on nuclear energy and allow the building of new nuclear reactors to gradually replace its existing nuclear fleet. In February 2010, the Swedish government put forward a draft law that would allow the construction of a maximum 10 new nuclear units in the country to replace existing units as they are shut down. The Swedish parliament voted on 18 June 2010 to officially bring to an end the nuclear phase-out policy that was first introduced in 1980 and paved the way for the building of new nuclear reactors in Sweden.

### **Phase-out policy**

Sweden decided to phase out nuclear power following a referendum that was held in 1980. Sweden's population voted for the closure of all four nuclear power plants (NPPs). The Chernobyl accident in 1986 launched a heated political debate about Sweden's nuclear power programme. The Parliament decided in 1988 that the phasing out of nuclear power would start up between 1995 and 1996, with two initial units closing. After a few years, the industry and the trade unions fuelled an intensive debate, with official reports showing that the total cost of an early phase-out would amount to more than SEK 200 billion. The price of electricity for Sweden's electricity-intensive industry (paper and steel) would double, resulting in between 50,000 to 100,000 job losses. Therefore, the Swedish Parliament decided, in 1991, not to start the phase-out until 1995. In 1997, the decision was taken to close the two units at Barsebäck NPP, the first one by 1 July 1998 and the second by 1 July 2001, provided that closure of the second reactor was compensated for by new electricity production from renewable sources and by reduced use of electricity. The Barsebäck 1 reactor was shut down in November 1999. In October 2000, the government announced that the conditions for closing the second reactor had not yet been fulfilled.

However, the Social Democrats, the Left Party and the Centre Party put forward a proposal for an agreement for the continued phase-out of nuclear power. Under this strategy, the second unit of Barsebäck was closed on 31 May 2005, and the oldest remaining reactors were to be reviewed.

### **Uprating**

The government set up plans to raise the capacity of existing NPPs to compensate for the loss of power due to the nuclear phase-out programme. In October 2005, it approved uprates for units 1 and 3 of the Ringhals Nuclear Power Plant and of the relicensing of unit 2 saying that Nuclear power is vital both domestically and in the Nordic region. In April 2007, the uprate of Ringhals' unit 1 was completed.

### **Reversal of phase-out policy and new build**

In September 2006, the Alliance for Sweden coalition government won the national election and in October 2006, the new Swedish prime minister said no political decision will be taken on phasing out nuclear power during his government's 2006-2010 term in office. On 5 February 2009, the Swedish government announced in a statement that it intends to reverse the country's long-standing ban on nuclear energy and allow the building of new nuclear reactors to gradually replace its existing nuclear fleet. The statement still needs to be ratified by the Parliament. An energy bill should be presented to the Parliament by 16 March. The agreement is a compromise, with the restrictions that new units are only going to be built to replace old reactors and that they will be built at existing sites. In February 2010, the Swedish government put forward a draft law that would

allow the construction of a maximum 10 new nuclear units in the country to replace existing units as they are shut down. The Swedish parliament voted on 18 June 2010 to officially bring to an end the nuclear phase-out policy that was first introduced in 1980 and paved the way for the building of new nuclear reactors in Sweden.

## Switzerland

In February 2007, the Swiss government adopted a new energy policy strategy, which emphasises the necessity to replace existing units with new nuclear power plants to avoid a future “energy gap”. The Swiss Federal Nuclear Safety Inspectorate (ENSI) gave on 15 November 2010 a positive assessment on the suitability of three sites for the construction of new nuclear power plants (NPPs). In 2008 and 2009, the operators Axpo, BKW and Alpiq had sent their license application to the Swiss federal Office of Energy to build a NPP near Gösigen, and replace two others at Beznau and Mühleberg. The green light given by ENSI is a milestone towards new nuclear build in Switzerland.

Switzerland is not a member of the European Union, but it is part of the European Economic Area and has close links and international agreements with the EU. Switzerland has electricity interconnections and power exchange with several EU Member States. The Swiss nuclear forum is also a member of FORATOM.

### Nuclear power

In 2009, nuclear power accounted for 42% of Swiss electricity production. Four Swiss companies operates five power reactors at four sites with a total net capacity amounting to 3 220 MWe: Axpo operates Beznau-1 (first power in 1969) and -2 (1971), BKW operates Mühleberg (1971), KKG operates Gösigen-Daniken (1979), KKL operates Liebstadt (1984).

### Nuclear policy

In 2003, Swiss voters firmly rejected two anti-nuclear proposals that were originally put forward in 1998 and that recommended the phasing out of nuclear power by 2014. Two thirds of Swiss voters rejected the first proposal and 58% rejected the second, with practically all cantons refusing both. All Swiss reactors have been uprated. In 2006, VSE - an alliance of all Swiss utilities - presented a study outlining possible scenarios for meeting growing energy consumption and for counteracting the loss of more than 1100 MWe from nuclear plants whose lifetimes are due to expire around 2020. The study<sup>1</sup> considers different scenarios building both gas power plants –and/or nuclear power plants, which could be operational by 2025. A report of the department of energy, *Energy perspectives up to 2035*<sup>2</sup>, shows that the country’s long-term energy supply is not secured. Switzerland could face an energy shortage by 2020 because of the eventual expiration of a number of long-term contracts for imported electricity supplies and because three of the country’s five reactor units are nearing the end of their lifetimes.

### New build

In February 2007, the Swiss government adopted a new energy policy strategy, which emphasizes the necessity to replace existing units with new nuclear power plants to avoid a future “energy gap”. The Swiss Federal Nuclear Safety Inspectorate (ENSI) gave on 15 November a positive assessment on the suitability of three sites for the construction of new nuclear power plants (NPPs). In 2008 and 2009, the operators Axpo, BKW and Alpiq had sent their license application to the Swiss federal Office of Energy to build a NPP near Gösigen, and replace two others at Beznau and Mühleberg. The green light given by ENSI is a milestone towards new nuclear build in Switzerland. ENSI asked however for more information regarding the frequency and the magnitude

<sup>1</sup> You can find the report, “Vorschau 2006” at: [http://www.strom.ch/de/internet/vorschau\\_2006\\_content---1--3259--1084.html](http://www.strom.ch/de/internet/vorschau_2006_content---1--3259--1084.html)

<sup>2</sup> You can find the report, “Energy Perspectives for 2035” at: <http://www.bfe.admin.ch/themen/00526/00538/index.html?lang=en>

of earthquakes. The three Swiss operators have indicated that they will provide the regulator with relevant information. The final decision on nuclear new build in the country is still a long way to go. Indeed cantons all over the country are empowered to give their opinion on the three submitted general license applications and have to send their contribution to the consultation by March 2011. In some Cantons the final decision must be taken through a referendum. The Federal Council should then grant the general license in summer 2012 and the Parliament will have to vote on it within one year. Nevertheless, the parliamentary decision is subject to an optional referendum that could take place in 2013.

## United Kingdom

On 10 January 2008, the British government published a Nuclear White Paper, which announces that a new generation of nuclear power plants will be built in the UK to contribute to the promotion of a “secure, diverse and low-carbon energy mix.” On 12 June 2008, the British Business Secretary, John Hutton, announced the Government’s action plan for the construction of new units. Meanwhile, the Government released its White Paper on Radioactive Waste Management that provides a framework for implementing geological disposal. On 9 November 2009, the draft Nuclear National Policy Statement (NPS) presented by the government indicated that ten sites had been listed as potential locations for new nuclear power plants (NPP) as part of an over whole energy strategy. Public consultations have been carried out and the regulatory justification (assessment of social, economic or other benefits versus potential health impact) and a National Policy statement were meant to be adopted by the Parliament later in 2010. However the new coalition government adopted revised draft NPS on energy and launched on 18 October a consultation on them, which was open until 24 January 2011. The statements recognize the essential role that nuclear has to play in ensuring energy supply along with other low-carbon energy sources by 2025 and confirm eight sites as suitable locations for nuclear new build. Meanwhile the Secretary of State for Energy and Climate Change, Chris Huhne, announced the regulatory justification of two new nuclear reactor designs: Westinghouse’s AP1000 and Areva’s EPR.

### **Closure**

The UK's nuclear fleet is nearing the end of its lifetime and some plants built in the 1940s and 1950s have already been shut down. Half of the UK's 14 nuclear sites are due to be decommissioned by 2010 - and by 2023, all but one plant, Sizewell B, will have shut. On 31 December 2006, the two oldest nuclear power plants in the world, Dungeness A in Kent and Sizewell A in Suffolk, were shut down. The decision was not made not on safety grounds, but because they are less efficient than their larger counterparts, and because a reprocessing plant at Sellafield, which is necessary to make their spent fuel safe, is due to close in 2012.

### **Decommissioning**

However, part of the long-term problem in UK is that costs for decommissioning gas-cooled reactors are much higher per unit of capacity than for light water reactors. This is due to the large volume of material and the need to dispose of a lot of graphite moderator. Decommissioning waste volumes per unit capacity for Magnox are ten times those for western light water reactors. A Nuclear Decommissioning Authority<sup>3</sup> (NDA) study published in August 2005 estimates that the cost of dismantling and cleaning up Britain’s civil nuclear power stations and infrastructure will amount to at least £56 billion. It shows however that costs involved are quantifiable and manageable.

### **Lifetime Extension**

British Energy has been granted a life extension on Dungeness B to 2018. On 11 December 2007, British Energy (BE) announced its decision to extend the lives of its Hinkley Point B and

<sup>3</sup> You can have access to NDA’s website at : <http://www.nda.gov.uk>

Hunterston B nuclear power plants by five years to 2016. Further studies will also be carried out by 2013 regarding the potential for additional life extensions beyond 2016.

### **New build**

The Energy White Paper of March 2003 states that the government will “keep the nuclear option open” but does nothing to make new build likely. It also states another White Paper should be produced before they do. Following the latest general election in May 2005, Tony Blair hinted at the possibility of building a new fleet of nuclear plants. The Prime Minister then announced a review of the country’s energy policy, which would include all aspects including nuclear. On 11 July 2006, the British government’s energy review signalled the building of a fleet of new nuclear power plants and on 23 May 2007, the UK government’s Energy White Paper, *Meeting the Energy Challenge*, reiterated its backing for “serious consideration” of the nuclear power option<sup>4</sup>.

A report of the Department of Trade and Industry (DTI), *Siting New Nuclear Power Stations*<sup>5</sup>, recommends that the new generation of plants be built at existing or redundant civil and military nuclear power stations, as well as at existing coal and/or gas-fired conventional power stations. Many utilities, such as EDF, Westinghouse, British Energy and E-ON, have already expressed interest in investing in new build in the UK.

On 10 January 2008, the British government published a Nuclear White Paper, which announces that a new generation of nuclear power plants will be built in the UK to contribute to the promotion of a “secure, diverse and low-carbon energy mix”. On 12 June 2008, the British Business Secretary, John Hutton, announced the government’s action plan for the construction of new units. It includes the creation of an Office of Nuclear Development within the Department of Business and a Nuclear Development Forum that will gather together government and industry representatives. The Energy Secretary, Ed Miliband, announced at the British Parliament on 9 November 2009 that ten sites had been listed as potential locations for new nuclear power plants (NPP) as part of an over whole energy strategy. Nuclear power is among the low-carbon technologies including clean coal and renewables that will contribute to cutting greenhouse gas emissions and securing energy supply.

The draft Nuclear National Policy Statement (NPS) was presented along with five other NPS dealing with energy in general, fossil fuel, renewables, gas supply and electricity for the period up to 2025. The new Coalition government formed after the elections of May 2010 launched on 18 October 2010 a consultation on the coalition’s revised draft NPS on energy, which was open until 24 January 2011. The statements recognize the essential role that nuclear has to play in ensuring energy supply along with other low-carbon energy sources by 2025. Eight sites are also earmarked as suitable locations for nuclear new build. Meanwhile the Secretary of State for Energy Climate Change, Chris Huhne, announced the regulatory justification of two new nuclear reactor designs: Westinghouse’s AP1000 and Areva’s EPR.

<sup>4</sup> The UK Energy White Paper is available at: <http://www.dtistats.net/ewp/>

<sup>5</sup> The report, *Siting Nuclear Power Stations*, is available at: [http://news.bbc.co.uk/2/shared/bsp/hi/pdfs/24\\_05\\_07\\_nuclear\\_siting\\_report.pdf](http://news.bbc.co.uk/2/shared/bsp/hi/pdfs/24_05_07_nuclear_siting_report.pdf)

### **III Countries where a phase-out policy is still being carried out**

#### **Belgium**

**Executive Summary** Belgium is heavily dependent on imported energy. Its main indigenous source of energy used to be coal, but coal reserves are now almost exhausted or available only at uncompetitive prices. The country has no gas, no uranium, no oil and very limited hydraulic resources. Belgium has to import most of its primary energy sources. Consequently, it is extremely energy dependent. Belgium's nuclear industry has a long history. Its first prototype reactor was commissioned back in 1962. Nuclear reactors supply more than half of Belgium's electricity output. A law regarding the closure of Belgium's nuclear power plants, which is scheduled to take place between 2015 and 2025, was approved by the federal parliament in January 2003. The law also prohibits the building of new power plants and limits the operational period of the existing nuclear power plants to 40 years. None of this phase-out policy is related to the condition or safety of the plants. The law does not affect the operation of research facilities, and does not rule out fusion as a future technology. The suitability of the law is now being questioned. If it is implemented, Electrabel, the country's largest energy generator, will have to take initial steps with regard to the shutdown of the plants in 2009 or 2010.

On 12 October 2009, the Belgian government decided to extend the period of operation of three reactors at the country's nuclear power plants (Doel 1, Doel 2 and Tihange 1) by 10 years. The decision, which still needs to be approved by Belgium's federal Parliament, is consistent with the recommendations of the GEMIX, a group of national and international experts that was in charge of identifying the optimal energy mix in order to secure sustainable energy supply at affordable prices. However due to political instability, the decision has not been rubberstamped yet.

#### **Nuclear policy**

A law regarding the closure of Belgium's nuclear power plants, which is scheduled to take place from 2015 to 2025, was approved by the federal parliament in January 2003. The law also prohibits the building of new power plants and limits the operational period of the existing nuclear power plants to 40 years. None of this phase-out policy is related to the condition or safety of the nuclear plants. The law does not affect the operation of research facilities, and does not rule out fusion as a future technology. The phase-out policy can only be reversed if new legislation is brought in or if a new government decides as much. This might occur if Belgium's regulator (GREG) decided that security of supply would be threatened by the closure of the plants.

However, the suitability of the law is now being questioned. If it is implemented, Electrabel, Belgium's largest energy generator will have to take initial steps with regard to the shutdown of the plants in 2009 or 2010. On 22 June 2007, the Commission on Energy (CE) 2030 report, *Belgium's Energy Challenges towards 2030*, was published<sup>6</sup>. One of the main recommendations made by the CE 2030, an expert committee set up by the Belgian government to identify an energy roadmap for Belgium up to 2030, is that the government reverse its nuclear phase-out policy. According to the report, current policy on nuclear is likely to lead to a doubling of electricity prices and its reversal would not only save money for consumers but also give Belgium a realistic chance of meeting its current and future energy needs and significantly cutting its CO<sub>2</sub> emissions.

<sup>6</sup> To consult the CE 2030 report, please go to the following website: [www.ce2030.be](http://www.ce2030.be)

The phase-out of nuclear power will result in an increase in the use of gas. The gas distributor in Belgium, Fluxys, has estimated that there would be a 50% increase in the demand for gas, which implies that work would have to be started now to increase the capacity of the underground infrastructure. The recent oil price rise has increased gas prices. Moreover, a major accident took place in Ghislenghien in 2004, which was caused by a defect in the underground infrastructure. So, the question of whether gas is a better energy option than nuclear is currently being assessed.

On 12 October 2009, the Belgian government decided to extend the period of operation of three reactors at the country's nuclear power plants (Doel 1, Doel 2 and Tihange 1) by 10 years. The decision, which still needs to be approved by Belgium's federal Parliament, is consistent with the recommendations of the GEMIX, a group of national and international experts that was in charge of identifying the optimal energy mix in order to secure sustainable energy supply at affordable prices.

However, nuclear power generators had to agree on a series of conditions. The main one is for electricity producers to allocate a significant part of nuclear profits to the State budget (€215 to 245€ million per year from 2010 to 2014). Electrabel and GDF-Suez have also already committed themselves to ensuring affordable prices, to investing in renewables and energy efficiency, to developing research on energy efficiency, environment and waste management, and to supporting employment and education and training in the energy sector. For instance, GDF-Suez has agreed to create 10,000 jobs by 2015.

### **Climate change**

Belgium has signed the Kyoto Protocol and is committed to reducing its GHG emissions by 7.5% below 1990 levels by 2012. Therefore, the government has taken different measures to curb GHG emissions: by reducing taxes on "clean energy;" by improving energy efficiency in industry, transport and households and by promoting the construction of large offshore windmills. It is anticipated that Belgium will find it very hard to meet its Kyoto targets. Indeed, Belgium has to decrease its GHG emissions by about 15% (7.5% to meet its Kyoto target, and a further 7.5% to compensate for the increase in GHG emissions that it registered between 1990 and 2002). The nuclear phase-out will not help Belgium meet this target.

According to the federal bureau, CO<sub>2</sub> emissions from electricity generation will increase by 38% by 2030 compared to the 1990 levels. This would make it difficult for Belgium to meet its commitments under the Kyoto Protocol. GHG emission plans approved by the Flemish, Walloon and Brussels Capital regions do take into account this fact, but so far the regions have failed to meet the plan's objectives.

## **Germany**

### **Executive summary**

Apart from coal, Germany has limited domestic primary energy sources and relies upon imports to meet most of its energy needs. The country's 17 operating Nuclear Power Plants (NPPs) generate around one third of the country's electricity. The 1998 coalition government formed between the Social Democratic Party (SPD) and the Green Party agreed to phase out nuclear power. In June 2001 the leaders of the Red-Green coalition government and the four main energy companies signed an agreement to limit the operational lives of the reactors to an average of 32 years. On 28 September 2009, Angela Merkel's party, the Christian Democratic Union (CDU), won the German federal elections with a comfortable majority. The Black-Yellow coalition (CDU/FPD) government agreed on 5 September 2010 to extend the operational duration of the NPPs by 12 years on average beyond 2021. The decision was confirmed by the adoption on 28 September of a new energy strategy, which includes the decision on the extension of the NPPs' operational duration. This decision was ratified by the Parliament in November 2010.

### **Nuclear policy**

Nineteen experimental and commercial reactors have been shut down and are being decommissioned. In 1990, following reunification, five VVER-440 units (Soviet-designed reactors) at Greifswald were shut down. In October 1998, a coalition government was formed between the Social Democratic Party (SPD) and the Green Party. They agreed to phase out nuclear power. Long “consensus talks” with the electricity utilities took place and, in 2000, a compromise was announced that helped the government save face while ensuring uninterrupted operation of the NPPs for many years ahead. While limiting plant lifetime to some degree, the agreement averted the risk of any enforced plant closure during the term of the government. In June 2001, the leaders of the Red-Green coalition government and the four main energy companies signed an agreement that implemented the 2000 compromise. The agreement entered into force in 2002. Under the terms of the agreement, the companies agreed to limit the operational lifetimes of the reactors to an average of 32 years. The permitted electricity production at the one non-operational reactor (at Muelheim Kaerlich) was transferred to other power plants. The 2002 law also forbade the construction of new NPPs for the time being.

On 28 September 2009, Angela Merkel’s party, the Christian Democratic Union (CDU), won the German federal elections with a comfortable majority. The Black-Yellow coalition (CDU/FPD) government agreed on 5 September 2010 to extend the operational duration of the country’s 17 nuclear power plants (NPPs) by 12 years on average. The agreement is part of a broader energy strategy that the government adopted on 28 September. The main goal of the energy concept is to reduce Greenhouse gas emissions by 80-95% compared to 1990 level by 2050, while ensuring security of supply and maintaining affordable prices. To do so, the share of renewables is set to increase to 80% of total electricity supply and energy demand to decrease by 50%. To meet this target, concrete measures have been put forward. Nuclear energy is described as a bridge technology until renewables and energy efficiency enable Germany to do without it. Older NPPs would operate for 8 more years and newer ones for 14 more years. The decision also includes a nuclear fuel tax aimed at raising 3 billion € a year to develop renewable energies. The bill providing for the extension of NPPs’ operational lifetime was adopted on 28 October by the Bundestag, the lower house and by the Bundesrat, the upper house, on 26 November. According to independent sources, extending the operational duration of Germany’s NPPs could help create thousands of jobs including 7000 construction jobs as the Environment Minister wants them to be fitted with additional concrete to protect against airplane crashes. It would also contribute to economic growth.

### Climate change

Germany is strongly committed to environmental protection and has fixed ambitious goals to reduce greenhouse gas emissions. Germany ranks fourth in the total carbon emissions league table of the G-8, after the United States, Russia and Japan. Germany has signed the Kyoto Protocol and according to the EU, burden-sharing agreement must reduce its greenhouse gas emissions by 21% below the 1990 level by 2012. Though Germany aims to increase the share of power generated by renewables to 20% by 2020, the goal will be harder to achieve if the current phase-out policy is maintained. Indeed, Germany’s other main fuel source used for base-load electricity is brown coal (which produces about 1.25 tonnes of carbon dioxide per MWh). Coal-fired power plants generate over half of the country’s electricity.

## Spain

### Executive Summary

Spain has few energy sources of its own. Nuclear power accounted for 23% of total electricity production in 2005. Spain currently has nine nuclear reactors. What is noticeable about Spain’s nuclear industry is its power plant uprate programme. It intends to add 810 MWe (11%) to its nuclear capacity by increasing capacity at its nine reactors by up to 13%. The PSOE (Socialist Party) won the general elections in March 2004. It has made a strong political statement to progressively phase out nuclear power, but so far, no calendar or specific strategy has been fixed. The José Cabrera NPP (also called “Zorita”), which is located in the municipality of Almonacid de

Zorita, in the province of Guadalajara (Spain), was shut down on 30 April 2006 because of a political decision taken two years ago.

The PSOE won the latest elections in March 2008. The policy of the government regarding nuclear power remained unchanged. The Spanish government announced on 2 July 2009 that it had decided to grant an operating licence to the Garoña nuclear power plant in Northern Spain for a further four years. The plant's current operating licence expires on 5 July 2009. The decision to allow it to continue producing electricity until 2013 is not consistent with the recommendation of the Consejo de Seguridad Nuclear (the Spanish Nuclear Safety Council) that the plant could continue operating safely for another 10 years, until 2019. However, it means that the plant that was commissioned in 1971 will be allowed to run for over 40 years. On 15 February 2011, the Spanish Congress ratified a Sustainable Economy Law, in which the reference to a maximum operational duration of 40 years for Spain's nuclear power plants (NPPs) has been deleted. It paves the way for the NPPs to remain operational longer.

### **Nuclear policy**

The main legislation regarding nuclear energy was passed in April 1969. It reasserts Spain's commitment to the peaceful use of nuclear power and stresses the need for safety and radiological protection. What is noticeable about Spain's nuclear industry is its power plant uprate programme. It has launched a programme to add 810 MWe (11%) to its nuclear capacity by increasing output at its nine reactors by up to 13%. For example, the capacity of the Almaraz NPP will be increased by more than 5% at a cost of \$50 million. The Cofrentes NPP was upgraded by 2% in 1988 and by a further 2.2% in 1998, 5.6% in 2002 and 1.9% in 2003.

As part of its electoral programme for the general elections of 2004, the Socialist Party announced its intention to progressively shut down Spain's NPPs and gradually replace them with other renewable energy sources such as wind. The PSOE (Socialist Party) won the general elections of March 2004. The PSOE has made a strong political statement about nuclear energy, promoting its progressive phase-out. So far, however, no calendar or specific strategy has been fixed. This decision was confirmed during the investiture speech of the new President, José-Luis Rodríguez Zapatero.

Although the proposal has been mentioned on several occasions, the Government has made, so far, no progress with its nuclear phase-out policy. The José Cabrera NPP (also called "Zorita"), which is located in the municipality of Almonacid de Zorita, in the province of Guadalajara (Spain), was shut down on 30 April 2006 because of a political decision taken two years ago. A debate was held in autumn 2006 on the future of the nuclear energy programme.

In May 2006, the nuclear energy assessment group, a group of environmental, industry and business experts set up by Industry Minister José Montilla in November, presented its conclusions in the Congress. However, the government has renewed its commitment to phase-out nuclear power, but has fixed no calendar yet. The PSOE won the latest elections in March 2008. The policy of the government regarding nuclear power remained unchanged. The Spanish government announced on 2 July 2009 that it has decided to grant an operating licence to the Garoña nuclear power plant in Northern Spain for a further four years. The plant's current operating licence expires on 5 July 2009. The decision to allow it to continue producing electricity until 2013 is not consistent with the recommendation of the Consejo de Seguridad Nuclear (the Spanish Nuclear Safety Council) that the plant could continue operating safely for another 10 years, until 2019.

On 15 February 2011, the Spanish Congress ratified a Sustainable Economy Law, in which the reference to a maximum operational duration of 40 years for Spain's nuclear power plants (NPPs) has been deleted. It paves the way for the NPPs to remain operational longer. The decision by the Spanish Congress not to limit the operational duration of the NPPs confirms the subtle but significant political shift that is taking place in Spain away from its official nuclear phase-out policy. The recommendation that was submitted by the ruling socialist party (PSOE), the Partido Popular (PP), the Catalan political grouping (CiU) and the Basque Nationalist Party (PNV), illustrates the growing political consensus in Spain that extending the operational duration of its nuclear power

plants is essential if the country is to ensure continued security of energy supply and fulfil its CO<sub>2</sub> reduction commitments.

### **Climate change**

In September 2004, the Government approved the National Emission Rights Assignment Plan, which fixed as one of its objectives a decrease of 24% in CO<sub>2</sub> emissions during the period 2005-2007, with respect to 1990 levels. The Government intends to increase the use of renewable energy sources and to improve energy efficiency in order to meet the Kyoto targets. In this respect, Spain is allowed to increase its emissions by 15% above 1990 levels during the period 2008-2012. However, they had already increased their emissions by over 40% by 2004. National CO<sub>2</sub> emissions reached 50% above their 1990 level in 2005. The summer's severe drought resulted in a lack of water that cut hydro-electric generation by 40%, forcing a 30% rise in production by fossil fuel power stations. Spain has exceeded its Kyoto Protocol target of 15% over 1990 levels and has the worst record of any EU Member State. The recently published International Energy Agency's (IEA) report , "Energy Policies of IEA Countries – Spain 2009 Review", says that Spain must keep all the energy options open including nuclear power and renewables to achieve its CO<sub>2</sub> emissions target and to make its power sector less carbon-intensive<sup>7</sup>.

---

<sup>7</sup> The report, "Energy Policies of IEA Countries – Spain 2009 Review" is available at: [http://www.iea.org/Textbase/press/pressdetail.asp?PRESS\\_REL\\_ID=289](http://www.iea.org/Textbase/press/pressdetail.asp?PRESS_REL_ID=289)

