ENEL: Business prospects and risks in nuclear energy

Steve Thomas

Professor of Energy Policy

Public Services International Research Unit (PSIRU)
Business School
University of Greenwich
30 Park Row
London SE10 9LS
UK
Tel: 44 208 331 9056
Fax: 44 208 331 9980

April 2009

Report prepared for:

GREENPEACE

Fondazione Culturale RESPONSABILITÀ ETICA

1. Introduction

ENEL was often bracketed with other large nationalised European electric utilities such as Electricité de France (EDF), the Central Electricity Generating Board (UK), Public Power Company (Greece) and Electricidade de Portugal. However, each of these companies had its own particular specificities and, for example, there were important differences between it and EDF. It was founded in 1962, much later than EDF (1947), and, unlike EDF, it never had a near total monopoly of generation and much of its power was distributed through municipal companies. Perhaps most important, it was never seen as such an integral tool of government policy as EDF. While the French government has done no more than the minimum required by the European Union Energy Directives to break up EDF and reduce its market power, the Italian government has been pro-active in breaking up the company and breaking its market power.

2. Government break-up policies: 1999-2006

ENEL was fully state-owned until 1999 when 32 per cent of the shares were sold. A series of further sales left the Italian government with only 31.2% of the shares, 21.1% directly and 10.1% through the state-run lender, Cassa Depositi e Prestiti. Under the so-called 'Bersani Decree' ENEL had to be broken up into separate units for generation, transmission, distribution and sales to 'eligible' customers. ENEL was also required to reduce its generating capacity by selling about 15,000 MW by the end of 2002, a target that was not met till 2005.

2.1. Generation

The government required ENEL to sell of 15,000MW of its generating capacity in three packages. The government placed limits on the extent to which municipal utilities could own this capacity, so that publicly owned companies could only take a minority stake. The first, Elettrogen, with 5418MW, was sold in July 2001 to a consortium led by the Spanish utility Endesa (45 per cent) that included AEM Brescia (15 per cent), the municipal utility, with the balance being held by the largest Spanish bank, Santander Central Hispano. Subsequently, Endesa raised its stake to a controlling 51 per cent, buying 5.7 per cent of the shares from the Spanish bank and changed the name to Endesa Italia.

A second tranche of 7008MW, known as Eurogen, was sold to a consortium, Edipower, dominated by Edison (Italy) and EDF (France) in March 2002. The consortium was a complex one. Edison had the largest share with 40 per cent. Other members were AEM Milano (13.4 per cent), AEM Torino (13.3 per cent), the Swiss utility Atel (13.3 per cent), Unicredit (10 per cent), Royal Bank of Scotland (5 per cent) and Interbanca (5 per cent). Under the consortium agreement, the banking partners will not have rights to the capacity. Therefore, Edison will get direct control of 3,500MW, while the Milano and Torino groups and Atel (in which EDF holds 20 per cent) will gain control of another 1,150MW each. Edison, then the second largest generator in Italy with a controlling interest in over 10,000MW of capacity had been acquired in 2001 by Italenergia Bis (IEB), a partnership of Fiat (38.6 per cent) and EDF (18 per cent) although EDF had an option that seemed to require it to buy the outstanding 82 pct it did not own. However, the Italian government invoked the reciprocity clause of the 1996 Electricity Directive to limit EDF's voting rights in Edison to 2 per cent. EDF already supplies about 15 per cent of Italy's power through imports but the Italian government claimed the French market was effectively closed to foreign companies. EDF attempted to remove these restrictions on its voting rights but in April 2005 IEB was subject to a number of takeover offers. Endesa offered to buy 100 per cent of the shares in IEB in a deal that would also see its municipal partner ASM Brescia taking 20 per cent of Edison. AEM offered to buy a 40 per cent stake in Italenergia with the expectation that other municipal companies would take further stakes, notably Enia, the new municipal resulting from the merger of TESA from Piacenza, AMPS from Parma and AGAC from Reggio Emilia.

In April 2005, EDF and ENEL signed a Memorandum of Understanding under which ENEL would be able to buy electricity from EDF and re-sell it on the French market. ENEL was seeking to obtain a 35 per cent stake in the French energy group SNET, the use of EDF power plants, the takeover of distribution networks in France, the purchase of power generation plants EDF is selling abroad and participation in the commercialisation of the EPR (European Pressurised water Reactors) nuclear power plant. This agreement was designed to allow the Italian government to lift the restrictions on EDF's voting rights in Edison.

In May 2005, EDF and AEM Milano announced an agreement to take over Edison. EDF would end up with 50 per cent of Edison, while AEM and any future partners are expected to hold up to 40 per cent. The balance will remain quoted. This agreement was contingent on the Italian government lifting the restriction on EDF's voting rights.

The final tranche, Interpower, comprising 2611MW of plant was sold in November 2002. Ownership of the new company was split equally between Energia Italia and a consortium of Electrabel and ACEA. The main shareholder in Energia Italia is the de Benedetti family's Cir holding. Energia Italia is 62 per cent controlled by Energia, which in turn is 74 per cent controlled by Cir with the largest Austrian electricity company, the Verbund, holding the balance. The municipal companies based in Genoa (Amga SpA) and in Bologna (Hera SpA) own much of the 38 per cent balance of Energia Italia. The Electrabel ACEA joint venture is 70 per cent owned by Electrabel and 30 per cent by ACEA, but for the purchase of Interpower, the ownership will be split 50-50.

2.2. Transmission

Operation of the transmission sector was separated off as Gestore della Rete di Trasmissione Nazionale (GRTN) a public body controlled by the Ministry for Economic Affairs and Finance. In 2005, GRTN changed its name to Gestore del Sistema Elettrico (GRTN SpA). The new company was owned by the Italian Ministry of Economy and Finance. At the same time, GRTN's electricity dispatching, transmission and grid development assets were transferred to TERNA.

Ownership of the transmission assets was through TERNA, then partly still owned by ENEL. ENEL was required to reduce its holding in TERNA to no more than 20 per cent by July 1, 2007 and it began selling shares in June 2004. As of 2005, ENEL only held 5 percent of the shares of TERNA and it expects to sell this stake in April 2009.

2.3. Distribution

Significant changes were also required to the distribution sector. In any municipality, only one distribution company would be licensed. Previously, most Italian cities were served by a local independent distribution company and by a company controlled by ENEL. All non-ENEL distribution companies serving more than 300,000 end users were given 180 days to create joint stock companies into which the distribution assets would be transferred. In cities where a non-ENEL distributor served more than 20 per cent of consumers, ENEL was required to transfer its distribution assets and personnel by March 31, 2001

Several of the municipal companies began then to convert to public companies. However, in all the municipal companies, the public still has a majority stake. For foreign companies attempting to enter the Italian market, a collaboration of some sort with a municipal company was very attractive, offering access to final consumers.

3. Diversification

In the past decade, ENEL has tried to diversify out of energy into a number of new sectors. Its first major venture was the Wind telecoms company, launched in 1997, in which ENEL held 51% and the remaining 49% was held by Deutsche Telekom and France Telecom. Subsequently, ENEL took over Deutsche Telekom's and France Telecom's stakes and from July 2003, ENEL owned all the shares until it sold 62.75% of them in May 2005 to Weather Investments, a company owned by an Egyptian entrepreneur, Naguib Sawiris in return for a stake in 26% stake in Weather. An option for Weather to buy the remaining 37.75% of the shares was exercisable from 2006.

It launched a range of other companies. The 2001[1] and 2002[2] Annual Reports noted activities in: Information technology and e-business; real estate and services; engineering and contracting; public and art lighting; and water. Most of these activities were however closely related to the core activities in energy. In the 2003 Annual Report, the Chief Executive Officer, Paolo Scaroni told shareholders[3]:

> 'ENEL today is a very different company from what it was two years ago. Management is now entirely focused on our core business of electricity and gas.'

In its 2004 report, it reported the intention to divest its shares in TERNA and Wind.[4]

4. International expansion

Despite the income ENEL received from divesting some of its network and generation assets, ENEL was slow to start to expand internationally. The other major European electric utilities, such as EDF, RWE and E.ON had, by 2005 already expanding, for example into UK and some of the more prosperous Eastern European countries such as Czech Republic and Hungary. Up to 2006, ENEL's main acquisitions were:[5]

- the Spanish utility, Viesgo, bought from Endesa in 2001;
- control of Bulgaria's largest power plant, Maritza East III (840MW, lignite), 2003;
- control (66 per cent) of Slovenske Elektrarne (SE), the largest electricity generator in Slovakia, 2005;
- control (51 per cent) of Electrica Banat and Electrica Dobrogea, electricity distributors in Romania with 1.4 m customers;
- operation in partnership with the local private group ESN Energo of the North-West Thermal Power Plant in St. Petersburg, Russia in June 2004.

However, its first major attempted acquisition was signalled in February 2006, when it acknowledged it wanted to buy the French-owned company, Suez, in particular its electricity division Electrabel, which holds a dominant position in Belgium. This quickly led to an acrimonious dispute between the French and Italian governments.[6] The bid was quickly pre-empted by an agreement between Suez and Gaz de France (GDF) to merge but it was not till October of 2006 that ENEL acknowledged defeat.

At the same time as this was taking place, an equally prolonged and controversial attempt was underway for the German utility, E.ON, to take over the largest Spanish utility, Endesa. This had been subject to a takeover bid by the Spanish gas company, Gas Natural, but in February 2006, E.ON outbid them with a cash offer worth €29.1bn. By January 2007, E.ON had raised its bid twice, to €41bn, most regulatory hurdles appeared to have been cleared and Gas Natural had withdrawn its offer. However, by March 2007, the takeover was in doubt, with ENEL, the Italian company, taking a rival position in the company and potentially blocking majority control. E.ON agreed to withdraw its bid and received compensation of its costs from ENEL. It also took a package of assets valued at €11.5bn from ENEL/Endesa in France, Italy and Spain. These included: Endesa Italia, the fourth largest generation company in Italy with 7.2GW; 65% of Endesa/SNET France, which owns 2.5GW of generation (the third largest French generator); and ENELViesgo and other Spanish assets (2.5GW plus 580,000 customers).

In October 2007, ENEL and Acciona, a Spanish engineering company, completed the takeover of Endesa for €43bn, Spain's largest utility. ENEL (67%) and Acciona (25%) hold 92% of Endesa's shares. Endesa's main assets outside Spain are in Latin America, where it owns 14,317MW of generating capacity.

Under the terms of the Endesa takeover, Acciona had the option (a 'put' option) to sell its stake any time between 27 March 2010 and 26 March 2016. Selling its stake would allow Acciona to reduce its debts of over €17bn but would increase ENEL's debts. In February 2009, ENEL agreed to buy Acciona's stake in Endesa for €11.1bn. The deal included the transfer of €2.9bn of Endesa's renewable energy assets to Acciona. Acciona will receive €9.6bn from ENEL, with the remaining €1.5bn being paid through an early dividend by Endesa. The details of how ENEL will finance this deal are examined below.[7]

The acquisition of Endesa placed ENEL squarely amongst the five largest utilities in Europe (EDF, E.ON, RWE and GDF Suez are the other four). How these five companies rank against each other depends on the measure – installed capacity, energy sold, turnover – but these five companies are now much more than double the size of their nearest competitors and the gap between them and their smaller competitors seems to be growing. All have made major acquisitions in the past two years – EDF has taken over British Energy, E.ON has acquired assets from ENEL, Suez and GDF have merged, RWE has taken over Essent. So from that point of view, ENEL's acquisition of Endesa seems to place it amongst an elite group of companies with such huge market power that their profitable future seems guaranteed. Its 2008 results stated: 'international expansion complete'.[8]

5. ENEL's position

5.1. Financial position

Table 1 ENEL results – 2004-08

	2004	2005	2006	2007	2007 pro forma	2008
Revenue	31011	33787	38513	43673	43688	61184
Net income	2631	3895	3036	3977	3916	5293
EBIT				6990	6781	9541
EBITDA				10023	9840	14318
Net debt	24514	12312	11690	55791	55791	49967
Employees at year end	61898	51778	58548	73500		

Sources: For 2004-07 http://www.enel.it/azienda/en/investor_relations/dati_sintesi/ For 2007 pro form and 2008 ENEL, 2009 'FY 2008 consolidated result and 09-13 plan' ENEL.

Notes

1. EBIT = Earnings before interest and taxes, EBITDA = Earnings before interest, taxes, depreciation and amortisation. These measures were not published in the annual reports prior to 2007

Table 2 ENEL's credit rating

	2005	2006	2007	2008
Standard & Poor's				
Outlook	Stable	Negative	C.W. Negative	C.W. Negative
Medium/long-term	A+	A+	A-	A-
Short-term	A-1	A-1	A-2	A-2
Moody's				
Outlook	Stable	Stable	C.W. Negative	C.W. Negative
Medium/long-term	Aa3	Aa3	A1	A2
Short-term	P-1	P-1	P-1	P-1

Sources: For 2004-07 http://www.enel.it/azienda/en/investor_relations/dati_sintesi/ For 2007 pro form and 2008 ENEL, 2009 'FY 2008 consolidated result and 09-13 plan' ENEL.

Evaluating the position of ENEL is complicated by the acquisition of Endesa in October 2007. The 2007 'pro forma' figures show the 'restated' results i.e. those that would have applied if Endesa had been owned by ENEL for the entire year (see Table 1 and Table 2).

Over the past five years, revenue and net income (profits) have doubled, mostly since 2007 and the acquisition of Endesa, which also led to a significant increase in number of employees. However, what is most striking from the overall results is the increase in debt, which had been falling for several years up to 2006, but increased five-fold in 2007. There was a reduction of 10% in net debt in 2008, but levels of debt are still far above levels in the past decade. The credit rating has also been falling (see Annex for a description of the different categories). For the long-term, both Standard & Poor's and Moody's rate ENEL well below their highest ratings and the outlook is for further declines. ENEL's short-term ability to repay its debts is not in doubt but its declining long-term rating will impact adversely on its cost of capital, particularly important given ENEL's high debts and its ambitious nuclear investment plans.

As a result, its analysis of its 2008 results state[9]: 'Maintaining A-/A2 rating is key to deploying our plan' and it aims to reduce net debt to €41bn by 2013. It aims to do this primarily through asset sales (€10bn), a rights issue (€8bn) and free cash flow (€4bn). These have to be off-set against the €12bn that will be required to finance the buyout of Acciona from Endesa. The asset sales include:

- Sale of high voltage electricity grid (2009);
- Sale of majority stake of gas network (2009);
- Sale of minority stake of ENEL Green Power (2009); and
- Other non-strategic assets (2009 and 2010).

The first three sales are expected to raise €6bn, while the non-strategic assets (unspecified) are expected to raise €1.6bn in 2009 and €2.4bn in 2010.[10] The sale of the high voltage grid (TERNA) is already agreed and

will raise €1.15 in April 2009.[11] Two separate binding offers for ENEL's low-pressure gas network (out of 12 companies expressing an interest) have been received, reportedly for about €1.3bn.[12] The value of the stake in ENEL Green Power that must be sold to make up the €6bn target is, implicitly, €3.5bn. Whether this is realistic remains to be seen.

The rights issue is expected to take place in 2009 and will be underwritten by a group of banks and backed by the Italian state, a 31% shareholder, which has agreed to back the rights issue.[13]

ENEL is also increasing its free cash flow by abandoning a target of a fixed €0.49 a share in favour of paying out 60% of net profits from 2009 onwards. It is reducing its capital expenditure plans by €12bn from its previous capital expenditure plans, and will spend €33bn over the next five years.[14]

5.2. Divisional breakdown

Table 3 and Table 4 show ENEL's results by division. In terms of revenue, the largest division is the 'Market – Italy' division. However, reflecting that this is a simple retail business, the profits and headcount are low and the investment needs are minimal. 'Generation & energy management – Italy' is also a high revenue business with higher profits and investment ('capex') needs than 'Market – Italy'. 'Infrastructure & network – Italy' is highly profitable (as measured by EBITDA as a percentage of revenues), but also consumes a high proportion of 'capex' and employs nearly a third of ENEL's total workforce. The 'international' division also employs a large number of employees. The new 'Iberia & Latam' division is profitable but employs about a quarter of ENEL's workforce and accounts for nearly 40% of investment needs. The ENEL Green Power division appears highly profitable although it does require a large amount of 'capex'.

Table 3 ENEL profitability by division (2008)

	EBITDA as % of Revenue
Gen & energy management - Italy	14
Market - Italy	2
Infrastructure & network - Italy	57
International	22
Iberia & Latam	29
ENEL Green Power	64
TOTAL	**19**

Source: ENEL 2008 Results Annexes

While the sale of stakes in the high voltage grid, the gas distribution network and ENEL Green Power will help reduce the investment requirements, these divisions represent by far the most profitable parts of ENEL accounting for only 12% of revenue but 34% of EBITDA.

5.3. Physical assets

The acquisition of Endesa has significantly expanded ENEL's scope so that now more than half of its generating capacity and more than two thirds of its production is located outside Italy (see Table 5).

Table 5 ENEL's generating capacity

	Generating capacity (GW)	Production (TWh)
Italy	40.3	96.3
Iberia	16.7	61.9
S E Europe	6.4	26.4
Russia	8.2	22.5
Americas	11.7	46.1
Total	83.3	315.9

Source: ENEL, 2009 'Annexes to FY-2008 consolidated results and 09-13 plan', ENEL

Table 3 ENEL results by division

	Revenues €m/%		EBITDA €m/%		Capex €m/%		Headcount	
	2007	**2008**	**2007**	**2008**	**2007**	**2008**	**2007**	**2008**
Gen & energy management - Italy	17063 / 32	22143 / 30	2743 / 28	3113 / 22	900 / 19	887 / 14	6931 / 10	6829 / 10
Market - Italy	22179 / 41	22609 /31	318 / 3	554/ 4	59 / 1	72 / 1	4669 / 7	4170 / 6
Infrastructure & network - Italy	5457 / 10	6537 / 9	3543 / 36	3719 / 26	1587 / 33	1407 / 22	22710 / 34	20394 / 30
International	2794 / 5	4708 / 6	766 / 8	1044 / 7	332 / 7	681 / 11	11259 / 17	16865 / 25
Iberia & Latam	4517 / 8	15805 / 21	1420 / 14	4647 / 33	1255 / 26	2382 / 37	19786 / 29	17827 / 26
ENEL Green Power	1536 / 3	1852 / 3	989 /10	1188 / 8	663 / 14	951 / 15	2313 / 3	2432 / 4
TOTAL	53546 / 100	73654 / 100	9779 / 100	14265 /100	4796 /100	6380 / 100	67668 / 100	68517 / 100

Source: ENEL 2008 Results Annexes

Notes

1. Figures for 2007 are ‘pro forma’

6. ENEL's nuclear aspirations

6.1. ENEL's record

Italy's record in Italy with nuclear power is very mediocre (see Table 6). ENEL was one of the first utilities to enter nuclear power, buying three small demonstration plants, two from the USA and one from UK. The reliability of these plants was generally poor. The record of the Latina plant was reasonably good. However, the record of both the Garigliano, a Boiling Water Reactor (BWR) unit and the Trino Vercellese, a Pressurised Water Reactor (PWR) unit, plants was very variable. The Garigliano plant only operated for 14 years before it had to be permanently shut down. In the period 1970-78, while the annual load factor exceeded 80% in two years, for four years, it was less 35% or less. For the Trino Vercellese plant, in the period 1970-86, while in four years, its load factor[15] exceeded 85%, in four years it produced no power.

The one commercial size plant, Caorso, took more than eight years to build and for more than three years after its completion, it was in the testing phase producing little power. Its reliability over the next five years was mediocre and it closed for repairs in 1986 and did not restart again. All four plants were closed for repairs or already permanently shutdown (Garigliano) by the time of the referendum on nuclear power in November 1987.

Table 6 Italy's nuclear power plants

	Vendor	Net power (MW)	Construction start	Commercial operation	Last power	Average load factor (%)
Latina	UK	153	1958	1964	1986	74
Garigliano	GE	150	1959	1964	1978	54
Trino Vercellese	Westinghouse	260	1961	1965	1987	52
Caorso	Ansaldo/GE	860	1970	1981	1986	62

Source: IAEA PRIS database. http://www.iaea.or.at/programmes/a2/

Note: Load factor is calculated as the actual output of a plant during a year as a percentage of the output it would have produced had it operated at full power uninterrupted throughout the year. Load factor is generally seen as a good indicator of the reliability of a plant

The Italian government and thus ENEL had grandiose plans for nuclear expansion, especially after the first oil crisis but these came to nothing. A two unit BWR station, Montalto di Castro, was ordered in 1975 but construction did not start until 1982 and by 1988, when work was finally abandoned, the units were only 67% and 42% complete.[16] The station was converted to gas-firing. Sites for three stations each comprising two PWRs of about 1000MW were designated in 1983 (one of which was the Trino Vercellese site), but little in the way of construction came of these plans.[17]

In November 1987, a referendum was held on nuclear power. The question was not a simple one of whether or not to use nuclear power, it related to whether three specific laws aimed at facilitating nuclear construction should be allowed to stand. One law allowed money to be provided to towns that agreed to accommodate nuclear plants. The second allowed a small group of Cabinet ministers to decide where plants should be built. The third allowed the state energy company, ENEL, to be involved in nuclear power projects abroad.

All three laws were decisively rejected by a majority of about 4 to 1.[18] However, as the questions did not explicitly relate to the operation of the two remaining plants (Garigliano had already been closed and Latina was permanently closed in 1988) and it was not till July 1990 that it was decided that Trino Vercellese and Caorso should be formally closed.

While the four plants that operated have been defuelled, little progress has been made with decommissioning them. The plants are in 'safestore', awaiting dismantlement of the contaminated structures. By end 2007, Sogin, the company (100% owned by the Italian Treasury) whose duty it is to decommission the plants claimed only 7% of decommissioning had been completed but that it expected to complete 51% of the job by 2012.[19]

In December 1987, the Italian government imposed a 5-year ban on planning and construction of new nuclear units.[20] When the moratorium expired, there was pressure, more symbolic than serious, from some quarters to re-open Trino Vercellese and Caorso.[21] Under the moratorium, ENEL was allowed to continue to carry out R&D on inherently safe designs. However, while there were continual calls from some quarters for the moratorium to be lifted, it was not under serious question until January 2005 when Prime Minister

Berlusconi suggested Italy should reconsider the de facto ban on nuclear power[22] and in 2008, the Berlusconi government made construction of nuclear plants a 'priority'.[23]

By 2005, ENEL had already committed to complete two part-built nuclear plants of Russian design (Mochovce 3 and 4) as a condition for its takeover of the Slovak generation company, Slovenske Elektrarne, and it had also made agreements with EDF on participation in construction of nuclear plants in France. ENEL hoped that these projects would help it re-build its nuclear expertise so that construction could start on its first new nuclear unit in 2013 and by 2030, 25% of Italy's electricity would come from nuclear power.

6.2. Italy

ENEL has never made any secret of its wish to restart a nuclear programme in Italy and the announcement by Berlusconi in 2008 gave them the green light to start to develop plans. In February 2009, at the same time as ENEL took a 12.5% stake in the Penly EPR (see below), EDF announced a 50/50 joint venture with ENEL to build four EPRs in Italy. The EDF-ENEL agreements coincided with the signing of a nuclear cooperation agreement in Rome between President Sarkozy and Prime Minister Berlusconi. The agreement is still very much a preliminary one that will last for five years, when it could be renewed. Final choice of technology has not been made yet and the plans are dependent on changes being made to Italian law.[24]

6.3. France

ENEL's largest potential nuclear investment outside Italy is in France, where it has been working with EDF on the construction of new nuclear plants in France since 2003. It had tried to take a stake in a small French generation company, SNET, which Endesa also had a share in but these holdings were passed to E.ON as part of the deal under which E.ON withdrew their bid for Endesa. For most of 2004, a deal with EDF was said to be imminent but it was not till May 2005 that the deal was finally agreed.[25] Under the deal, ENEL would take 200MW (12.5%) from each of the first five EPRs built in France. Construction on the first unit, Flamanville 3, started in December 2007. Because power from Flamanville-3 was not expected to be available before 2012, ENEL will be given access to the equivalent of that 12.5% stake in six reactors, or about 1,200 MW, from EDF's existing nuclear plant fleet.[26] ENEL will pay 12.5% of the cost of Flamanville-3 and will participate in the top-level engineering and construction project, to gain experience for future nuclear projects of its own. Conclusion of the deal was delayed until November 2007.[27]

In July 2008, President Sarkozy announced that a new EPR would be ordered for construction start in 2011.[28] EDF would build the next EPR in France rather than GDF Suez (who would build the third EPR) and it would be built at the Penly site (two PWRs are already in service at that site). A number of possible additional investors as well as ENEL, which is entitled to take 12.5% of the project under the 2007 agreement, have been mooted including E.ON[29] but this has subsequently been denied.[30] In February 2009, ENEL and EDF announced an 'industrial agreement' for ENEL to take up a 12.5% stake in Penly.[31]

The 2007 EDF Annual Report states:

> "On November 30, 2007, EDF and ENEL signed a strategic partnership agreement, under which ENEL bears a 12.5% share in all construction, operation, decommissioning and back-end nuclear cycle management expenses for the Flamanville 3 EPR-type nuclear plant, in return for access to 12.5% of the electricity generated by the EPR over its lifetime. The plant's nuclear operator is EDF, which bears full responsibility for its operations. The partnership agreement also gives ENEL the option of progressively acquiring the electricity generated by EDF's nuclear plants, up to a total capacity of 1,200 MW."[32]
>
> And:
>
> "ENEL also has an option, until 2023, to take a 12.5% stake under similar terms in the five potential EPR projects likely to be implemented by EDF in France up to that date."[33]

In November 2008, EDF did acknowledge that the expected construction costs for Flamanville had increased from €3.3 billion to €4 billion.[34] However, for future EPRs, EDF estimated in September 2008 that the cost would be €4.5bn[35].

6.4. The take-over of Slovenske Elektrarne and the Mochovce plant

ENEL agreed to buy 66% of the Slovak utility Slovenske Elektrarne (SE) in February 2005 for €840m. The deal was completed in May 2006. ENEL's main competition came, not as for many other utilities in the region, from the giant West European utilities such as EDF and RWE, but from the Czech company CEZ and

the Russian company RAO UES. SE then operated about 7,000 MW of capacity (83% of the total in Slovakia), including six reactors of the Russian design, WWER-440, at the Bohunice (four units) and Mochovce (two units) sites. As a condition of the deal, ENEL said it would continue SE's plan to complete two more reactors at Mochovce, where two recently completed WWER-440s are operating.[36] However, it was reported in the Slovak press that completion of Mochovce was not part of the formal deal and that completion would only take place if found possible after a feasibility study.[37]

In May 2008, Greenpeace lodged a complaint with the European Commission that SE had received illegal state aid in the takeover by ENEL because SE had shifted some of the future decommissioning liability for Mochovce-3 and -4 and the existing liability of SE's other reactors to the national budget.[38]

The first two units at the Bohunice site, which were of a generation WWER-400 design, the '230' design, were excluded from the deal, as was a gas-cooled reactor that was closed in the 1977 following a severe accident. The two WWER-440 units at the Bohunice site were permanently closed in 2006 and 2008 respectively.

The four Mochovce units are second-generation WWER-440 plants of the '213 design'. Construction began in 1983 but was suspended in the country's transition from a planned to a market economy in the early 1990s. Units 1 and 2 were then reported to be 90% and 75% complete respectively. Work on the first two units recommenced in 1995 led by a consortium of Siemens, Framatome and Czech and Slovak companies and the units entered commercial operation in 1998 and 1999.

The cost of completing the plants is not known but the fact that it took 3-4 years to finish plants that were said to be already 75-90% complete suggests the process was far from smooth. The reliability of the plants has been about typical for that of WWER-440 units with the average life-time load factor for the two units, a little under 80%.[39]

The third and fourth units were reported to be only 40% and 30% complete when work was halted on them. When ENEL took over SE the forecast completion date for the reactors was 2011-12. ENEL was expected to finalise a feasibility study in April 2007 and then take a final decision whether or not it would invest in the units.

The result of the feasibility study was positive but the timescale to complete Mochovce 3 and 4 quickly slipped. By 2007, the expected completion date was 2012-13[40] when the contracts for completion were expected to be signed in mid-2008. Obtaining finance became a problem. In 2007, a consortium of nine banks[41] agreed to provide ENEL/SE with a €800m 'revolving credit' facility over seven years. However, in 2008, under pressure from Greenpeace, three banks, ING, Banca Intesa and Erste Bank, refused to allow the credit facility to be used for the completion of Mochovce, then projected to cost €1.7bn. ENEL/SE was forced to issue a statement that it would finance completion of the plants from internally generated cash.[42]

The European Commission also became concerned in May 2008 that the designs were not adequately safe.[43] However, in July 2008, it ruled that ENEL/SE's plans: 'were "in line with the objectives of the Euratom Treaty," provided the utility "bring(s) the design in line with the existing best practices" concerning protection against external attack.'[44]

The process was further delayed in September 2008 by a Slovak government decision to require ENEL/SE complete a new Environmental Impact Assessment (EIA).[45] Signing of the contract to complete the plants was still being delayed. Nucleonics Week reported in October 2008 that the price for completion being offered by Skoda and Atomstroyexport had tripled and that they were unwilling to sign up to 'turnkey terms'.[46] Nevertheless, site work was started, perhaps due to the threat that the Slovak government had been prepared to expropriate ENEL's 66-percent stake in power producer SE if it had not commenced completion of Mochovce.[47]

In November 2009, the contract price was reported to be €2.775bn, but ENEL/SE was still claiming it would finance the project from cash-flow.[48] Significantly, Skoda had been replaced as overall project manager by ENEL. By March 2009, the contract was still not signed.[49]

A further threat to the Mochovce project came with the decision to reduce the market dominance of SE in Slovakia. In December 2008, the Slovak government announced a joint venture agreement between CEZ, the Czech electric utility that had tried to buy SE, and a Slovak government owned utility, Javys, which operates the Bohunice plants. Under the joint venture, a new nuclear plant would be built at the Bohunice site,

expected to come on-line in 2020.[50] If built, this would leave Slovakia with a surplus of base-load power and this could force down the price ENEL/SE would receive for the output of Mochovce 3 and 4. It remains to be seen whether the CEZ/Javys joint venture is a serious proposition.

6.5. Romania

ENEL controls two energy distribution companies in Romania with 51% of the shares, Electrica Banat and Electrica Dobrogea, with 1.4 m customers. This makes it the biggest foreign operator in the Romanian electricity distribution sector, with a market share of around 30%. However, in 2008, it began to bid for involvement in the construction of two new nuclear plants at the Cernavoda site. The site has an even longer history than Mochovce. A deal was originally signed in 1978 for supply by the Canadian vendor, AECL, of five reactors. The plants were of the Canadian 'Candu' design, which is a heavy water cooled and moderated design. The actual orders were delayed and problems of finance slowed work on the units from the start. The first unit was finally completed in 1996, by which time, unit 2 was only 25% complete and construction had been halted. Work restarted on unit 2 and the plant was completed in October 2007. For units 3-5, civil work has been carried out but no equipment has been purchased yet. In mid-2006 a scoping study for the Environmental Impact Assessment was issued for the completion of units 3 and 4.

The plants are owned by a state-owned utility, Societatea Nationala Nuclearelectrica, which in November 2008 set up a new company, S.C. EnergoNuclear S.A., in which it is the majority shareholder with 51%. The other shareholders are ENEL, CEZ, GDF Suez and RWE, each with 9.15%, and Iberdrola and ArcelorMittal Galati, both with 6.2%. The new company will be responsible for the construction, commissioning and operation of the two new units.[51] In March 2009, construction was expected to start at the beginning of 2010 and the plants are expected to be in service in 2015 at a cost of about €4bn.[52] It remains to be seen whether these targets will be met or whether delays will continue. The two new units will use the AECL Candu-6 design, which was first ordered more than 30 years ago, the most recent order being for two units for China, ordered in 1996. AECL is now offering an 'enhanced' Candu-6 which has not yet been ordered and it may be that the new Cernavoda units will use this design.

7. Scale and risks of ENEL's nuclear plans

7.1. Investment scale

It is difficult to estimate the timing and extent of ENEL's investment requirements given the notorious tendency for nuclear costs to escalate and for target dates to be missed.

7.1.1. France

Perhaps the most likely plans to be fulfilled are those of EDF in France. ENEL has an option to take 12.5% of 6 EPRs built by EDF. EDF estimated in November 2008 that the Flamanville EPR would cost €4bn. The exact details of the agreement between ENEL and EDF are not known, but the text in the EDF annual report (see section 6.3) strongly suggests that ENEL will have to pay 12.5% of the actual cost, not the forecast cost. It will also have to pay 12.5% of the operation, decommissioning and back-end nuclear cycle management expenses. These costs will only be incurred after the plant starts up and ENEL would expect they can be recovered from the proceeds of sale of electricity. If these costs are higher than expected and cannot be recovered from the sale of electricity, this will be an additional burden on ENEL.

The construction cost has already escalated by more than 20% to €4bn and experience suggests that risk of more cost escalation is significant. If there is no further cost escalation, ENEL's share would be €0.5bn.

EDF has acknowledged that subsequent EPRs would cost at least €4.5bn. [53] While the location (Penly) and the estimated construction start (2011) of the next French EPR that EDF is to build, the timing of the following four units is far from clear. The need for any new nuclear plants to be ordered in France is far from clear[54], but if we assume the plants are ordered and they cost no more than €4.5bn, that implies an investment need for the next five plants of a further €2.8bn. There is also, as with Flamanville the risk associated with higher than expected operating, decommissioning and waste disposal costs. The total investment cost for France would be at least €3.3bn

7.1.2. Slovakia

The completion of the Mochovce plants (units 3 and 4) is problematic from a number of perspectives. Experience of completing part-built units in Czech Republic (Temelin) and Ukraine (Khmelnitsky 3 and Rovno 4) has been fraught with difficulties. In particular, bringing orders placed 20 or more years ago up to current safety standards has proved difficult. There is also the quality of the work that has been done so far which is frequently not well documented.[55] Mochovce 3 and 4 are reported to be only 30-40% complete so this does allow more scope for changing technology. However, this begs the question, if Mochovce 3 and 4 are effectively new build, how can it be acceptable to be using what is essentially 1960s technology? The suspicion must be that using modern technology with state-of-the-art safety would be far more expensive.

If they really are 'completions' then this exposes ENEL to the risks that were apparent in the completion of Temelin, Mochovce, Khmelnitsky and Rovno. The Slovak investment was estimated in November 2009 to be €2.775bn, but this figure increased by more than 60% between 2007 and end-2008 and experience at Temelin and elsewhere suggests there will be more cost escalation. Construction did formally commence in November 2008, but this seemed more symbolic than and the contract for the plant's construction had not been signed by March 2009.

7.1.3. Romania

Construction of the two Candu units in the Romanian programme is expected to start in 2010 at a total cost of €4bn, of which ENEL is expected to take 9.15% or €370m. The timing and extent of the expenditure remains highly uncertain.

7.1.4. Italy

The largest potential investment in nuclear comes in the Italian market itself, where ENEL plans to build four units, in collaboration with EDF, which will share the costs of the feasibility studies. It is not clear whether the agreement places EDF under any obligation to invest in plants in Italy: the agreement with ENEL is reported to require that ENEL is only the majority owner.[56] Given that EDF's levels of debt are already higher than it wants and it expects to have to sell some assets to reduce this[57] and it also expects to have to finance nuclear investments in France and the UK, it seems unlikely that EDF will want more than a small share if any.

If we assume that ENEL has to finance all four units but that they can be built for no more than the forecast cost of French EPRs, €4.5bn, this would require an investment of €18bn. Even if the figure of €4.5bn for EPRs does apply in France, it seems highly unlikely that this figure could be matched in Italy given ENEL's lack of experience for more than 20 years in building nuclear plants. E.ON, the largest German electric utility estimated in 2008 that the cost of building an EPR in the UK would be €6bn[58]. Estimates for US plants are now in the order US$5000-8000/kW. At an exchange rate of €1=US$1.33, and if we assume the capacity of an EPR is 1700MW, this implies a cost per unit of €6.4-10.0bn. If we assume E.ON's estimate for building an EPR in the UK would be realistic for Italy, this suggests the cost of four units would be about €25bn. The first plant is expected to be in service by 2020, implying a construction start in 2014/15. It is not clear when the follow-up orders would be placed.

7.1.5. Total

If we add together the four nuclear programmes, France €3.3bn, Slovakia €2.8bn, Romania €0.4bn and Italy €25bn, the total investment comes to about €31.5bn. All historic experience suggests there is ample scope for costs to escalate.

8. Conclusions

The purchase by ENEL of Endesa for more than €40bn was the major factor between an increase in ENEL's net debt from about €10bn in 2006 to the current level of about €50bn. Whether the acquisition of Endesa will be a good strategic move remains to be seen, but the deal is done and ENEL now has to cope with the consequences, especially in a high level of debt. It is worth noting in this context that EDF, which has a turnover of about the same level as ENEL is concerned about its level of debt despite it being only €25bn, half that of ENEL.

The need to buy out ENEL's minority partner in Spain, Acciona, will require a further €11bn, although this will be offset by already committed sales of stakes in the high voltage electricity network (€1.15bn) and the

gas distribution network (about €1.3bn). To reduce debt to the target level of about €40bn, ENEL is planning to: sell other assets (about €8bn), including a stake ENEL Green Energy (implicitly about €3.5bn); raise €8bn from a rights issue; and contribute €4bn from cash flow. As the Italian government still owns 31% of ENEL, Italian taxpayers will pay for about €2.5bn of the rights issue.

Of course, if the priority is raising money, the assets that will raise most are the most profitable ones and Table 4 shows that the assets ENEL wants to sell are by far its most profitable ones. The profitability of 'ENEL Green Power' and the 'Infrastructure and Network Italy' division is three times that of the group as a whole.

Reducing ENEL's debt to manageable levels will therefore be extremely challenging. This makes it all the more surprising that ENEL should be contemplating major and economically risky investments costing in the order €30bn over the next decade. These investments appear almost entirely discretionary.

The deal with EDF is only an option, not an obligation, to take 12.5% of up to six new EPRs built by EDF (3000MW). This would effectively replace the capacity ENEL has given up in France in the past few years but would still leave it as a very small player in France compared to EDF and the newly formed GDF Suez group. It seems unlikely that acquiring these stakes would lead to a significant business in France.

The Slovak press has reported that completion of Mochovce was not part of the formal deal to take over SE and that completion would only take place if found possible after a feasibility study. Given that the price for completion had tripled, this would surely have been ample grounds to argue that the risk that the completed plants would be uneconomic was far too high to proceed. Whether ENEL is now irrevocably committed to the completion is far from clear. Construction work has been reported to have been resumed but since contracts do not appear to have been signed, it should be a priority now to establish whether ENEL's position is really irreversible.

The investment in the Romanian plant, while relatively small, is also entirely optional and its main purpose seems to be to contribute to re-building ENEL's nuclear capability.

However, by far the largest planned investment is in Italy itself and is probably of the order €25bn alone. ENEL's historic record with nuclear plants is poor. Plants have been unreliable, and costs and lead-times have far exceeded forecast levels. While a poor record does not condemn ENEL to always fail, it does illustrate the risks. ENEL may claim to have learnt from its past failings but it has had little experience with nuclear for more than two decades, so it is effectively starting from scratch. Whether Italy needs additional generating capacity is a moot point. It clearly needs to replace some of its fossil fuel capacity with low-carbon sources. While nuclear power is a low carbon-source, it does bring with it other environmental issues that other low carbon sources, such as wind, solar, biomass etc and, most important of all, energy efficiency measures do not bring.

9. Annex Credit Ratings

9.1. Standard & Poor's

Standard and Poor's long term (i.e., more than a year forward) ratings are, in descending order of credit-worthiness: AAA, AA, A, BBB, BB, B, CCC, CC, C and D (default). All of these except D can be modified up by a '+' sign or down by a '-' sign. According to Standard & Poor's:[59]

> 'An obligation rated 'A' is somewhat more susceptible to the adverse effects of changes in circumstances and economic conditions than obligations in higher-rated categories. However, the obligor's capacity to meet its financial commitment on the obligation is still strong.'

Standard & Poor's short-term ratings are, in descending order of credit-worthiness: A-1, A-2, A-3, B-1, B-2, B-3, C, and D (default). Standard & Poor's states:

> 'A short-term obligation rated 'A-1' is rated in the highest category by Standard & Poor's. The obligor's capacity to meet its financial commitment on the obligation is strong. Within this category, certain obligations are designated with a plus sign (+). This indicates that the obligor's capacity to meet its financial commitment on these obligations is extremely strong.'

While:

> 'A short-term obligation rated 'A-2' is somewhat more susceptible to the adverse effects of changes in circumstances and economic conditions than obligations in higher rating categories. However, the obligor's capacity to meet its financial commitment on the obligation is satisfactory.'

'Outlook ratings' can be either 'stable', 'negative' or 'positive' a Credit Watch (C.W.) qualification 'focuses on identifiable events and short-term trends that cause ratings to be placed under special surveillance by Standard & Poor's analytical staff.'

9.2. Moody's

Moody's long-term ratings fall into two main bands, 'investment grade' or 'speculative grade' (also known as high yield or junk). Within 'investment grade, there ten subdivisions: Aaa, Aa1, Aa2, Aa3, A1, A2, A3, Baa1, Baa2 and Baa3. Moody's states:[60]

> 'Obligations rated Aa are judged to be of high quality and are subject to very low credit risk, but "their susceptibility to long-term risks appears somewhat greater [than Aaa]".'

While

> 'Obligations rated 'A' are considered upper-medium grade and are subject to low credit risk, but that have elements "present that suggest a susceptibility to impairment over the long term".'

Its short term ratings are P-1, P-2, and P-3, with P-1: 'Issuers (or supporting institutions) rated Prime-1 'have a superior ability to repay short-term debt for the obligations.' Its 'outlook' ratings are as for Standard & Poor's.

10. Notes and References

[1] ENEL, 2002 'Annual report and Accounts, 2001', ENEL, Rome. http://www.enel.it/azienda/en/investor_relations/bilanci_documenti/doc/2001BILCONS/Annual_Report2001.pdf Accessed on March 11 2009

[2] ENEL, 2003 'Annual report and Accounts, 2002', ENEL, Rome. http://www.enel.it/azienda/en/investor_relations/bilanci_documenti/doc/2002BILCONS/Annual_Report_2002.pdf Accessed on March 11 2009

[3] ENEL, 2004 'Annual report and Accounts, 2003', ENEL, Rome. http://www.enel.it/azienda/en/investor_relations/bilanci_documenti/doc/2003BILCONS/relazioni03_01.pdf Accessed on March 11 2009

[4] ENEL, 2005 'Annual report and Accounts, 2004', ENEL, Rome. http://www.enel.it/azienda/en/investor_relations/bilanci_documenti/doc/2004BILCONS/Annual_Report_2004.pdf Accessed on March 11 2009

[5] ENEL, 2006 'Annual report and Accounts, 2005', ENEL, Rome. http://www.enel.it/azienda/en/investor_relations/bilanci_documenti/doc/2005BILCONS/annual_report_2005.pdf Accessed on March 11 2009

[6] The Times, 2006 'Berlusconi fans flames of national energy row with France' February 24, 2006

[7] New York Times, 2009 'Italian Utility buys out Spanish partner in venture' February 21, 2009.

[8] ENEL, 2009 'FY 2008 consolidated result and 09-13 plan' ENEL.

[9] ENEL, 2009 'FY 2008 consolidated result and 09-13 plan' ENEL.

[10] FD Wire, 2009 'Full Year 2008 Enel S.p.A. Earnings and 20092013 Business Plan Presentation – Final' March 12, 2009

[11] International Oil Daily, 2009 'Enel Flags Disposals' March 13, 2009.

[12] European Spot Gas Markets, 2009 'For the record' March 11, 2009.

[13] International Oil Daily, 2009 'Enel Flags Disposals' March 13, 2009.

[14] Breakingviews, 2009 'Enel's E8bn cash call more than enough' March 12, 2009

[15] Load factor is calculated as the actual output of a plant during a year as a percentage of the output it would have produced had it operated at full power uninterrupted throughout the year. Load factor is generally seen as a good indicator of the reliability of a plant

[16] See IAEA PRIS reactor database at http://www.iaea.org/cgi-bin/db.page.pl/pris.prdeta.htm?country=IT&refno=7 Accessed on March 11 2009 and Nucleonics Week, 1983 'The Italian government finally designated sites this week' March 3, 1983, p 2

[17] Nucleonics Week, 1983 'The Italian government finally designated sites this week' March 3, 1983, p 2

[18] Associated Press, 1987 'Referendum Leaves Italy's Nuclear Future Unclear' November 17, 1987.

[19] Thomson Financial News, 2008 'Italy's Sogin to speed up nuclear decommissioning' September 19, 2008

[20] Nucleonics Week, 1987 'Italian Parliament approves policy lukewarm to nuclear' December 24, 1987, p 2

[21] Nucleonics Week, 1992 'As Italy's moratorium expires, scientists ask reactor restart' December 10, 1992, p 4.

[22] Nucleonics Week 'Prime minister wants to reverse Italy's phase-out of nuclear' January 27, 2005, p 4

[23] Daily Telegraph 'Italy switches back to nuclear as rising fuel bills bite' June 16, 2008, p 16

[24] Nucleonics Week, 2009 'EDF to look at building EPRs in Italy; ENEL to take stake in Penly-3' February 26, 2009.

[25] Nucleonics Week 2005 'EDF-ENEL MOU foresees 1,200 MW of new nuclear for Italians' June 2, 2005, p 3.

[26] Nucleonics Week, 2005 'French-Italian pact spells out ENEL participation in EDF's EPR' June 15, 2005, p 6

[27] Nucleonics Week, 2007, 'Italy's ENEL takes shares in EDF projects, including EPR' December 6, 2007, p 4.

[28] Nucleonics Week, 2008 'Sarkozy launches second French EPR, citing higher fuel prices', July 10, 2009, p 9.

[29] Nucleonics Week, 2009 'EDF tapped for next EPR at Penly, with GDF Suez in line for third unit' February 5, 2009, p 1.

[30] Nucleonics Week, 2009 'German utilities not planning investment in Penly-3 project' February 26, 2009, p 11.

[31] Nucleonics Week, 2009 'EDF to look at building EPRs in Italy; ENEL to take stake in Penly-3' February 26, 2009.

[32] EDF, 2008. 'Consolidated financial statements', EDF, Paris, p 77. http://www.edf.fr/html/RA2007/uk/accueil.html. Accessed January 26, 2009.

[33] EDF, 2008. 'Consolidated financial statements', EDF, Paris, p 77. http://www.edf.fr/html/RA2007/uk/accueil.html. Accessed January 26, 2009.

p 128.

[34] Keller. G. 2008. "EDF to lead up to euro50B in nuclear plant investment", Associated Press Worldstream, December 4, 2008.

[35] Nucleonics Week, 2008 'Areva official says costs for new EPR rising, exceeding $6.5 billion' September 4, 2008, p 1

[36] Nucleonics Week, 2005 'EDF mulling options as deadline nears on buying Italian utility' February 24, 2005, p 9.

[37] The Slovak Spectator 'Cabinet seals privatisation deal' February 18, 2005

[38] Nucleonics Week, 2008, 'Greenpeace files complaint alleging illegal state aid for Mochovce-3, -4' May 1, 2008, p 13.

[39] http://www.iaea.or.at/programmes/a2/

[40] Nucleonics Week, 2007 'With ENEL's support, new reactors seen operating in Slovakia by 2013' March 1, 2007, p 9

[41] The banks in the consortium are ING, Erste Group/Slovenska sporitelna (Austria/Slovakia), Intesa Sanpaolo (Italy), KBC/CSOB (Belgium/Slovakia), Societe Generale/Komercni Banka CZ (France/Czech Republic), Societe Generale/ Komercni Banka SK (France/Slovakia), Dexia (Belgium/France), Calyon (France), and Mizuho Group (Japan)

[42] Nucleonics Week, 2008 'Pressed by Greenpeace, second bank bans Mochovce-3, -4 from credit line' May 1, 2008, p 1.

[43] Nucleonics Week, 2008 'EC questions whether design of Mochovce-3, -4 is safe enough' May 1, 2008, p 14

[44] Nucleonics Week, 2008 'EC approves Mochovce VVER-440s provided crash protection improved' July 17, 2009

[45] Nucleonics Week, 2008 'Slovak government says full EIA needed for Mochovce-3/4 operation' September 25, 2008, p 8

[46] Nucleonics Week, 2008 'Slovakia pushing to get contract settled for completion of Mochovce' October 23, 2008, p 3.

[47] The Slovak Spectator, 2008 'ENEL faced losing SE shares, Fico says' November 15, 2008

[48] Nucleonics Week, 2008 'SE begins site work at Mochovce; contracts to be signed by year-end' November 6, 2008, p 1

[49] Nucleonics Week, 2009 'ENEL/SE sees contract signing for Mochovce-3, -4 by end of March' February 12, 2009, p 6.

[50] Nucleonics Week, 2008 'CEZ sizes up Bohunice project as potential for growth in Slovakia' December 25, 2008, p 10.

[51] Nucleonics Week, 2008 'Six companies sign investor pact on Cernavoda-3, -4 project' November 27, 2008, p 7

[52] Nuclear News, 2009 'Shareholding agreement for Cernavoda-3 and -4', January 2009.

[53] Nucleonics Week, 2008 'Areva official says costs for new EPR rising, exceeding $6.5 billion' September 4, 2008, p 1

[54] S Thomas, 2009 'Areva and EDF:

Business prospects and risks in nuclear energy' Greenpeace International, Amsterdam

[55] To be added

[56] Nucleonics Week, 2009 'EDF to look at building EPRs in Italy; ENEL to take stake in Penly-3' February 26, 2009.

[57] Bloomberg, 2009 'EDF to Sell Assets, Cut Debt as Earnings' February 12, 2009. http://www.bloomberg.com/apps/news?pid=20601087&sid=aJ5bbxn_LsbM&refer=home# Accessed February 24, 2009

[58] The Times 'Reactors will cost twice estimate, says E.ON chief' May 5, 2008, p 32.

[59] http://www2.standardandpoors.com/spf/pdf/fixedincome/Ratings_Definitons.pdf

[60] Accessed through: http://en.wikipedia.org/wiki/Moody%27s#Moody.27s_ratings