

The Seven Brothers: Then there were five

by

Prof. Steve Thomas

Stephen.Thomas@gre.ac.uk

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The Public Services International Research Unit (PSIRU) investigates the impact of privatisation and liberalisation on public services, with a specific focus on water, energy, waste management, health and social care sectors. Other research topics include the function and structure of public services, the strategies of multinational companies and influence of international finance institutions on public services. PSIRU is based in the Business Faculty, University of Greenwich, London, UK. Researchers: Prof. Steve Thomas, Dr. Jane Lethbridge (Director), Dr. Emanuele Lobina, Prof. David Hall, Dr. Jeff Powell, Sandra Van Niekerk, Dr. Yuliya Yurchenko

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1. Introduction

In 2003, Thomas (2003) examined whether seven large energy utilities, the Seven Brothers, would emerge to parallel the ‘Seven Sisters’, the Anglo-American oil companies that from the 1940s until the 1970s dominated and were said to control world oil markets.¹ Thomas found that seven large companies with international interests were indeed emerging in Europe. Like the Seven Sisters, there were three big siblings: Electricité de France (EDF), RWE and E.ON (both based in Germany) to parallel Exxon, Shell and BP and four smaller siblings: ENEL (Italy), Endesa (Spain), Vattenfall (Sweden) and Suez (Belgium) to parallel Texaco, Mobil, Chevron and Gulf. Thomas concluded that while these Seven Brothers had an increasingly strong grip on European markets, they were unlikely to be strong forces outside Europe.

By 2009 (Thomas, 2009), this forecast seemed to be proving accurate with mergers and takeovers meaning there were just five Brothers left. All were of a comparable, large size and had increased their market share in Europe but most had few holdings outside Europe. EDF, RWE and E.ON remained, ENEL had taken over Endesa, and Suez had merged with Gaz de France to form GDF Suez, subsequently renamed ENGIE. Vattenfall is much smaller than these five and seems to be increasingly focused only on the integrated Nordic market. The Five Big Brothers seemed to have a stronger than ever grip on the European market.

However, by 2017, there were strong signs their grip on the market was substantially weakening and there was a real prospect it would be broken. E.ON and RWE had both split themselves into two entirely separate businesses with their large power plants the centre of one part and renewables and customer services in the other. EDF was selling much of its foreign assets to try to finance its nuclear ambitions and was being required to buy the collapsed French reactor vendor, Areva NP. ENEL and ENGIE shrank significantly - 20-30 per cent – between 2012 and 2016 and there appeared to be little coherence in their strategies.

In this paper, we review their financial position in 2017, their corporate policies over the period 2009-17, identify the factors behind their apparent decline and discuss their future prospects.

2. The companies

The cash value of sales for energy companies inevitably tends to fluctuate with changes in fossil fuel prices (see Table1) and with weather conditions. Nevertheless, all of the Big Five except EDF (whose generation is dominated by nuclear) have lower value sales in 2016 than

¹ The term Seven Sisters was coined in the 1950s by Enrico Mattei, then head of the Italian state oil company ENI.

in 2012 when fossil fuel prices were far higher than in 2016 despite the volume of their sales, in kWh, being similar to then. For all five companies, the financial position appears to have deteriorated since 2009 with profits much lower with three of the five recording losses in 2015. Their credit ratings are weaker despite all except RWE carrying far less debt in 2015 than 2009.

2.1 EDF

EDF was created in 1947 as the nationally owned electric utility for France. It was part privatised in 2005 when about 15 per cent of the shares were sold, but the rest remain in the hands of the French government which retains a 'golden share' entitling it to veto EDF decisions which the French government regards as being against France's interests.

2.1.1 Corporate changes from 2009

In 2009, EDF made a concerted effort to expand its foreign nuclear holdings. In the USA, it took 49.99 per cent, equivalent to about 2GW, of Constellation Energy's five nuclear plants (completed in 2009) to form Constellation Energy Nuclear Group (CENG). This group proposed to build a new French-designed reactor at its Calvert Cliffs site. In the UK, it acquired the privatised British nuclear power plant generator with 9GW of capacity, British Energy, selling on 20 per cent of the company to Centrica. EDF/Centrica also formed a consortium that planned to build four new reactors in the UK. EDF and ENEL signed a cooperation agreement for the development of nuclear power in Italy and set up a 50/50 joint venture, Sviluppo Nucleare Italia SRL. The new joint venture was to conduct feasibility studies for the construction of at least four EPRs in Italy. These acquisitions led to a massive increase in its net debt from €24.5bn at end 2008 to €42.5bn at end 2009.

In 2010, the level of debt was reduced by the sale of EDF's three UK electricity distribution networks (covering a third of the UK territory) for £5.8bn and the sale of its stake in one of the four major German utilities, EnBW, for €4.5bn. It also allocated 50 per cent of the shares in its French electricity transmission business, RTE, to its dedicated asset portfolio to cover back-end of the fuel cycle costs. These measures reduced EDF's net debt to €27.3bn.

The Fukushima disaster severely dented this strategy. In Italy, a verdict against nuclear power in a referendum held after the disaster effectively closed the Italian market to new nuclear plants. Constellation Energy, its US partner in the Calvert Cliffs project signalled its intention to leave the project and the application for a Combined Construction and Operation License (COL) with the US Nuclear Regulatory Commission was put on partial hold.² Its prospects of further expansion in China beyond the two reactors under construction in which it had taken a 30 per cent stake in 2008 looked poor.

By 2012, the Calvert Cliffs project had been shortlisted for loan guarantees from the US government but the project proved not to be viable and was abandoned. In 2013, agreement was finally reached on the terms for the sale of power from the UK Hinkley nuclear project,

² <http://www.world-nuclear-news.org/NN-Calvert-Cliffs-3-COL-withdrawn-2107157.html> (Accessed August 21, 2015)

although the plant was by then not expected on line before 2023 implying start of construction only in 2018.

2.1.2 The business in 2016

Around 2000, EDF had major holdings round the world including, for example, Brazil, Cote D'Ivoire and Vietnam.³ However, by 2015, while it lists a large number of countries it is active in, most are these are for small volumes of renewable generation sources (see Tables 2 and 3). Its home market accounted for 55 per cent of its sales in 2016, with its UK (13 per cent) and Italian (16 per cent) accounting for most of the rest. Its flagship policy as set out in its 2015 annual report was its CAP 2030 strategy. This has three priorities: proximity to customers and local communities; low carbon generation, with a balanced mix of nuclear and renewable energy; international expansion. A measure of how far EDF is trying to change its image is given in EDF's 2016 'Book'⁴ The first 80 of its 147 pages are concerned with consumer self-generation, energy storage, 'smart' systems, electric vehicles and energy from waste. Almost the first reference to nuclear is on page 105 where EDF states it spends as much on renewables as it does on nuclear.

From 2015 onwards, there have been major changes that are dramatically altering the shape of the company. In March 2015, the annual report by Areva, the French nuclear reactor and fuel cycle company, 87 per cent state-owned, showed losses for the fifth consecutive year, this time of €4.8bn. It became clear that a major restructuring was needed if it was to continue to trade. Areva comprised two main divisions, Areva NP the reactor business and Areva NC, the fuel cycle business. The French government led this effort and it proposed that the reactor company be spun off with EDF taking a 75 per cent stake with the rest owned by the new Areva company. EDF would then attempt to reduce its stake to 51 per cent selling on shares to a foreign company. For the rescue to be feasible, the French government will have to assume responsibility for all Areva NP's historic liabilities and these could amount to more than €10bn. In November 2016, the deal was agreed under which the liabilities like Olkiluoto would remain in a rump Areva NP company, with the other assets placed in 'New NP', 75 per cent owned by EDF for €2.5bn.⁵

The deal is only expected to be concluded in the second half of 2018, subject to favourable conclusions from French nuclear safety regulator concerning quality control issues affecting the reactor under construction in France and historic quality control issues relating to parts supplied by three of Areva NP's factories. It seems inevitable that the European Commission will be obliged to carry out an investigation to determine whether the French government's role in the rescue constituted unfair state-aid. If it decides it is, the rescue could be prevented

³ Information drawn from EDF's Reference Document. https://www.edf.fr/sites/default/files/contrib/groupe-edf/espaces-dedies/espace-finance-en/financial-information/regulated-information/reference-document/edf-ddr_2015-va.pdf (Accessed November 1, 2016).

⁴ <https://www.edf.fr/sites/default/files/contrib/finance/Annual%20Report%20VA/2015/edf-instabook-2015-va.pdf> (Accessed June 8, 2017)

⁵ <http://www.world-nuclear-news.org/C-Contract-signed-for-Areva-reactor-business-sale-1611167.html> (Accessed November 25, 2016)

or allowed only with significant conditions. How far EDF wants to take on the role of reactor vendor and servicer and how far it has any choice in the matter is a moot point.

In September 2015, EDF and the British government announced agreement had been reached on the terms for the deal to build the Hinkley nuclear project. However, there still remained problems for EDF in raising the finance. A Chinese company, China General Nuclear (CGN), would take a 33.5 per cent stake but at least initially, EDF would have to finance the project via equity rather than debt. However, its profits are insufficient to support this so it is proposing to sell bonds worth €4bn (€3bn to be bought by the French government) and sell non-core assets worth about €10bn by 2020, €6.5bn in 2016. These are reported to include: the 50 per cent stake in the transmission company, RTE, not allocated to the decommissioning fund; its 49.9 per cent stake in CENG; a 29 per cent stake in British Energy; and some coal-fired plants in Poland and Italy. Of these, only the sale of stakes in RTE and British Energy will raise significant sums. The target for 2016 was badly missed. There is no sign of interest in the stake in British Energy but in December 2016 a French state-owned bank, Caisses des Dépôts agreed to take the stake in RTE for €4bn subject to approval by antitrust authorities.

If the other sales take place, they will represent a further retrenchment for EDF back into France. In May 2016, Standard & Poor's down-rated EDF's long-term credit rating to from A+ to A with a negative outlook because it judged its 'business fundamentals have weakened.'⁶ It downgraded EDF's rating again in September 2016 to A- (stable) as a result of the UK government's decision to approve construction by an EDF-led consortium of the Hinkley Point C nuclear power plant.⁷

2.2 E.ON

E.ON was created in 2000 from the merger of two of the largest German utilities, Preussen Elektra and Bayernwerk. While some of the shares are owned by local authorities, it operates essentially as a privately owned company.

2.2.1 Corporate changes from 2009

In 2009, to meet the requirements of the German energy regulator, E.ON sold its high voltage German transmission company and some coal-fired generation capacity. It also sold other German subsidiaries with the total cash raised of all these transactions amounting to €6bn. It set up a joint venture with RWE, Horizon, to build up to 6GW of nuclear plant in the UK. In 2010, 2011, and 2012 the divestments continued raising a further €4bn, €6bn and €4.4bn. However, the Fukushima disaster in 2011 and the subsequent decision by the German government to accelerate the phase-out of nuclear power resulted in some write-offs. In 2012, the Horizon joint venture was sold in entirety to Hitachi.

⁶ https://www.edf.fr/sites/default/files/contrib/groupe-edf/espaces-dedies/espace-finance-en/investors-analysts/credits/rating/sp_ratingsdirect_researchupdate_13052016.pdf (Accessed October 28, 2016)

⁷ <https://www.edf.fr/en/the-edf-group/dedicated-sections/investors-shareholders/investors-analysts/bonds/rating> (Accessed October 28, 2016) and The Times 'Hinkley cost hits EDF's credit rating' September 23, 2016

The major change came in November 2013 with the decision to split the company spinning off the conventional power generation and gas businesses into a new company to be called Uniper, leaving E.ON to concentrate on ‘customer service, efficient and increasingly smart grids, renewables, distributed generation, and technical innovations’⁸ While E.ON and Uniper had been operating independently since January 2015, the complexity of the split mean that it was not until September 2016, that Uniper was floated on the Frankfurt stock exchange. 53.35 per cent of the stock was floated with E.ON retaining the rest. Uniper was ‘deconsolidated’ on December 31 2016. E.ON had planned to include the nuclear business in Uniper but the government was against this because of concerns about ensuring adequate provisions for decommissioning were available and in September 2015, E.ON decided to retain these assets in E.ON as a business called Preussenelektra which is categorised as a ‘non-core business’.

E.ON has not fared well since the flotation. It reported losses of €16bn for 2016, mostly attributable to discontinued operations, including an impairment charge of €7bn against Uniper.⁹ While the settlement with the government on decommissioning did cap the liability (see below), their contribution will be about 25 per cent more than they had provisioned.

2.2.2 The business in 2016

In February 2016, S&P put E.ON on review for a potential downgrade, while Uniper was given a BBB- rating (see Tables 4, 5, and 6). In 2016, its German operations still account for half its turnover with the UK another quarter. Its other main businesses are ‘customer solutions’ in Sweden, Russia and the Czech Republic. 94 per cent of Uniper’s revenue in 2016 was classified as ‘global commodities’ making it difficult to see the shape of the business. This category includes buying and selling of electricity, gas, oil, coal, freight and carbon allowances.

2.3 RWE

RWE has, for more than a century, been one of the largest German utilities (see Table 7)

2.3.1 Corporate changes from 2009

In 2009, RWE made its most recent major foreign acquisition buying one of the two large Dutch utilities, Essent, for €7.8bn and it set up a joint venture with E.ON, Horizon, to build up to 6GW of nuclear plant in the UK. It sold its remaining stake in American Water for about €1.3bn marking the end of its attempt to become a multi-utility. By 2010, it was targeting divestments worth €8bn by 2013. The Fukushima disaster and the costs it imposed through the accelerated nuclear phase-out increased the urgency for assets sales and led to the sale of RWE’s stake in Horizon to Hitachi. In 2010, as required by the European Commission, it sold its gas transmission business, Thyssengas, and in 2011, it sold a majority stake in its electricity transmission business, Amprion. In 2012, its divestments amounted to €2.1bn and in 2013 to €2.2bn and in 2015 it completed the sale of its oil and gas subsidiary, RWE DEA for €5.1bn.

⁸ http://www.eon.com/content/dam/eon-com/ueber-uns/publications/150312_EON_Annual_Report_2014_EN.pdf (Accessed November 2, 2016)

⁹ <http://www.eon.com/en/about-us/publications/interim-report.html> (Accessed November 18, 2016)

At the end of 2015, it decided to follow E.ON's example and split the company with one part containing its renewables, its networks and its retail operations and the other its traditional generation assets. However, unlike E.ON, the 2015 RWE Annual report said the new RWE would be based on the traditional generation business with the new, business spun off albeit RWE intends to sell off only 10 per cent of the new company initially and to retain a majority holding in the long-term. In fact, the new business, innogy was launched on the Frankfurt stock exchange in October 2016 with the sale of 23 per cent of the shares valuing innogy at about €20bn. The sale was oversubscribed several times over and EBITDA for the first three quarters of 2016 was €3.8bn, 13 per cent down on the same period in 2015.¹⁰

2.3.2 The business in 2016

In June 2016, S&P downgraded RWE to BBB- with a negative outlook partly because of the German government's decision to increase requirements on the utilities to pay for nuclear waste disposal and decommissioning (see Table 7).¹¹

The separate reports for RWE AG and innogy reveal that the split of RWE is significantly different to that of E.ON with Innogy representing about 90 per cent of the old RWE (see Tables 8 and 9). The rhetoric on renewables is clearly no more than aspirational with income from renewables representing little more than 1 per cent of innogy's revenue. Its core business is clearly retail (73 per cent of revenue) and infrastructure most of the rest although more than half of its profits come from infrastructure and renewables. From a geographical point of view, like that of E.ON, its business is dominated still by Germany, 60 per cent, and the UK, 19 per cent.

As with E.ON, the reorganisation revealed large impairments resulting from the write-down in value of the generating assets and from the settlement of the nuclear liabilities requiring it to pay €6.8bn into the German government's decommissioning fund meant losses for 2016 were €5.7bn (net income) and no dividend was paid for 2016.

2.4 ENEL

ENEL was created in 1962 as the nationally owned electric utility for Italy. It was part privatised from 1999 onwards and by 2015, the Italian government holding had fallen to 25 per cent (see Table 10).

2.4.1 Corporate changes from 2009

In 2009, ENEL completed the takeover of the largest Spanish utility, Endesa, after a process lasting more than two years and costing it in excess of €40bn leaving it with huge debts. This not only gave it a strong presence in the Iberian Peninsula, it also gave it major holdings in Latin America and about 3.3GW of nuclear capacity in Spain. It was attempting to re-build its nuclear expertise so it could build new reactors in Italy. It had taken a majority stake in the

¹⁰ <http://www.rwe.com/web/cms/mediablob/en/3256198/data/110822/9/rwe/investor-relations/reports/RWE-interim-release-Q1-Q3-2016.pdf> (Accessed November 18, 2016)

¹¹ <https://www.rwe.com/web/cms/mediablob/de/1780926/data/1775774/10/rwe/investor-relations/anleihen/kreditrating/standard-poors-download-13-06-2016.pdf> (Accessed November 4, 2016)

Slovak utility, Slovenske Elektrarne, and was promising to complete construction of two old-design Russian reactors there as well as operating two similar existing reactors. It signed a cooperation agreement with EDF for the development of nuclear power in Italy and set up a 50/50 joint venture, Sviluppo Nucleare Italia SRL. The new joint venture was to conduct feasibility studies for the construction of at least four EPRs in Italy. It already held a 12.5 per cent stake in a nuclear plant under construction in France, Flamanville 3, and agreed to take a similar stake in a further five plants in France. It did sell its Italian transmission system for €1.15bn.

In 2011, the Fukushima disaster and the referendum result in Italy rejecting new nuclear power put an end to its ambitions to build new reactors in Italy. In 2015 Enel announced the sale of its stake in Slovenske Elektrarne, but conditional on the completion of the Mochovce reactors which, by then were about 5 years late and far over-budget.

2.4.2 The business in 2016

Just over half ENEL's sales were accounted for by its Italian operations, 27 per cent by the Iberian Peninsula and 15 per cent by Latin America (see Tables 11 and 12). However, Latin America was by far its most profitable division accounting for 20 per cent of operating income, whereas the Iberian Peninsula accounted for only 14 per cent.

2.5 ENGIE

ENGIE was created from the merger in 2008 of the part privatised French national gas company, GDF, and the French company Suez, whose main assets in energy were through its subsidiary, Electrabel, which still holds a dominant position in the Belgian electricity market (see Table 12). In 2015, the company was re-named ENGIE. The French state retains 28.65 per cent of ENGIE's shares and has a 'golden share' entitling it to veto decisions that the French state regards as against France's interests.

2.5.1 Corporate changes from 2009

The merger between GDF and Suez to form GDF Suez was completed in July 2008. The water services part of Suez, Suez Environnement, was spun with GDF Suez retaining 35.4 per cent. It was trying to expand its nuclear capability taking a 37.5 per cent stake in a consortium, NuGen, set up to build nuclear reactors in the UK. It also had an agreement with EDF to partner it in the construction of a new reactor at the Penly site and was lobbying hard to be allowed to lead a project to build a new reactor in France. It stressed its role outside Europe, especially in Latin America and also its strong position in natural gas markets and LNG.

The Fukushima disaster led to a re-evaluation of its nuclear objectives and in 2012, it listed three priorities: continuing investment in developing countries and in LNG; focusing in Europe on energy efficiency and renewables; and strengthening its presence in infrastructure and services. Its holding in NuGen was increased to 50 per cent (Iberdrola holding the rest) in 2011 with the withdrawal of Scottish & Southern Energy but in 2014, Iberdrola withdrew and was bought out by the Japanese reactor vendor, Toshiba, which also took some of ENGIE's stake

reducing it to 40 per cent. Toshiba's financial collapse allowed ENGIE to activate a condition requiring Toshiba to buy ENGIE's stake for £111.3m.¹²

2.5.2 The business in 2016

In 2015, ENGIE's businesses were much more geographically diversified than its peers. Its main businesses were in France (31 per cent of revenue), Benelux (14 per cent) and its liquefied natural gas (LNG) and global energy management (GEM businesses (13 per cent) but it had significant businesses in the rest of Europe, Latin America, North America and Africa/Asia and these appeared far more profitable than its three main businesses.

3. Where did it all go wrong?

There has been a dramatic deterioration in the financial position of the Big Five since 2010 as measured by sales, profits and credit rating. This deterioration led to two of the Big Five to choose the radical option of splitting their businesses into two with the traditional large-scale generation in one part, and renewables and customer service in the other. There are a number of possible explanations for this apparent dramatic decline: the failure of large-scale low-carbon technologies; the dramatic improvement in the economics of small-scale low-carbon technologies; poor mergers & acquisitions policies; and the extent of nuclear liabilities.

3.1 Failure of large-scale low-carbon technologies

One of the strengths of the large companies has been their scale and technical expertise. This allowed them to take on large, expensive and complex technologies such as nuclear and large coal-fired generation. These technologies are thought to offer major scale economies and modern technologies are typically 600MW for coal-fired plant and more than 1000MW for nuclear and have construction costs in excess of €1bn. New entrants would not have the financial strength to take on these technologies and they would also find it difficult to provide the high level of user skills these options require.

This advantage began to be eroded in the 1990s with the emergence of combined cycle gas turbine (CCGT) technology. The construction cost per unit of capacity was far less than coal-fired plant and a small fraction of the cost of nuclear plants. A typical unit might be around 250MW and its operation and maintenance is straightforward. The low construction cost meant that in most markets, especially those exposed to competition (this tends to increase the cost of capital), CCGT technology dominated new capacity additions.

While the greenhouse gas emissions of CCGT plant are significantly less than for coal the increased priority to reducing greenhouse gas emissions meant there was a need for low-carbon technologies. These included small-scale options such as solar photovoltaic (PV), on-shore wind and biomass.

¹² The Telegraph 'Toshiba left holding the baby as NuGen partner backs out of Moorside nuclear project' April 4, 2017. <http://www.telegraph.co.uk/business/2017/04/04/toshiba-left-holding-baby-nugen-partner-backs-moorside-nuclear/> (Accessed June 8, 2017)

However by 2009/10 the Big Five appeared to be pinning their hopes on large scale technologies such as nuclear power, coal generation with carbon capture and storage (CCS) and, to a lesser extent, concentrated solar power (CSP). This optimism has proved misplaced and the one large low-carbon source that has done well is off-shore windfarms.¹³

3.1.1 Nuclear

In its 2009 annual report, EDF, describing itself as: ‘the world leader in nuclear power’, gave as one of its key objectives to be: ‘a major player in the global revival of nuclear energy.’ It identified four countries apart from France as target markets, including UK, USA, Italy and China. These plans were soon in tatters. For France, the report mentioned the project, now long forgotten to build a new EPR reactor at Penly; the Italian market is now closed to any nuclear plants as a result of a referendum decision; EDF has withdrawn from the US market. For the UK, in 2009, it expected the first of four reactors to be built there to be in operation in 2017. By 2016, while the plan to build four reactors remained, construction of the first was not expected to start until 2019. For China, EDF was an equity investor (30 per cent) in a project, already under construction in 2009 to build two reactors, then expected to be completed in 2013/14. By 2017, these plants were four years late and there was little expectation that there would be further orders for EPRs in China (Thomas, 2016). Its claim to be the ‘world leader in nuclear power’ looked hard to justify given that the one plant it had under construction in France was at least six years late and three times over budget (Thomas, 2015).

In 2009, E.ON and RWE placed new emphasis on nuclear following the decision by the Chancellor, Angela Merkel, to relax the phase-out dates for existing reactors in Germany with the newest reactors expected to continue in operation until beyond 2030. Some interpreted this as a fore-runner to a decision to reverse the nuclear phase-out in Germany and allow new reactors. E.ON talked about: ‘preparing to extend the life of our nuclear power stations in Germany and participating in projects to build new nuclear plants in several countries.’¹⁴ In the UK, its joint venture with RWE, Horizon, planned to build four reactors, while it was also competing to build new reactors in Sweden and Finland, the latter through 34 per cent stake in Fennovoima. RWE also stressed the opportunity nuclear life-extension in Germany gave to them. As well as its stake in Horizon, it had a 15 per cent stake in a consortium set up to build two reactors, Cernavoda, in Romania. However, it withdrew its 49 per cent stake from the consortium set up to build two reactors, Belene, in Bulgaria because of difficulties of financing the project.

¹³ The quotes in this section are taken from annual reports of the companies for 2009 and 2015. For EDF see: <https://www.edf.fr/en/the-edf-group/dedicated-sections/finance/financial-information/publications/annual-report>; for E.ON <http://www.eon.com/en/about-us/publications/annual-report.html>; for RWE http://www.rwe.com/web/cms/en/110822/rwe/investor-relations/reports/?et_cid=86&et_lid=16088&et_sub=reports; for ENEL <https://www.enel.com/en/investors/a201609-annual.html> ; and for ENGIE <http://www.engie.com/en/investors/publications-2/> (all accessed November 9, 2016)

¹⁴ http://www.eon.com/content/dam/eon-com/en/downloads/e/EON_Company_Report_2009_.pdf (Accessed November 11, 2016)

The Fukushima disaster led to the re-imposition by Merkel of the phase-out in Germany with all reactors to be closed by 2022, this time with no prospect of a policy reversal. By 2015, E.ON's German nuclear capacity had fallen to 6.3GW compared to 8.6GW in 2009, while RWE's had fallen from 6.3GW to 3.9GW compared to 6.3GW in 2009. There is little expectation of new orders for Sweden, E.ON and RWE sold their stakes in Horizon in 2012 and E.ON sold its stake in Fennovoima. RWE pulled out of the Cernavoda project in 2011.

In Italy, Prime Minister Berlusconi overturned a referendum decision of 1987 to phase-out nuclear power in Italy in 2008. ENEL took equity stakes in new nuclear plants yet to be built in France and set up a joint venture with EDF to build four reactors in Italy. Its take-over of Endesa in Spain had given it 3.3GW of operating plant in Spain while its take-over of Slovenske Elektrarne had given it 900MW of operating reactors plus about 900MW of reactors under construction at the Mochovce site¹⁵. A referendum soon after the Fukushima disaster came to a strong verdict against new reactors in Italy. As a result, ENEL quickly pulled out of its nuclear joint ventures with EDF and in 2015, announced the sale of its stake in Slovenske Elektrarne. However, this sale cannot be completed until the plants under construction are completed, not expected before 2018.

There were also political moves in favour of nuclear power in ENGIE's electricity base, Belgium. A decision in 2003 to prohibit construction of new nuclear plants and to limit the life of existing reactors to 40 years (this would have led to their closure between 2014-25) was under pressure and in 2009, the Belgian government agreed to postpone the start of the phase-out to 2025.¹⁶ In its 2009 Reference Document, ENGIE claimed: 'Nuclear energy is a competitive source for electricity production, but it is also the only energy source that can help cut greenhouse gases massively in the short and medium term.' It had also taken a stake in the next proposed reactor in France, Penly, and was a partner (37.5 per cent) in a consortium, NuGen set up to build reactors in the UK. In 2008, it had lost out to RWE as a 49 per cent partner in the plan to build two reactors in Bulgaria but like RWE, it held a 15 per cent stake in the consortium attempting to build two reactors in Romania. As noted above, the Penly project has been shelved and it withdrew from the Cernavoda project at the same time as RWE. Its stake in NuGen increased to 40 per cent following the withdrawal of both of its original partners and it was not able to withdraw from NuGen until April 2017.

3.1.2 Coal with CCS

The German companies were particularly prominent in promoting CCS. E.ON talked about making CCS technology commercially viable by 2020 and was competing for funding for demonstration plants in Germany, UK, Netherlands and the USA. RWE was similarly enthusiastic, planning to build pilot plants in the UK and the USA. In 2009, ENEL signed a memorandum of understanding to set up an Institute (Global Carbon Capture and Storage Institute) to develop more than 20 pilot CCS projects. ENGIE committed to invest in research

¹⁵ Construction of these two units commenced in 1986 but was suspended for 16 years before restarting in 2008

¹⁶ <http://www.world-nuclear.org/information-library/country-profiles/countries-a-f/belgium.aspx> (Accessed November 11, 2016)

on CCS and its 700MW Wilhelmshaven coal plant under construction in Germany was said to be CCS ready. While EDF paid lip service to the need for CCS, it merely said it wanted to ‘contribute to [its] development.’

In their 2016 annual reports, the Big Five made little or no reference to CCS.

3.1.3 Concentrated solar power

The flagship project for CSP was the Desertec project, led initially by German companies, under which a large volume of CSP would be built in North Africa and exported to Europe with the objective of supplying 15 per cent of Europe’s power by 2050. E.ON and RWE were a founding members of the Desertec consortium, Desertec Industrie Initiative (DII), in 2009. ENEL Green Power joined the Desertec joint venture in 2010.

In 2013, the Desertec joint venture effectively collapsed after the withdrawal of 16 of its 19 industrial backers, including E.ON and ENEL, but not RWE.¹⁷ While DII still exists, in 2016, it appeared to have little chance of proceeding.

3.1.4 Offshore wind

In 2009, while most of the companies mentioned offshore wind, it was not a strategic priority for any of them. E.ON did have several projects under construction in which it was partner and by 2015, it claimed it was the world’s second largest offshore wind company. RWE was also an early mover in off-shore wind, having stakes in a number of projects in 2009 and in 2015, it commissioned two large-scale offshore wind farms.

In 2015, ENGIE and EDF still owned no operating capacity but were involved in a few projects. ENEL, which had not mentioned offshore wind in its 2009 annual report still had no involvement in offshore wind projects, concentrating on onshore wind. Spectacular reductions in off-shore wind costs mean that this option is likely to expand significantly in the next few years. In April 2017, a Danish energy company, DONG, claimed it could build off-shore wind-farms with no subsidy.¹⁸

3.2 Improvement in decentralised options

3.2.1 The company response

The spectacular reductions in small scale renewable costs, especially solar PV and on-shore wind are well documented with the ‘Energiewende’ process in Germany that has been underway since the re-imposition of the nuclear phase-out in 2011 and the large-scale adoption of these technologies in China providing the scale, experience and development that has driven these cost reductions.

In 2009, EDF stressed the need for subsidies for onshore wind, but by 2015, it said that onshore wind was close to competing or matching traditional sources in some areas. It was similarly more optimistic about solar PV. Even in 2009, E.ON was more positive about onshore wind

¹⁷ <http://www.reuters.com/article/germany-desertec-idUSL6N0S535V20141014>

¹⁸ Financial Times ‘Dong Energy breaks subsidy link with new offshore wind farms’ April 14, 2017. <https://www.ft.com/content/f5b164a6-20f8-11e7-b7d3-163f5a7f229c?mhq5j=e3> (Accessed June 8, 2017)

and solar claiming it was one of the world's largest wind power producers. It was also strengthening its commitment to solar. The restructuring of E.ON puts renewables as one of its key businesses.

RWE was much less involved in onshore wind and solar PV in 2009, preferring to channel its effort on solar energy through Desertec. In 2008, ENEL created ENEL Green Power as a wholly owned subsidiary albeit it contributed less than 3 per cent of ENEL's revenues. In 2010, 30 per cent of the stake was floated on the stock exchange raising €2.6bn. In 2015, ENEL began the process of re-integrating ENEL Green Power back into ENEL reflecting the high priority ENEL placed developing this business. For ENGIE, in 2009, renewables appeared not to be a strategic priority. However, by 2015, one of its two 'key themes' was to be 'the leader in energy transition in Europe' giving priority to 'more mature technologies' including onshore wind and solar.

3.2.2 Issues raised

An increased priority for renewables raises a number of issues for the large companies. Renewable and nuclear sources tend to be inflexible, renewables being able to generate only when conditions are right and nuclear having to generate at all times¹⁹. In some European countries, including Spain and Germany, where at times the system is powered entirely by renewables and nuclear, system operators have to require a reduction in output from either nuclear or renewables. Unless and until a cost-effective electricity storage there must be doubts about the viability of an electricity system dominated by nuclear and renewables.

The growth of renewables has already had an impact on wholesale electricity markets. Renewables (and nuclear) usually have priority in system dispatching and because renewables are generally not in the market, and avoidable generation costs for nuclear are low, this means that wholesale prices have been falling sharply over the past eight years. In a commodities-type market, as has been introduced for electricity, unless the market is in shortage, the market price will be set by the marginal cost of the marginal source. This has had a very adverse effect on the economics of fossil fuel plants, which have seen prices and utilisation seriously reduced.

In the long-term, even if and when renewables do not need to be taken out of the market, this presents a challenge to market design and to fossil fuel generation. Until there is cost-effective electricity storage, there will need to be flexible plant, probably gas-fired to fill demand peaks. With low prices and uncertain utilisation, market signals will not be sufficient to get this plant built and kept on-line. For most renewables, the marginal cost is effectively zero meaning that many plants will be unable to recover their fixed cost, not a sustainable position. In recognition of this, governments are increasingly introducing capacity payments designed to cover fixed costs, to ensure all the required capacity is available when needed.

The other issue raised is how well adapted the large companies are to play a major role in owning and operating small, decentralised power sources. To some extent, this depends on how

¹⁹ So-called load-following is possible for nuclear plants but it adversely affects the economics and also places additional thermal strains on the plant and is therefore not desirable

incentives to stimulate renewables are set up. In centralised countries, for example, the UK, mechanisms like capacity auctions favour the large companies which have the resources and expertise to compete. However, in decentralised countries where the requirements are less severe, for example, the Feed-in Tariff system in Germany, local enterprise, often public appears much better adapted to take advantage of the opportunities for renewables.

3.3 Bad purchases

In general, the success rate of take-overs and mergers is low so it would not be surprising if some of the many takeovers the Big Five carried out in the period 2000-2010 had not been as successful as expected. The CEO of EDF, Jean-Bernard Levy acknowledged this in April 2016, saying: ‘Our foreign acquisitions have not always been very successful. We often bought companies at the wrong time and then sold them again at the wrong time, after not after having managed these assets well.’²⁰

Perhaps the more significant question, particularly towards the end of the period, is whether the companies overstretched their finances making acquisitions and whether they overpaid for them. By then, the number of utilities available to take over was very limited and this may have led the companies to bid too much to avoid being left behind in a race for increased scale. Two clear examples are the purchase by ENEL of Endesa and the purchase of Essent by RWE.

In 2005, the Spanish gas company, Gas Natural, made a takeover bid for Endesa, offering €23bn, which was rejected. In February 2007, E.ON made a bid valuing the company at about €30bn. This bid was withdrawn in exchange for some of Endesa’s assets and in October 2007, ENEL made a successful bid for the company valuing it at €42.5bn.

In 2009, the two largest Dutch utilities, Essent and Nuon, both previously owned by Dutch municipal and local authorities became available. Nuon was sold to the Swedish utility, Vattenfall for €10.3bn and Essent was sold to RWE for €9.3bn. These takeovers were the most recent large transactions. RWE was already heavily indebted by then and given the poor performance of Essent since then, this does not appear a wise purchase.

3.4 Global recession

The global recession from 2008 onwards led to significant reductions in electricity demand, particularly in the UK and Italy, which showed no sign of being recovered by 2015 (see Table 11. Over the five largest European countries, which also make up the main markets of the Big Five, demand fell on average by about 7 per cent. With renewable capacity, often owned by new entrants, entering the market rapidly over that period, this was bound to significantly reduce utilisation of the existing fossil fuel plants

3.5 Nuclear liabilities

All of the Big Five own a significant volume of nuclear power plants, some already retired and most of the operating capacity is 25 years old or more. The utilities are legally obliged to provide sufficient provisions to pay for the full decommissioning of the plant. The design life

²⁰ <http://uk.reuters.com/article/edf-strategy-idUKL5N1785CX> (Accessed November 10, 2016)

of reactors is typically 40 years so, unless the plants are operated longer than expected, the provisions will soon be needed and if they are insufficient, the utilities will be obliged to make up any shortfall.

EDF has the largest number of operating reactors with 58 in France as well as a handful of already retired reactors using old technology.²¹ Its operating reactors reach their 40th birthday in large numbers (five or six per year) from 2017 onwards. However, it is hoping to life-extend these plants by up to 20 years and if it is successful in doing this, this will create much more time to ensure the provisions are adequate. This life-extension will not be cheap. EDF estimates the cost will be €50bn²² while the Cour des Comptes estimates it will cost €100bn.²³

A European Commission report (European Commission, 2016) published in April 2016 showed estimates of EDF's liability for decommissioning and waste management costs of €68.4bn comprising €22.6 for decommissioning and the rest for waste management costs. EDF expects to meet these liabilities via an internal segregated fund, managed by EDF that can only be used for the designated purpose. This is usually seen as not as secure as an independently managed external segregated fund. By 2016, the fund was worth only €23bn, 34 per cent of the required amount and so the assumption must be that further contribution and fund growth will make up the shortfall. The decommissioning cost per installed kW of €300m is the joint lowest (with Sweden) of any country in the EU and is only about 40 per cent of the EU average.

RWE and E.ON must close all their reactors by 2022 with no possibility of life-extension. E.ON had hope to hive off its reactors in Uniper but pressure from the German government meant they were unable to do this and the parent companies will be responsible for the liabilities. In October 2015, the German government set up a Commission Kommission zur Überprüfung des Kernenergieausstiegs (KFK) to recommend how the decommissioning liability should be funded. In March 2016, it recommended that the four nuclear owners (E.ON, RWE, Vattenfall and EnBW) should pay €23.3bn into a state-owned fund to pay for decommissioning of the plants and managing radioactive waste. This proposal was accepted by the Cabinet in October 2016.²⁴ RWE and E.ON will pay the majority of the amount with a combined contribution of €16.7bn. While this is a large sum of money, the settlement was welcomed by the utilities because it included a 35.5 per cent risk premium, which exempts them from having to make any additional contributions to the fund. Contributions would be made in stages over the next few years.

The European Commission showed that Germany's total liability was €45.7bn²⁵ and that €38bn was available to pay the liability (European Commission, 2016). However, this

²¹ It owns eight nuclear power plants in the UK but as a condition of it buying these, it was not responsible to pay for the main parts of the decommissioning process.

²² Nuclear Intelligence Weekly 'France: Financing the "Grand Carenage"' May 5, 2017 p 4

²³ Le Figaro 'Les quatre chiffres à connaître sur l'énergie nucléaire en France' May 18, 2017

²⁴ <http://www.world-nuclear-news.org/WR-Cabinet-approves-German-nuclear-phase-out-funding-bill-2010164.html> (Accessed November 18, 2016)

²⁵ The decommissioning estimate includes some waste management costs so it is difficult to compare with that of other countries

data was published before the KfK's recommendations were adopted. The funds were non-segregated internal funds exist in Germany, under which the companies operating reactors must build up reserves in their balance sheets for the future decommissioning and waste management costs. This method is generally seen as less secure than segregated external funds and the creation of a national fund gives more security to the funding albeit the current utilities' contribution will cover only about half of the liability.

ENGIE owns seven reactors in Belgium three of which are already past their 40th birthday. The Belgian government position has changed several times over the past 15 years²⁶ and in 2016, the position was that the reactors would close between 2022 and 2025. ENGIE is likely to seek life-extension beyond that time but if it is unsuccessful and the existing funds prove insufficient, it could be called on to make up the shortfall.

The European Commission estimated Belgium's liability as €10.7bn comprising €3.7bn (about 75 per cent of the EU average) for decommissioning and the rest for waste management (European Commission, 2016). The funds identified (€7bn) cover 70 per cent of the liability. Like France, these are held in an internal segregated fund, managed by the utilities that can only be used for the designated purpose.

ENEL is least exposed to decommissioning liabilities. It is selling its stake in the two operating reactors in Slovakia. In Spain it has a share of five reactors but this amounts to only 3.3GW (46 per cent of Spain's operating nuclear capacity) and the reactors do not begin to reach their 40th birthday until 2021 onwards.

The European Commission estimated Spain's total liability as €14.5bn comprising €4.5bn (about 75 per cent of the EU average) for decommissioning and the rest for waste management (European Commission, 2016). The funds identified (€4.3bn) cover 30 per cent of the liability and are held as an external segregated fund.

4. Conclusions

For the period since the start of the attempts in the mid-90s to transform network energy supply to a competitive market, the record of the strategic policies of the major international European utilities is dismal. They have generally followed similar policies whether it be becoming multi-utilities or focusing on nuclear power and carbon capture & storage with little success. This inept strategising appears to have had little impact on their financial strength until about 2010. Until then, a combination of strong and profitable home-markets, the barriers to entry created by the large complex generation technologies and the reluctance of most national authorities to introduce measures that put the large incumbent utilities under serious competitive pressure protected them from their failings. From 2012 onwards, the financial position of the Big Five

²⁶ <http://www.world-nuclear.org/information-library/country-profiles/countries-a-f/belgium.aspx> and <http://www.world-nuclear-news.org/NP-IEA-advises-rethink-on-Belgian-phase-out-policy-2005164.html>
(Accessed November 14, 2016)

has deteriorated alarmingly with sales going down, profits minimal leading to significant down-rating by the credit rating agencies.

By 2015, the new fashion, led by the two German utilities, RWE and E.ON, seemed to be to hive off the old businesses of large-scale fossil fuel and nuclear generation in order to concentrate on retail, networks and renewables. In most cases, this change would be rather cosmetic in nature with the businesses hived off being in steep decline. There is also a gap between the rhetoric of the changes, which generally stresses low-carbon generation and the reality, which is the businesses are heavily based on retail and to a lesser extent networks albeit networks make up a disproportionately high proportion of their profits. Ironically, the networks business is one which the European Union energy directives discourages them from holding requiring networks where they are still owned in integrated companies to be legally separate from the generation and retail businesses

However, this time it is less clear that the Big Five will survive. Regulators are becoming impatient with the incumbents exploiting their market power, the large technologies, nuclear and coal are failing, and the new decentralised low-carbon technologies with low entry barriers are making rapid cost reductions. If the big companies are to survive in the new environment, they will face competition from new entrants in fields, small-scale generation and retail, where their scale will be of little value and where they may prove too old and lumbering to compete with small innovative new companies.

The analysis presented in this paper begs two questions: how far is the weak position of the Big Five down to poor strategies; and what are the prospects that they will be able to transform themselves into a new form able to prosper in the new environment.

The historical parallels may be the loss of dominant market position that companies with apparently impregnable market positions like IBM and ITT suffered. A combination of rapid technical change and emergence of small scale technologies meant these companies remained but they were overtaken but much nimbler newcomers.

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Table 1 Sales of the Five Brothers (€m)

	2009	2012	2014	2015	2016
EDF	66336	72729	73383	75006	71203
E.ON	81817	132093	113,095	116,218	38173
Uniper					67788
RWE	47741	53227	48468	49599	5684
innogy					43611
ENEL	64035	84889	75791	75658	70592
ENGIE	79908	97038	74686	69883	66639

Sources: Annual reports and accounts

Table 2 EDF economic performance 2009-16

	2009	2012	2014	2015	2016
Sales (€m)	66336	72729	73383	75006	71203
Group net income (€m)	3905	3316	3773	1481	2851
Employees	169,000	160,000	158,000	159,000	155,000
Net indebtedness (€m)	42496	41575	34208	37395	37425
S&P long term credit rating ²⁷	A+ stable	A+ stable	A+ stable	A+ negative	A- stable
Share price (€) at Dec 31	41.56	13.98	22.825	13.575	9.68

Source: https://www.edf.fr/sites/default/files/contrib/groupe-edf/espaces-dedies/espace-finance-fr/informations-financieres/informations-reglementees/document-de-reference/edf-ddr_2016-en.pdf (Accessed June 6, 2017)**Table 3 EDF Revenue and profits by division, 2016 (€m)**

Division	External Revenue	EBITDA
France	39524	11258
United Kingdom	9267	1713
Italy	11125	641
Other international	5286	711
Other activities	7734	2091
Total	71203	16414

Source: https://www.edf.fr/sites/default/files/contrib/groupe-edf/espaces-dedies/espace-finance-en/financial-information/regulated-information/reference-document/edf-ddr_2015-va.pdf (Accessed November 8, 2016)**Table 4 E.ON economic performance 2009-16**

	2009	2012	2014	2015	2016: E.ON	2016: Uniper
Sales (€m)	81817	132093	113,095	116,218	38173	67788
Net income (€m)	8645	2641	-3130	-6377	904	-3973
Employees	88227	72083	58811	56490	43138	12890
Net indebtedness (€m)	44665	35879	33394	27714	26320	4167
S&P long term credit rating	A stable	A- stable	A- negative	BBB+	BBB+	BBB-
Share price (€) at Dec 31	29.23	14.09	14.20	8.93	6.70	12.00

²⁷ Standard & Poors has four basic ratings classified as 'investment grade' AAA, AA (subdivided into AA+, AA and AA-), A (subdivided into A+, A and A-) and BBB (subdivided into BBB+, BBB and BBB-). Its highest 'non-investment grades' (often known as junk) are BB and B.

Source: https://www.eon.com/content/dam/eon/eon-com/investors/annual-report/EON_Financial_Statements_2016.pdf and https://www.uniper.energy/content/dam/uniper-corporate/documents/en/investor-relations/Uniper_FY2016_US.PDF (Accessed June 6, 2017).

Table 5 E.ON Revenue and profits by division, 2016 (€m)

Division	External Revenue	EBIT
Energy networks Germany	11622	894
Energy networks other	1712	777
Customer solutions Germany	7781	232
Customer solutions UK	9659	278
Customer solutions other	6796	215
Renewables	1357	430
Other	2001	199
Total	38173	3112

Source: : https://www.eon.com/content/dam/eon/eon-com/investors/annual-report/EON_Financial_Statements_2016.pdf (Accessed June 6, 2017)

Table 6 Uniper Revenue and profits by division, 2016 (€m)

Division	External Revenue	EBIT
European Generation	2988	126
Global Commodities	63233	1327
International Power	1063	106
Total	67284	1362

https://www.uniper.energy/content/dam/uniper-corporate/documents/en/investor-relations/Uniper_FY2016_US.PDF (Accessed June 6, 2017).

Table 7 RWE economic performance 2009-16

	2009	2012	2014	2015	2016	2016 Innogy
Sales (€m)	47741	53227	48468	49599	45833	43611
Net income (€m)	3571	1306	1704	-170	-5710	1513
Employees	70726	70208	59784	59762	58652	40636
Net indebtedness (€m)	25787	33015	30972	25126	22709	15748
S&P long term credit rating	A negative	BBB+ stable	BBB+ stable	BBB negative	BBB- stable	BBB- positive
Share price (€) at Dec 31	49.89	31.24	25.65	11.71	11.82	33.01

Source: <http://www.rwe.com/web/cms/mediablob/en/3688522/data/2957158/7/rwe/investor-relations/reports/2016/RWE-annual-report-2016.pdf> and <https://www.innogy.com/web/cms/extshort/en/3703964/annual-report-2016> (Accessed June 6, 2017)

Table 8 innogy Revenue and profits by division, 2016 (€m)

Division	External Revenue	Adjusted EBITDA
Renewables	768	671
Grid & Infrastructure Germany	9854	1844
Grid & Infrastructure E Europe	907	778
Retail Germany	16540	592
Retail UK	8111	-11

Retail Benelux	3764	233
Retail E Europe	3514	243
Total	43611	4203

Source: <https://www.innogy.com/web/cms/extshort/en/3703964//annual-report-2016> (Accessed June 8, 2017)

Table 9 RWE Revenue and profits by division, 2016 (€m)

Division	External Revenue	Adjusted EBITDA
Conventional power generation	1967	
Trading/Gas midstream	3646	
Other	71	
Total	5684	

Source: <http://www.rwe.com/web/cms/mediablob/en/3688522/data/2957158/7/rwe/investor-relations/reports/2016/RWE-annual-report-2016.pdf> (Accessed June 8, 2017)

Table 10 ENEL economic performance 2009-15

	2009	2012	2014	2015	2016
Sales (€m)	64035	84889	75791	75658	70592
Net income (€m)	5395	865	517	2196	3243
Employees	81208	73702	68961	67914	62080
Net indebtedness (€m)	50870	42948	37383	37545	37600
S&P long term credit rating	A- stable	BBB+ negative	BBB stable	BBB positive	BBB stable
Average share price (€) Dec	4.06	3.06	3.75	3.96	4.02

Source: <https://www.enel.com/en/investors/a201609-annual.html> (Accessed October 28, 2016)

Table 11 ENEL Revenue and profits by division, 2016 (€m)

Division	External Revenue	Operating income
Italy	36957	4387
Iberian Peninsula	18953	1766
Latin America	10768	2163
Other	3914	605
Total	70592	8921

Source: https://www.enel.com/content/dam/enel-com/governance_pdf/reports/annual-financial-report/2015/Annual_Report_2015.pdf (Accessed November 8, 2016)

Table 12 ENGIE economic performance 2009-16

	2009	2012	2014	2015	2016
Sales (€m)	79908	97038	74686	69883	66639
Net income (€m)	4477	1544	2437	-4617	-415
Employees	242714	236156	236185	241913	
Net indebtedness (€m)	29967	43914	27511	27727	24807
S&P long term credit rating	A positive	A stable	A stable	A stable	A- negative
Share price (€) Dec low-high	28.50-30.29	15.10-17.45	18.27-20.52	15.51-16.55	

Source: <http://www.engie.com/wp-content/uploads/2017/03/fy-2016-management-report-and-annual-consolidated-financial-statements.pdf> (Accessed June 6, 2017)

Note: The 2016 Annual report did not include the share price at year-end, the number of employees or the credit rating. The credit rating for 2016 shown was set on April 28, 2017.

Table 13 ENGIE Revenue and profits by division, 2016 (€m)

Division	External Revenue	EBITDA
France	20332	1315
Benelux	9044	755
GEM & LNG	8981	3
Other Europe	8118	612
Latin America	4075	1696
N America	3814	475
Africa/Asia	3804	1162
Infrastructures Europe	3267	3459
Others	5204	1213
Total	66639	10689

Source: <http://www.engie.com/wp-content/uploads/2017/03/fy-2016-management-report-and-annual-consolidated-financial-statements.pdf> (Accessed June 6, 2017)

Table 14 **Net electricity generation: 2008, 2014**

	2008	2014
France	432.7	415.3
Germany	527.6	508.4
Italy	309.2	281.5
Spain	255.1	226.9
UK	341.9	303.6
Total	1866.5	1735.7

Source: http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Electricity_consumption_and_trade,_GWh,_2014_new.png (Accessed November 11, 2016)