

Facing the Climate and Digital Challenge: European Energy Industry from Boom to Crisis and Transformation

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Abstract

Our study shows how leading European energy companies (electricity and gas) that staged extraordinary growth in the mid-2000s experienced serious setbacks after the 2008 financial crisis. Not only did they lose share value dramatically, they have also retained depressed share value long after the general economy embarked on an upward trend.

The dramatic shift in energy industry's value creation has been taking place in a period of transformative policy change, involving European Union ever-stronger climate policy on top of its previous policy for deregulation. Concurrently, information technology has opened up avenues for new sharing economy and customer-centric green energy 'prosumership' which challenges conventional electricity industry based on a centralised generation model.

Based on nine case studies, this report explores business models and strategic trajectories behind this development, and finds that companies have moved in several directions with fairly different results. While a group of large players has retained the most depressed share prices, several medium sized companies have done substantially better. Engagement in renewable generation appears to have a positive effect on share prices. Green spinoffs from two energy incumbents, which have done far better than their mother companies, provide evidence which points in the same direction. Suppliers of renewable energy technology such as wind turbine manufacturers have done remarkably better, although their share value has oscillated far more than conventional energy industry. The solar technology supplier, however, has done worse than the conventional energy industry.

Finally, the study examines some of the emerging customer-centric approaches, and shows how they are 'invading' the conventional energy sector with new business models that challenge energy industry both at the product, business and industry levels. Based on this analysis, the study presents perspectives on future positioning of a sustainable European energy industry.

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1 Overview

European Energy Industry has seen a dramatic change in the first one and a half decades of the 21st century. Business strategies that were widely acclaimed and worked excellently up until 2008 seemingly ran out of steam and never regained their momentum after the financial crisis. Gradually, a new generation of business models has emerged, with radically different focus and composition.

The focus of the central energy incumbents at the turn of the millennium was generally based on the economics of scale and scope, which had traditionally played a central role in the energy industry. The customer was typically supplied with reliable delivery of energy, gas, electricity, and sometimes supplemented with water and waste disposal. De-regulation in the 1990s and early 2000s typically brought these sectors under competitive pressure, although the grid-infrastructure remained under natural monopoly regulation. For both the competitive and monopoly segments, the focus was on classical arguments of cost advantage gained due to size, scale of operation and co-production (Bersanko et al 2013; Gaughan 2002).

The period following the financial crisis has seen the emergence of new business strategies, characterised by green transition, de-centralisation, digitalisation and network economics. Motivated by the need to meet the climate challenge, extensive public funding has brought considerable volumes of renewable energy on the market, some of which was installed by consumers, leading to a trend of self-supply 'prosumership' in many EU countries. Over time, this has come to constitute a sizeable de-centralised supplement to the traditional centralised electricity industry (Schleicher-Tappeser 2012). As digital technologies are increasingly applied to energy infrastructure (Bughin and Manyika 2012), roles and relations in energy industry have started to be redefined (WEF 2016) and integrated into new types of entrepreneurship.

Our study also investigates responses from new green and digital competitors, as they move into the market. Relating to this dynamic technological and commercial setting, we concur with Chesbrough and Rosenbloom (2002) in their argument for adding a strong emphasis on the technological dimension of the business model, which thus becomes a focusing device that mediates between technology development and economic value creation.

As Henry Mintzberg (1985) has pointed out, disruptive changes in technologies, business models and industrial configuration raise a fundamental dilemma in business strategy: On the one hand, deliberate strategising, emphasising central direction and hierarchy, as well as goal-oriented planning, may be highly efficient under stable development with only incremental innovation. On the other hand, transitory situations call for emergent strategies with open, flexible, responsive and learning oriented management. Mintzberg argues that the latter is especially important when an environment is too unstable or complex to comprehend, or too imposing to defy. Similarly, researchers like Sarasvathy (2009) and Reis (2011) argue for trial and error based on user requirements and as opposed to planning and bureaucratic processes as efficient strategies to meet disruptive transition. Probing into Mintzberg's strategic dilemma, our study explores how central actors in European energy industry have framed their strategic outlook as they experienced the challenge of moving from strategising under scale and scope to new uncharted terrain under de-centralised green and digital transition.

2 Methodology

The study was based on a longitudinal comparative analysis of nine European energy incumbents, spanning 2000 - 2016. To supplement our research, the analysis of incumbents was compared to developments in the following three other groups of companies: 1) Green spinoffs from major European companies, 2) Renewable technology suppliers and 3) Emerging new actors in the European energy market.

The group of energy incumbents consisted of the following energy and utilities companies: Enel, ENGIE (former GDF Suez), EDF, E.ON, RWE and Iberdrola, representing the largest European players based on power sales (Statista 2016)³. We also included SSE, based on Forbes calculation of market capitalisation, assets, sales and profit (Power Technology 2016). We added two additional players to the group of incumbents: Verbund – the Austrian hydropower company, and Fortum – the Finnish energy company. Verbund was added as a traditional renewables based player, while Fortum was added because of its relatively high success in spite of operating in a low price Nordic energy market.

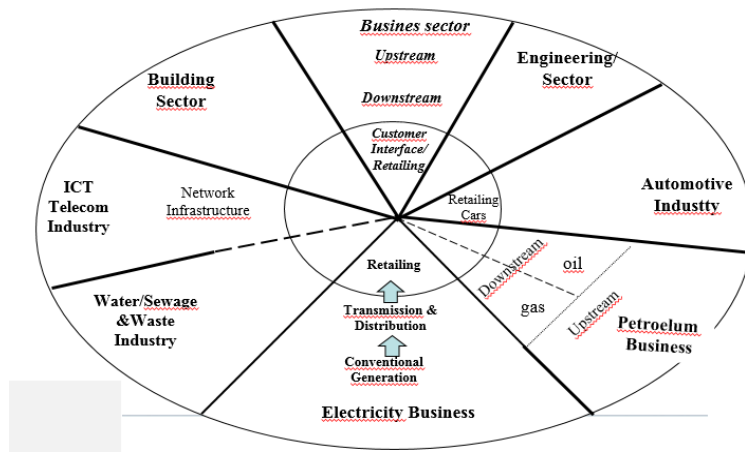
The green electricity generators included Enel Green Power – the spin-off from the Italian Enel, and EDP Renovaveis – the spin-off from the Portuguese EDP. The group of European renewable technology suppliers consisted of the Danish Vestas Wind System - the world's largest manufacturer of wind turbines, followed by its German peer Nordex. The last player was SolarWorld - the German solar panel manufacturer. We also briefly surveyed a group of emerging new actors in the energy market in order to bring in radically different business models. This included companies such as Sungevity (decentralized solar power), Techem (real estate comfort and energy management), Quivicon (internet based smart home platform), and Kiwigrid (internet based energy systems management company).

The analysis was explorative and combined qualitative and quantitative approaches. It did so by coupling a pragmatic textual analysis of strategic framing with a statistical analysis of economic and resource indicators. This allowed us to study the commercial trajectories, through analysing the underlying *business models* and how they have evolved over time, as well as to learn potential factors affecting conventional generators and the European electricity energy industry as a whole. A main source of information for top management's framing of company strategy was their investor communication in annual reports, particularly in the letters to the shareholders. This overview of strategies and business models was juxtaposed with economic data (e.g. EBIT, net profit, dividend, various financial ratios and share price development, and installed and production capacity, etc.) and resource data (energy sources mix in generation), all computed from 2000 or as long as they have existed. The main sources for the quantitative data were the companies' publications, Financial Times and Bloomberg's databases (FT 2016; Bloomberg 2016). The limited number of cases restricted how far the statistical analysis could be taken, and also dictated fairly simple statistical techniques such as Pearson Correlation analysis and ANOVA group comparisons.

Redefining strategies and business models in the energy industry involves reinventing business configurations across sectors and value chains. To structure our analysis of energy industry's complex strategic transition, we shall outline the strategic 'opportunity space' in a two-dimensional format (figure 2.1).

³ Swedish Vattenfall, which would have been included by the size-criterion, had to be excluded from the analysis since the company is not listed on a stock exchange market.

Figure 2.1. The Opportunity Space for Business Configuration of Energy Industry



In this format, the sectors within the circle indicate the sections of the economy that are potentially relevant to energy-related business reconfiguration, such as electricity, water/sewage, ICT and telecom, building, engineering and petroleum. Each sector is subsequently divided along a value-chain dimension into ‘upstream’ resource related activities towards the periphery to ‘downstream’ customer related activities in the centre.

3 Results

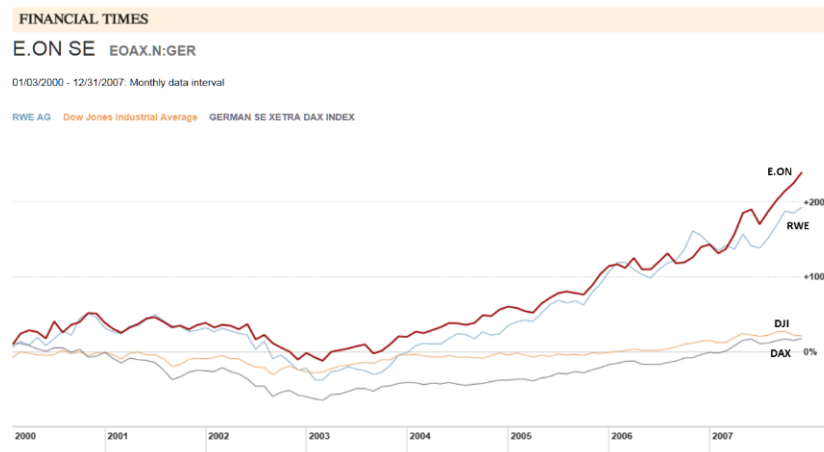
3.1 European Electricity Industry in Transition

3.1.1 E.ON and RWE from Supernovas to Black Holes

Golden Age of Success: Consolidating Scale and Scope

We started our research with the major German incumbents *E.ON* and *RWE* as core cases. Both *E.ON* and *RWE* began their 21st century on a merger and acquisition spree as part of an accelerating consolidation in the electric-utility industry following the deregulation in the late 1990s.

Figure 3.1. *E.ON* and *RWE* Benchmarked against *DAX* and *DJI* 2000-2007



Source: Financial Times (2016)

The massive upscaling of both companies took place against the background of impressive economic success. Markets picked up in 2003 after the burst of the dot com bubble. Following the increase in electricity prices, both companies saw an extensive upswing in share prices (figure 3.1), featuring growth many times higher than industry at large (*E.ON* 2016; *RWE* 2000a).

When it comes to the green dimension, neither *E.ON* nor *RWE* started the new millennium by reframing themselves as green pioneers. With a critical attitude to German green energy policy, they saw themselves as conventional actors aimed at moving slowly towards a green agenda with conventional low-carbon solutions like natural gas, playing a major role (*E.ON* 2001; *RWE* 2000a).

Nevertheless, both companies gradually revised their harsh critique of government greening policies and took on board part of the green agenda, but predominantly in line with conventional energy supply (E.ON 2005; RWE 2006).

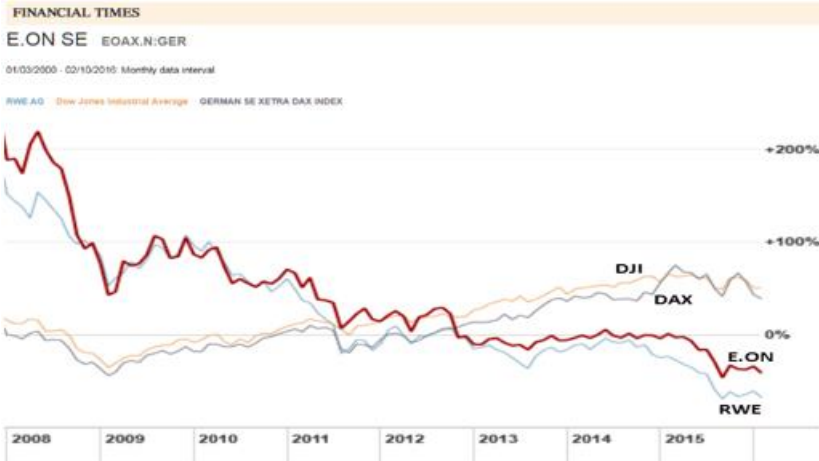
By 2007, both E.ON and RWE could note great successes. The two companies had built up their broad and integrated energy supply chains through ambitious mergers and acquisitions. They had also consolidated their business focus through sales of non-core business, thereby generating financial assets that allowed further expansion. Both companies maintained a broad engagement along the whole energy value chain including competencies from generation, transmission, wholesale trading, distribution and retailing. Long standing supply-partnerships with major multi-engineering companies such as Siemens allowed them to supplement internal competencies with highly qualified external.

Financially, the “golden age of success” was highly profitable for both companies. Electricity prices were rising, and energy industry shares grew at a much higher rate than the rest of the economy. Shared utilisation of organisations, expertise and customer bases allowed RWE and E.ON to reap advantages of scale and scope. The business model was strengthened by value feedback from the stock market, boosting E.ON and RWE stocks far beyond the industrial average. This development and a similar boom in profit rates made it hard to question business as usual.

Crisis and Transition: New Emergent Models

The financial crisis and the following slowdown of the European economy offered a serious blow to the profitability of the two German incumbents, leading to a massive drop in share value, under declining electricity prices. As opposed to the German economy as a whole, the share value of E.ON and RWE do not pick up, but rather continues on a downward trend (figure 3.2).

Figure 3.2. E.ON, RWE Benchmarked against DAX and DJI 2008-2016



Source: Financial Time (2016); Base year = 0%

In this period, E.ON and RWE have undertaken a major reframing of their strategic outlook. The first step was to emphasise efficiency and consolidation as core foci in meeting what was seen to be a temporary economic downturn. A second step in reframing was to gradually introduce green energy as a more substantive area of focus, thus aligning more with public energy policy.

In a final and more dramatic move, the incumbents accepted that the challenge to its business was of deeper and structural nature, and hence has to be met with more fundamental strategic rethinking.

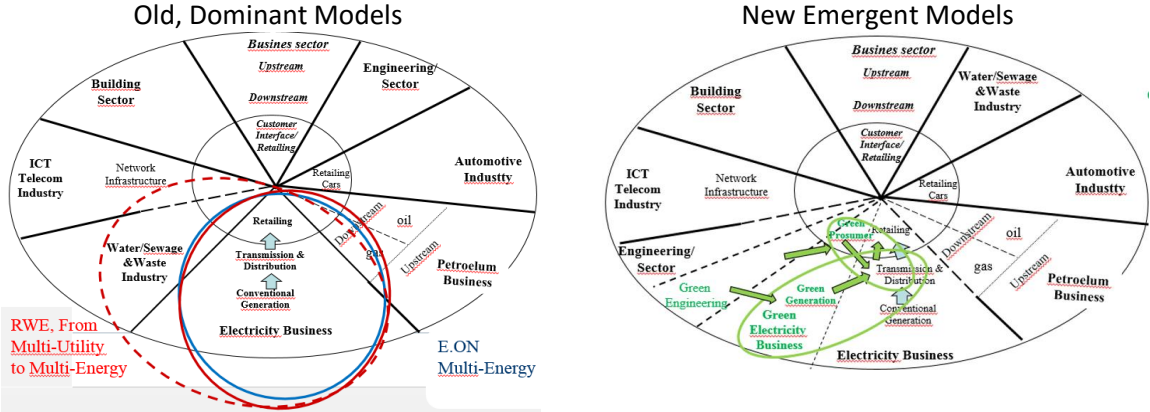
At the beginning, E.ON started responding to the unfamiliar downturn by strengthening its focus on efficiency. Gradually the company was also pushed to downscale, and stepped up divestment to secure its financial solidity (E.ON 2008a). The economic setback was seen as a blow against its traditional strategy and the downgrading of conventional generation went together with an upgrading of renewables (E.ON 2012). The shifting priorities from conventional to renewables and

from centralised to de-centralised customer focused strategy came in 2014, when E.ON announced its dramatic turnaround by splitting the company into two companies (E.ON 2014).

RWE initially took a more upbeat position than E.ON in its response to the economic downturn. It has also met the economic crisis with a strengthened focus on efficiency, while aggressively continuing its expansive investment and its merger and acquisition programme from the golden age (RWE 2008; RWE 2009; RWE 2011). However, a more pessimistic outlook was adopted and the expansive plans were reversed in 2013 (RWE 2013). RWE has gradually developed its green agenda, and in 2014 renewable energy was defined as one of the three growth areas, while the other two were networks and supply. The company thereby recognized that the epoch of expanding large-scale central stations had come to an end (RWE 2014).

Over the years following the financial crisis, both E.ON and RWE have moved towards more dualistic business models. The contours of the customer-centric business model have been introduced, but are less clearly defined. The concept has been mentioned, but the business model remains under-developed at this point, as illustrated in figure 3.3.

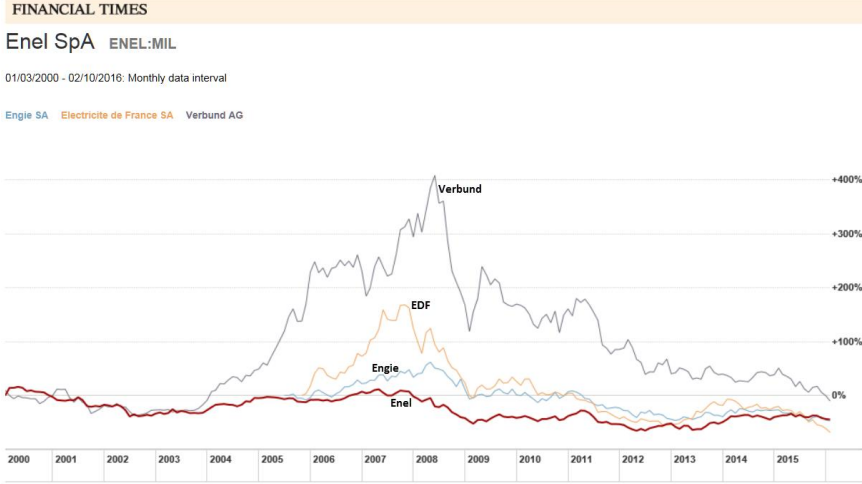
Figure 3.3. E.ON and RWE' dual Structures



3.1.2 Other European Incumbents with Share Value Losses

E.ON and RWE’s pattern was followed by many other incumbent energy utilities. The Italian *Enel*, the French *ENGIE*, the French nuclear champion *EDF* and the Austrian hydropower based *VERBUND* had seen massive rise in their share value under the ‘golden age’.

Figure 3.4. Major European Energy Companies with Share Value Losses 2000 -2016



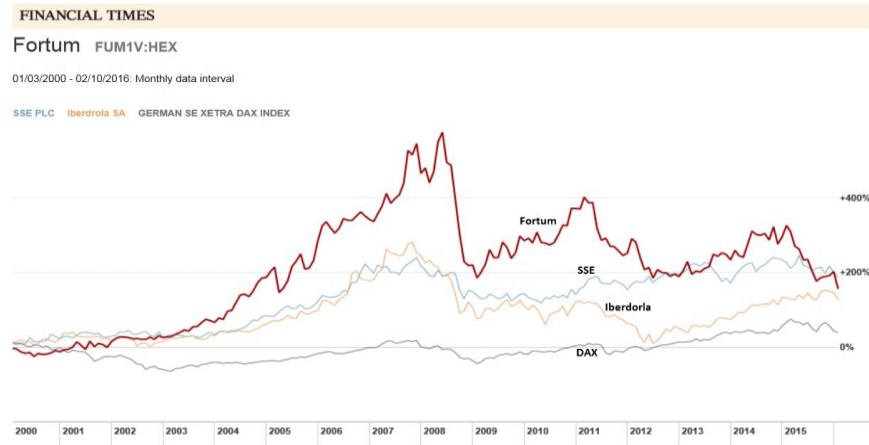
However, by 2016 all the gains had evaporated and they found themselves with net value losses compared to 2000, or for EDF and ENGIE to 2005 when their shares were noted on the stock exchange (figure 3.4). Yet in spite of their common experience, the strategies to meet the crisis vary.

Source: Financial Times (2016)

3.1.3 Other European Incumbents with Share Value Gains

In spite of the share value losses, there are incumbents that performed clearly above the industrial average (figure 3.5).

Figure 3.5. European Incumbents with Share Value Gains 2000 – 2016



The Finnish *Fortum* and the British incumbent *Scottish & Southern Energy (SSE)* both had a share price growth of more than 200% in the beginning of 2016 compared to 2000. This was more than twice the share price increase in the general economy.

Source: Financial Times (2016)

Iberdrola is another energy major that had a positive share price development, particularly after 2012.

3.2 Indicators under the Transition

The large variation in business models and strategic configuration, as well as our limited sample, makes it hard to find clear patterns that reveal the factors behind success. The business strategies behind our incumbent cases are quite diverse: On the one hand, Iberdrola, Enel and ENGIE have attributed much of their success to revenue from extensive engagement in external growth markets. On the other hand, SSE has boosted its share price through strong engagement in the home market. While SSE, for instance, has highlighted its broad engagement across generation, transmission and distribution, and even into telecom, Fortum has highlighted its concentration of production and sales, and its divestment of distribution, as a reason for success. Iberdrola has chosen the opposite strategy and engaged strongly in the regulated grid and renewables sectors.

Nevertheless, in our statistical analysis, three indicators stand out as factors behind share value success of our nine case studies: 1) the energy mix, 2) the business size and 3) financial performance

3.2.1 The energy source effect

As indicated in table 3.1, the change in wind and renewable output in the companies' energy mix correlates positively with the share price. Companies that have scaled up renewables, especially wind power, have done significantly better in the period after the financial crisis (2008-2016). The fact that the renewables and wind effect comes only in the second period may be indicative of the change in energy policy outlook, and guaranteed feed-in tariffs for renewables, in contrast to brutal markets for conventional generation.

Table 3.1. Correlations between Energy Source Mix and Change in Share Price (2000-2016)

		Share price 00 – 07 (%)	Share price 08 – 16 (%)
% Wind power 2015	Pearson Correlation	-,068	,770*
	Sig. (2-tailed)	,874	,025
	N	8	8
RE_Output change '00-'15(%)	Pearson Correlation	,067	,821*
	Sig. (2-tailed)	,874	,012
	N	8	8
RE_Proportional change '08-'15(%)	Pearson Correlation	,055	,763*
	Sig. (2-tailed)	,888	,017
	N	9	9
RE_Proportional change '00-'15(%)	Pearson Correlation	-,284	,781*
	Sig. (2-tailed)	,495	,022
	N	8	8
Wind_Proportional change '08-'15(%)	Pearson Correlation	-,056	,804*
	Sig. (2-tailed)	,895	,016
	N	8	8
Wind_Proportional change '00-'15(%)	Pearson Correlation	-,181	,802*
	Sig. (2-tailed)	,698	,030
	N	7	7

**Correlation is significant at the 0.01 level (2-tailed); *Correlation is significant at the 0.05 level (2-tailed).

Source: Bloomberg (2016); E.ON (2000, 2006,2008b,c, 2015); EDF (2003,2007a,b, 2008a,b,c,2015); Enel (2000b, 2008a,b, 2009,2015); ENGIE (2008,2015); Financial Times (2016); Fortum (2001, 2007,2008, 2015b,2016); Iberdrola (2000, 2009, 2015, 2016); RWE (2000b, 2007, 2008, 2015); SHE & SE (2001); SSE (2009, 2015); Verbund (2000, 2007, 2008, 2015)

3.2.2 The size effect

Our other significant finding is a negative size effect on share price development. As indicated in table 3.2, this effect only appears in the first period (2000 – 2007), when scale and scope were strategic foci. The negative effect on share price may perhaps indicate that the dramatic merger and acquisition spree of the largest companies, like E.ON and RWE, entailed very large investments, which in turn may have negatively affected their liquidity. In the second period, this effect may have drowned in general financial duress.

Table 3.2. Correlations between Installed Capacity and Share Price (2000 – 2016)

		Share price 00 – 07 (%)	Share price 08 – 16 (%)
2008 Installed capacity (MW)	Pearson Correlation	-,678*	-,400
	Sig. (2-tailed)	,045	,286
	N	9	9
2015 Installed capacity (MW)	Pearson Correlation	-,714*	-,295
	Sig. (2-tailed)	,031	,440
	N	9	9

**Correlation is significant at the 0.01 level (2-tailed); *Correlation is significant at the 0.05 level (2-tailed).

Source: E.ON (2000, 2006,2008b,c, 2015); EDF (2003,2007b, 2008b, 2015); Enel (2000b, 2008b, 2009,2015); ENGIE (2008,2015); Financial Times (2016); Fortum (2001, 2007,2008,2016); Iberdrola (2000, 2009, 2015); RWE (2007, 2008, 2015); SHE & SE (2001); SSE (2009, 2015); Verbund (2000, 2007, 2008, 2015)

3.2.3 The financial performance effect

Financial performance has also an effect on share price development, particularly in the second period when challenges to the energy industry create clearer distinctions between winners and losers. As shown in table 3.3, indicators of sound economic management, such as Return on Equity (ROE), have a substantially positive share price effect. Liquidity indicators such as interest coverage

ratio⁴ also correlate significantly with share price in the second period. Companies with high liquidity have been rewarded by the stock market, presumably because they had credibility in serving their debt. Dividend payment also affects the share price positively.

Table 3.3: Correlations between Financial indicators and Share Price (2000 – 2016)

		Share price 00 - 07(%)	Share price 08 - 16(%)
Div. change '08-'15 (%)	Pearson Correlation	,438	,694*
	Sig. (2-tailed)	,239	,038
	N	9	9
ROE 2015	Pearson Correlation	,055	,809**
	Sig. (2-tailed)	,889	,008
	N	9	9
CFO pre W/C Interest Coverage 2015	Pearson Correlation	,189	,698*
	Sig. (2-tailed)	,626	,037
	N	9	9

**Correlation is significant at the 0.01 level (2-tailed); *Correlation is significant at the 0.05 level (2-tailed). Source: Bisset et al (2014); Bloomberg (2016); E.ON (2000,2007,2008b,2015); EDF (2000,2008b, 2009,2015); Enel (2000a,2008a,2015); ENGIE (2008,2009,2015); Financial Times (2016); Fortum (2001,2008,2015a); Iberdrola (2000,2008,2016); Investopedia (2016); RWE (2000b,2007,2008,2015); SSE (2001,2008,2015); Verbund (2000, 2008,2015)

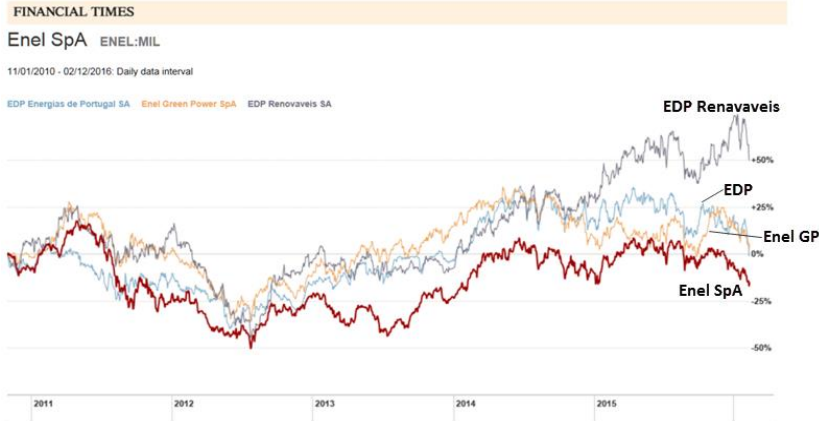
3.3 Renewables, A Safe Haven?

Given the extensive focus on climate change and the need for green transition, renewables would appear to be a secure bet, and companies with a pure green profile should likely become market winners. Our initial study of green spinoffs and green energy technology providers indicates that these expectations are justified, although not without exceptions.

3.3.1 Green Spinoffs from Incumbents

The two green spinoff cases included *Enel Green Power (EGP)* and *EDP Renovaveis (EDPR)*. EGP - the spinoff from Enel Group - engages in a broad spectrum of renewable technologies, while the green Portuguese spinoff – EDPR – focuses mainly on wind energy, with a small stake in solar power. As indicated in figure 3.6 and table 3.4, both have been fairly successful and more lucrative than their mother companies.

Figure 3.6. EDP Renovaveis and Enel Green Power Benchmarked Against their Mother Companies



Source: Financial Time (2016)

⁴ The Interest Coverage Ratio is measured by cash flow from operations before changes in working capital (CFO pre W/C) as practiced in Moody’s rating methodology for unregulated utilities and unregulated power companies

Table 3.4. EDP Renovaveis and Enel Green Power Benchmarked Against their Mother Companies

Share Price (€)	2010 (Nov.01,2010)	2016 (feb.10, 2016)	Change 2010-2016 (%)	Renewables in Energy Mix 2015 (%)
Enel Green Power*	1,60	1,70	6,2	100,0
Enel	4,08	3,53	-13,5	31,4
EDP Renovaveis	4,15	6,60	59,0	100,0
EDP	2,75	2,88	4,7	58,0

*First trading record Nov. 01, 2010

Source: EDP (2015); EDPR (2016); Enel (2015); Financial Times (2016)

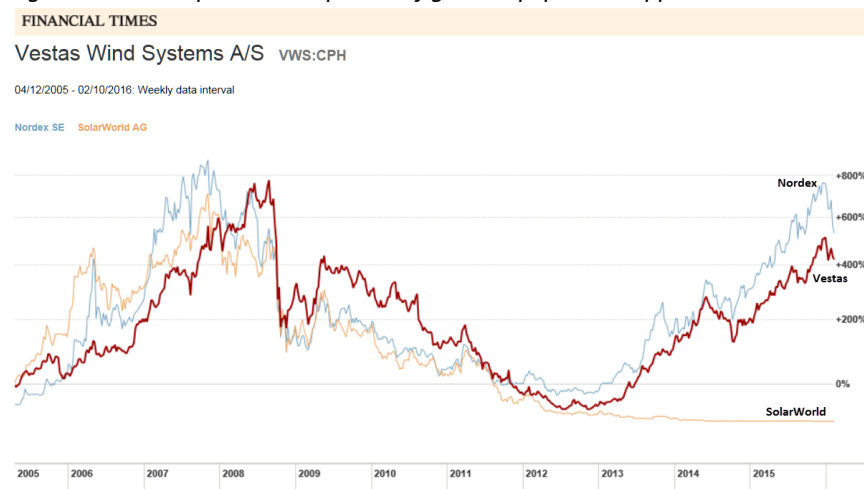
Enel Green Power (2016b) has managed to grow profitably, despite the challenging macroeconomic context in Italy and the stagnation in consumption in the wake of the financial crisis. By focusing on engagement in selected geographical areas and in renewables with attractive support programs, the company achieved a strong and profitable growth with prospects for further development globally. Following its success, the Enel Group decided to reintegrate EGP to the company's core renewable energy unit in 2016 (EGP 2016a).

EDP RENOVAVEIS (2016) engages actively in wind energy in many markets around the world. The company has built up a sustainability profile by positioning itself on the FTSE4Good and Dow Jones Sustainability indexes (EDPR 2011). In 2013, the company delineated a tipping point where renewables is about to become the new mainstream and depicts a bright future, where not only cost-competitiveness but also numerous positive side effects enhances their success (EDPR 2013).

3.3.2 Green Equipment Suppliers

Another group of pure green players in our study was the renewable technology suppliers. This group included *Vestas* and *Nordex*, the wind turbine producers, and solar panel producers *SolarWorld*. All companies saw a fabulous growth in share prices between 2005 and 2008, exceeding 650% value growth. However, their share prices were hit hard by the financial crisis and lost much value between 2010 and 2012 (figure 3.7).

Figure 3.7. Share price development of green equipment suppliers 2005 – 2016



Source: Financial Times (2016)

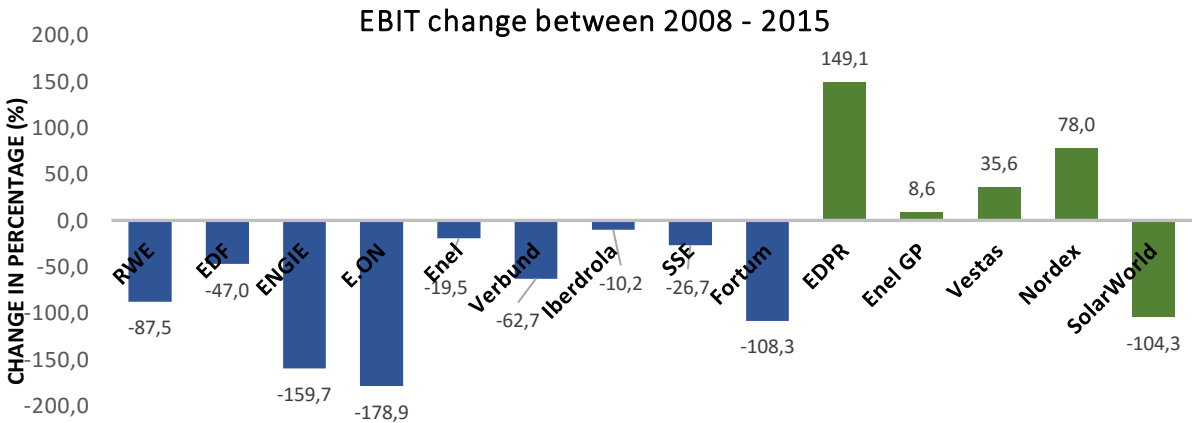
Nevertheless, after organisational and strategic reform, Vestas and Nordex have been able to note a positive growth in share value from 2012. By contrast, SolarWorld has lagged far behind and its share price has not picked up. Perhaps, this reflects the strong competitive challenge in solar cell production.

3.3.3 Discussion: Renewables, A Safe Haven?

With respect to economic performance, as judged by the share price development, there is little doubt that specialisation in green power has created added value. Both the green spinoffs, Enel Green Power and EDP Renovaveis have done better than their mother companies (table 3.4). Green equipment suppliers like Vestas, Nordex and SolarWorld achieved spectacular value increase but then lost their value following the economic crisis. However, they have made a remarkable comeback from 2012, except SolarWorld where the share value lost out and never recovered (Financial Times 2016).

As indicated in figure 3.8, there was a distinct difference between the incumbents and the pure green players – green spinoffs and green technology providers. The green players had significantly higher EBIT change during the period 2008-2015.

Figure 3.8. EBIT change between 2008 -2015 in percentage



ANOVA		N	Mean	Std. Deviation	Sig. ANOVA
EBIT change 2008-2015 (%)	Incumbent	9	-77,83	60,94	0,019
	Green player	5	33,40	93,48	
Total		14	-38,11	89,63	

Source: Bloomberg (2016); E.ON (2008b,2015); EDF (2009,2015); EDPR (2008,2015); EGP (2008,2015); Enel (2008a,2015); ENGIE (2008,2015); Fortum (2008,2015a); Iberdrola (2008a,2016); Nordex (2008,2015); RWE (2008,2015); SolarWorld (2008,2015); SSE (2008,2015); Verbund (2008,2015), Vestas (2008,2015)

3.4 Emerging Business Models from New Actors

Following the move towards green generation, the European energy industry has seen a change towards new business models, drawing heavily on opportunities created by digital technology. The models fall into three broad categories: 1) distributed energy, 2) broad customer-centric models, and 3) smart grids. These categories are not mutually exclusive and have considerable interfaces.

3.4.1 Distributed Energy

The distributed energy model locates electricity production with customers, typically based on installation of solar panels in flexible interplay with centralised energy supply. *Sungevity (2016)* is an interesting and innovative example. Sungevity offers users the ability to explore residential solar energy solutions online and receive a quote on the installation of a residential solar energy system without any site visits. This is achieved by utilising satellite-imaging technology to assess residential rooftops for solar panels, combined with Sungevity’s software for analysis of the production yield. The digital and automated process leading up to customer-offer makes the business model highly cost-efficient and scalable.

With the prosumer concept, Sungevity and other similar companies challenge the conventional business model of the electricity industry at the customer interface. The prosumer model takes advantage of the government authorised opportunity to establish de-centralised supplementary green power. Exploiting existing centralised generation and grid-infrastructure, prosumers may count on the right to sell surplus power to the incumbent electricity industry, and to buy supplementary power in case of insufficient local generation. The economic attractiveness of the prosumer model is that, while the costs of balancing supply and demand may be externalised, the use of advanced satellite imaging and meteorological data allows for estimation of production potential and associated financial offers at very low cost.

3.4.2 Broad Customer Centric Models

The broad customer-centric model attempts to integrate energy into a wider *smart home* platform, across different manufacturers, brands and devices. According to sector analysts, the global smart home market is growing exponentially, attracting an array of service providers, including technology giants and startups to major media players, device makers, big-box retailers, home improvement companies, utilities and telecom network operators (Markets and Markets, 2016). Deutsche Telecom's *Qivicon (2016)* is an interesting and innovative example. Qivicon and its partners have been developing an ecosystem that covers not only energy efficiency at home but also the areas of security, convenience and health. To achieve this, Qivicon has chosen a vendor-neutral solution that enables users to combine different brands of Smart Home solutions (Hauptfleisch 2014; Rodrigues 2014). The platform's technical control unit is connected to the Internet via a broadband connection in the house or apartment. Qivicon partners' devices can be controlled and monitored via various applications on smartphones, tablets and PCs (Lösel 2014).

While the Telecommunication companies are moving into the 'smart home' space from internet and mobile communication platforms, other actors have moved in from different positions. The German energy service provider, *Techem (2016)* is a case in point. Techem is a leading provider of energy services operating through two divisions. The first division, Energy Services, provides sub-metering services of measuring heating use and water consumption of individual housing units, and supplementary services such as smoke detector installation and maintenance and legionella analysis in drinking water. The second division, Energy Contracting, offers a holistic management of clients' energy consumption through planning, financing, construction and operation of heat stations, boilers, cooling equipment and combined heating and power units (Moody's 2016; Techem 2016).

Techem's home or estate management system is linked up to a radio technology for remote reading, which forms the basis for Techem's added-value services for all aspects of energy, water and cost savings. This offers customer advantages such as prompt billing, permanent supervision with automated device monitoring, and retrieving of reading values, allowing for transparent consumption and cost overviews. It also allows automatic control of heating systems with a saving potential (Techem 2016).

3.4.3 Smart grids

The smart grid resembles the smart home in its ambition to link up several functions to a common platform that allows for holistic management. However, while the smart home targets the individual household, the smart Grid concept penetrates deeper into the supply chain and includes producers, distributors and consumers. The recent German startup *KIWIGRID (2016)* is an interesting case. The company has developed a system that offers a flexible and adaptable platform solution to equipment manufacturers and energy utilities. It allows them to manage, monitor and control distributed energy resources like generators, storage, energy consumers and e-mobility, as well as to manage their interface with the electricity grid and centralised electricity supply.

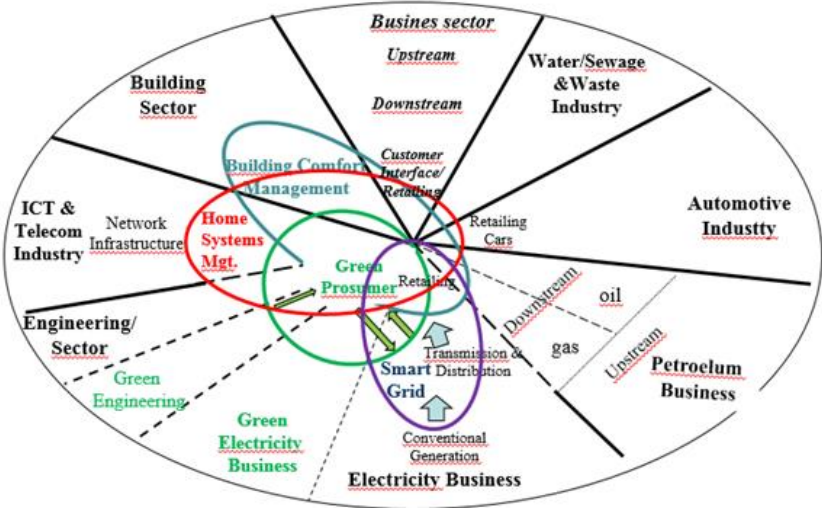
Kiwigrid seeks to offer an intermediary platform between home appliance-integrators and de-centralised generation on the one side, and the centralised energy system on the other. The company business model thrives on the complexity of the modern energy system in Europe. The extensive inputs of de-centralised generation makes the type of coordinated management, that Kiwigrid facilitates, more and more necessary.

3.4.3 Emerging Business Models – What Do They Bring To The Table?

Most of the emerging business models circle around the customer-interface where various digital solutions allow more flexible interplay between consumption and production of energy, and/or between several service alternatives to fulfill basic needs for customer home-comfort. Seen from an energy-sector perspective, they represent introduction of new platforms for service bundling, where energy is one of the core elements. These platforms are controlled by new entrants from other sectors, and energy incumbents are potentially reduced to one of many service providers that the platform can combine in various ways tailored to customer needs (figure 3.9).

The prosumer model introduces de-centralised energy production at the consumption site in competition with established centralised systems. It capitalises on flexible grid-access, often with net-metering mandated by new regulation. This allows the prosumer model to balance off intermittent production against flexible complementary supply from the central system without costs beyond regular charge for the net consumption. When this model is complemented with an efficient online exploration of residential solar energy solutions and a simple and understandable contractual model, it becomes a highly attractive alternative. The prosumer model, Sungevity style, has the advantage enabling unilateral implementation without partnering with complementary actors.

Figure 3.9. Emerging customer-centric models, a summary



The new digitally based model, which is closest aligned with traditional energy industry, is the smart grid model. The model allows the conventional electricity grid to expand its scope by adding on a flexible and adaptable platform solution for energy utilities, and to manage, monitor and control new distributed energy resources like generators, storage, energy consumers and e-mobility. This is done in conjunction with their management of the conventional energy system, so as to develop synergies and integrated solutions.

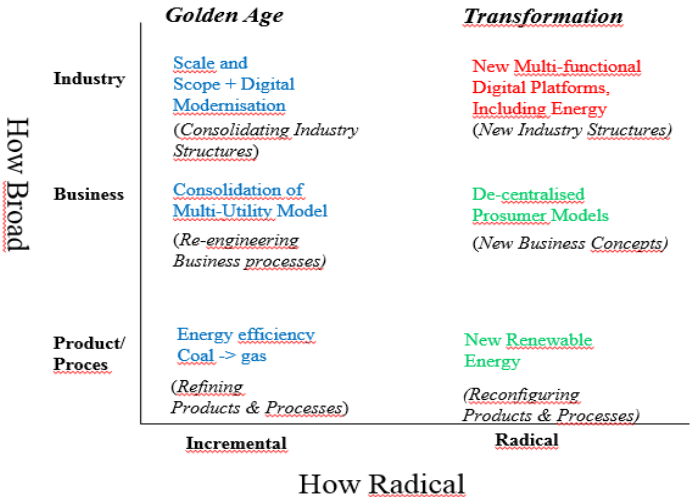
The building comfort and home system management represent digital platforms that transfer extensive control over the energy services to other actors with platform control. While the ICT

companies are moving into the ‘smart home’ space from internet and mobile telecommunication platforms, other actors are building up ‘smart home’ solutions from positions as holistic management of client’s technical systems. Either way, the electricity supply will be integrated in and subsumed under more general management systems, where it will be more systematically exposed to competition from alternative solutions and loose the direct customer- interface.

4. Conclusion

Much of energy industry now exists in a dualist limbo, between conventional and emerging new business strategies. From strategies of scale, scope and oligopolistic power based on conventional technologies preceding the financial crisis, energy industry is moving into new uncharted terrain characterised by greening, digitalisation, de-centralisation and disruptive innovation (figure 4.1).

Figure 4.1. From Technological to Industrial Reconfiguration



Elaboration inspired by Hammel (2000)

The strategic configuration during the ‘golden age’ focused on incremental product innovation to drive energy efficiency, together with gas for coal substitution. Companies reinforced a multi-utility and/or a multi energy model, and consolidated industrial concentration, accompanied with cautious digital modernisation within established business practice. The strategic configuration in the next period has been reshaping the industry, and redefining markets, products and customer relations towards green energy, digital multi-functionality and de-centralised prosumer models. In this period, digital platform providers have position themselves at the customer interface and bundled energy into broader home management, or estate management systems. In addition come digital communication and payment systems that have facilitate establishment of such platforms without the need for massive investments in the hardware of the underlying infrastructures that characterise the traditional grid-based energy supply.

As a consequence of the above disruptive transformation, energy industry in advanced European markets is now searching for novel business models. While the first ‘golden age’ of scale and scope competition of a mature industry invited strategic orientation geared at long term systematic planning, the transition to the second emerging new industrial field has invited a more process oriented strategic perspective.

With respect to products and services, the shifts have entailed engagement in renewables generation, very often with government guarantees. They also involve a move away from exclusive energy products towards broader services management, with an opening up of traditional sectoral domains into broader customer-interfaces.

The network-logic of the new emerging business models entails a race for positioning as the dominant platform provider acquires market control. The attractiveness of holding platform control is that it allows the actors to dominate the customer-interface, as well as to set the standards for industrial suppliers, while charging both sides (Baldwin and Clark 2000). There are therefore many contenders for platform control, including attempts at commercial repositioning from energy-incumbents.

Telecoms could, in many ways, be seen as a harbinger of the transition challenges that European energy industry is currently going through. Compared to the telecoms sector, electricity has for a long time been technologically and commercially stable. The competitive challenge was seen to lie in scale and scope along a well-developed technological trajectory. The telecoms sector was in the same period exposed to several technological quantum leaps - from fixed to wireless; from specialised telecoms platforms to general internet etc., with dramatic consequences for leading players like Ericsson and Nokia. With de-centralised green energy combined with digitalisation, the world of energy in advanced European markets has entered a period of dramatic transformative innovation, whose outcome is as exciting as it is unknown.

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Keyword set

European energy industry, incumbents, business models, crisis, transition, transformation, green energy, renewables, digital challenge, customer-centric model, de-centralisation, prosumership