Global Electricity Utilities in Transition

Leaders and Laggards: 11 Case Studies

Institute for Energy Economics and Financial Analysis
IEEFA.org

October 2017

Tim Buckley, Director of Energy Finance Studies, Australasia (tbuckley@ieefa.org) and

Simon Nicholas, Energy Finance Analyst (snicholas@ieefa.org)

Table of Contents

Acknowledgments

Many thanks to the following for their review and input: Tom Sanzillo, David Schlissel, Seth Feaster, Gerard Wynn, Karl Cates and Christa Ebert of IEEFA; Dr. Grové Steyn of Meridian Economics; and Jesse Burton of the Energy Research Centre, University of Cape Town.

Executive Summary

Renewable energy is disrupting electricity markets worldwide.

The pace of this change has surprised almost everyone, and indeed would have been difficult to imagine just a few years ago.

Crucially, renewables need only capture a relatively small market share for disruption to occur, and to continue. While it may take decades yet for renewables to become the dominant form of generation globally, their presence today is permanent and their advance inevitable.

By way of recent example, in 2016 Germany—the fourth-largest economy globally—saw two of its biggest companies, the power utilities E.ON and RWE, voluntarily break themselves up. Those moves came in response to a transformation that is reshaping the power-generation sector almost everywhere and wreaking havoc among utilities that have arrived late to this conversion. Germany is of special significance since the nation pioneered Energiewende, a policy shift toward a low-carbon economy that is now being adopted globally.

From Europe to Asia, from the Americas to Africa, wholesale electricity prices are being pushed down by the rise of renewable generation, which has no fuel costs and whose developers can now consistently outbid fossil fuel-based generation.

This report documents the gathering momentum of this trend, and how the impact of renewables on electricity prices is a key driver of this change.

Some highlights:

- Across Europe, lower wholesale electricity prices have created significant disruption and have shown how late-arriving major utilities are at risk of financial loss by not seizing the renewable-energy mantle quickly enough.
- In the United States, the renewable-energy leader NextEra sees renewables as a means to keep providing power at low prices.
- In China, the merger of Shenhua and China Guodian stands to create the world's largest power company by installed capacity (225 gigawatts, or GW).
- In South Africa, where electricity prices have quadrupled since 2007 and an expensive coal-fired power build-out threatens to drive prices even higher, renewables appear ever more appealing.
- In India, which passed a milestone in 2017 when solar tariffs came in lower than the cost of power generated from coal-fired capacity of the main national utility, NTPC.
- In Australia, electricity prices have become a major political issue driven by uncertainty on energy policy and a resulting delay in renewable-energy rollout.

Summary of 11 Major Utilities in Transition

The disparity between utilities in this report is considerable. Some are world leaders in positioning themselves for electricity systems dominated by renewables, while others are laggards seemingly unwilling to modernize their business models. In between are companies that are belatedly committing to transition, but have destroyed significant shareholder value in the meantime.

RENEWABLE ENERGY LEADERS	BELATED TRANSITION UNDERWAY	LAGGARDS NOT MODERNIZING
Enel Italy *Capacity is half renewables; targeting full decarbonization*	**Engie** France *Hobbled by debt*	**NRG** United States *Failure to act on technological disruption*
NextEra United States *North America's largest wind generator; has solar assets in Florida and Arizona*	**RWE** Germany *Declining revenues, five years*	**TEPCO** Japan *Nuclear capacity offline; now dependent on thermal power*
	E.ON Germany *Imperiled nuclear capacity*	**Eskom** South Africa *Failure to recognize technological disruption*
	AGL Australia *Coal capacity supported by energy policy undertainty*	
	NTPC India *Coal capacity supported by electricity demand growth*	
	CEIC China *Merger to cut reliance on coal*	

IEEFA is hardly alone in its view of transition. According to Morgan Stanley, for one, wherever utilities compete to sell electricity on an open market, those at the forefront of renewables will see significant upside while the owners of fossil-fuel and nuclear-powered fleets will suffer.

The disparities among utilities in this regard is considerable. Some are world leaders in preparing for electricity systems dominated by renewables, while others are laggards seemingly unwilling to modernize their business models. This picture is further complicated by the presence of companies that are belatedly committing to transition and, as a consequence, have inflicted significant damage to shareholder value in the meantime.

This report presents 11 brief case studies of leading electricity utilities that collectively illustrate the wide variation in readiness for a future of cheap renewable energy.

The singular lesson from the 11 case studies presented here:

Electricity utilities that perform best going forward will likely be those that transition to renewable energy-based business models in a way that avoids the financial damage typically incurred by late movers. Those that avoid or work against the roll-out of renewables will be met by a future that does not include them.

Introduction

Last year (2016) saw two of the largest companies in Germany, the power utilities E.ON and RWE, break themselves up in the face of the rapid transformation of the increasingly integrated European electricity market.

Such an event would have been difficult to imagine even a few years ago, but the pace of the energy transition now occurring globally has surprised everyone.

The rapid uptake of renewable energy, especially of solar and wind, has steadily undermined utilities' traditional business models, particularly in countries where electricity demand is flat or in decline. In such cases, zero-margin-cost renewables eat away at the utilization rates of coal-fired power stations, often rendering them loss-making operations.

Of particular note is that coal-fired power utilization rates in countries like India and China, where electricity demand is growing, have been affected by the roll-out of renewables.

What happened in Germany as a result of its pioneering *Energiewende* policies is now being seen globally. Worldwide, real wholesale electricity prices are being pushed down by renewable-generation projects that have no fuel costs and can consistently outbid fossil fuel-based generation. Companies with strong renewable portfolios are outpacing broad equity indexes.

In the United States, the state of Texas is a good illustration of the transition occurring across the country. As one of the largest electricity markets in the nation, Texas has seen rapid uptake of wind and solar power, a trend that has pulled down the cost of electricity and cheap natural gas. Coal-fired power generation in Texas is a fast-fading industry[1]. Crucially, renewables need only take a relatively small market share for such disruption to occur. Nor does its disruptive impact need decades of development, even though it will take decades for renewables to become the dominant form of generation globally.

A recent study by the U.S. Department of Energy concluded that advances in shale drilling, declining electricity demand, and improvements in wind and solar technologies have combined to drive down the value of fossil-fuel investments[2]. The report also identifies emerging trends: lower and more stable wholesale prices and lower retail utility prices as more renewables are added; and greater system diversity. The report also found that renewable energy expansion is being smoothly integrated into a grid system that historically has depended upon fossil fuels.

In Europe, the effect of more renewable energy installations has been clear too: Wholesale electricity prices have declined from around €80 a megawatt-hour (MWh) in 2008 to €30-50/MWh today. This disruption has led directly to decisions by E.ON and RWE to separate their renewable and fossil-fuel operations. More broadly, the International Energy Agency (IEA)

[1] http://ieefa.org/ieefa-texas-beginning-end-coal-fired-electricity- /

[2] https://energy.gov/sites/prod/files/2017/08/f36/Staff%20Report%20on%20Electricity%20Markets%20and%20Reliability_0.pdf

estimates that some US$150 billion of asset impairments have been incurred by European utilities over the period 2010-2016 (see Figure 1). Of note in this context is that the very nature of fossil fuel-based generation is that it involves substantial sunk investment costs. As a result, once a nation accelerates its energy transition toward more renewables, such operations are affected quickly and, as a result, likely to significantly underperform.

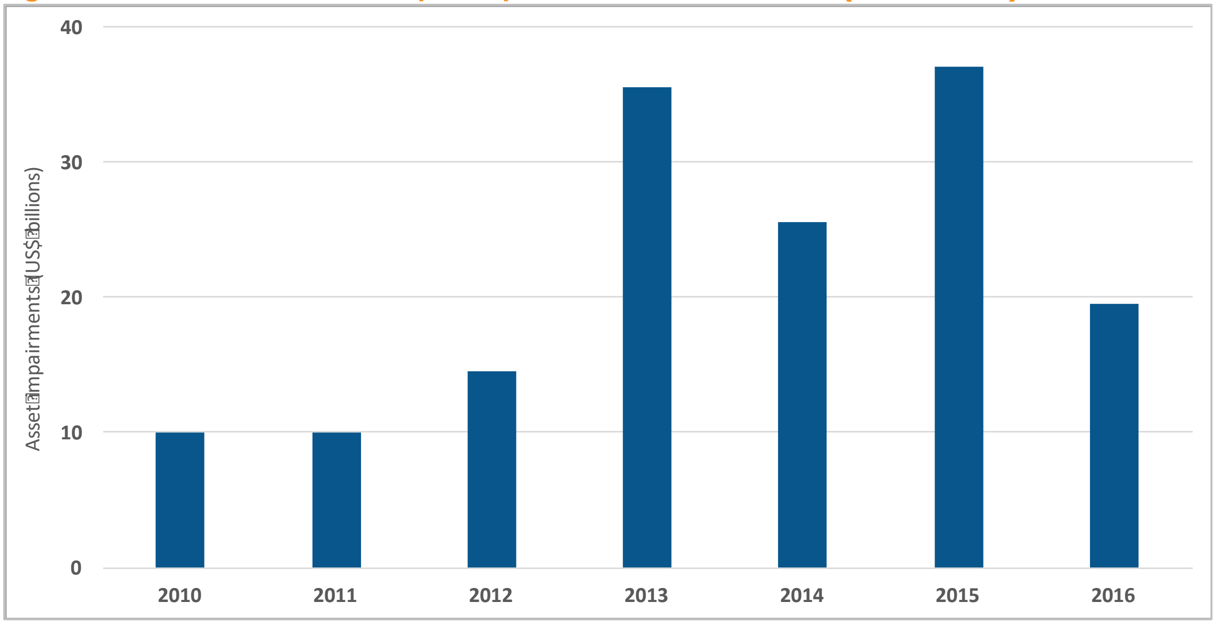
It is no surprise, then, that a recent report by Morgan Stanley notes the competitive advantages that power utilities positioned as renewable energy leaders have. Where utilities compete to sell electricity on an open market, the leaders will see significant upside while the owners of fossil- and nuclear-fueled fleets, especially those reliant on imported fuels, will suffer when in competition with renewable energy[3].

The report also noted wide variation in how utilities are performing in this regard:

> *"Globally, utilities' competitive positioning for the growth in cheap renewables varies significantly."*

A recent Standard & Poor's report also concludes that companies leading in renewables have the upper hand. Advantages to be gained include an ability to expand, through repowering or extending existing renewable installations, and in possessing globally diversified portfolios and significant investment pipelines. Such companies have more experience with weather-forecasting models and are likely to have benefited from previous renewables incentive plans. S&P sees credit-positive developments where changed strategies lead to a repositioning of generation portfolios.[4]

Figure 1: Asset Write-Downs by European Utilities 2010-2016 (US$ billions)



Source: IEA

[3] http://reneweconomy.com.au/cheap-wind-solar-mean-us-will-meet-beat-paris-targets-despite-trump-27946/?utm_source=RE+Daily+Newsletter&utm_campaign=ddb2c6a7d3-EMAIL_CAMPAIGN_2017_07_06&utm_medium=email&utm_term=0_46a1943223-ddb2c6a7d3-40324105

[4] S&P, European Integrated Utilities in 2017: Rebenchmarking the Sector, June 6th 2017.

This report presents 11 case studies of some of the world's leading electricity utilities as a way to highlight the variation in readiness for a world of cheap renewable energy. While some major utility companies are world leaders in positioning themselves for electricity systems dominated by renewables, others are laggards that seem intent on clinging to old business models. Further, many companies belatedly making the transition have created significant destruction in shareholder value as a result.

The report also reviews the strength and weaknesses of two companies that currently retain large coal holdings but maintain a viable business model.

The companies covered by this report have been selected to highlight these differences and include a wide geographic sampling. E.ON and RWE, recently through their respective break-ups, are featured ,as are two examples of European early movers—France's Engie, which is going through a major transition, and Italy's Enel, which made a transformational decision ahead of others.

In the U.S., the destruction of shareholder wealth at NRG is contrasted with the success enjoyed by the renewables pioneer and market leader NextEra.

In Asia, we contrast the post-Fukushima troubles of Japan's largest utility, TEPCO, with AGL, a coal-dominated electricity utility in Australia that has accepted that renewables represent the future. We also profile the absorption of China Guodian by Shenhua to create the world's largest electricity utility.

Finally, the circumstances of two government-owned utilities from less developed countries are presented. India's coal-dominant NTPC is a linchpin of India's economic growth and of the government's ambitious renewable energy program, while Eskom of South Africa provides an example of a utility that not only fails to respond to the energy revolution, but fails its owners and its customers as well.

The late response to renewable energy disruption by many utilities in this report carried significant financial implications. In addition to having taken huge impairments as a result, these companies have suffered significant loss of market value. The combined decrease in market capitalization of the underperforming utilities covered in this report over the 2007-2016 period is US$185 billion (see Annexure I), amounting to a loss of 67 percent of market share (not including the unlisted government-owned utilities Eskom and Shenhua Group).

By contrast, Enel, NextEra and AGL have added a combined US$27 billion in market capitalization over the same period, a gain of 29.5 percent. Despite its reliance on coal, AGL has also gained because its stalled investment in renewables has yet to drag down wholesale electricity prices in Australia—a situation that is about to change.

Engie SA (France)

Engie SA, the second largest electricity generator in France after EDF, has a presence in 70 countries. Until recently, the company was known as GDF Suez. Its rebranding is part of a shift in the company's focus, away from coal and toward renewable energy after having doubled down on coal power with the acquisition of International Power in 2012[5]. But accepting that a major energy transition is now occurring comes too late for Engie's share price performance, which has significantly lagged the market over the last five years (see Figure 2). Like many other fossil fuel-based electricity generators, huge debt and the rise of increasingly cheap renewable energy have been a drag on performance.

Figure 2: Engie Share Performance (Orange) vs. CAC 40 Index (Purple) Over 10 Years

Source: Thomson Reuters

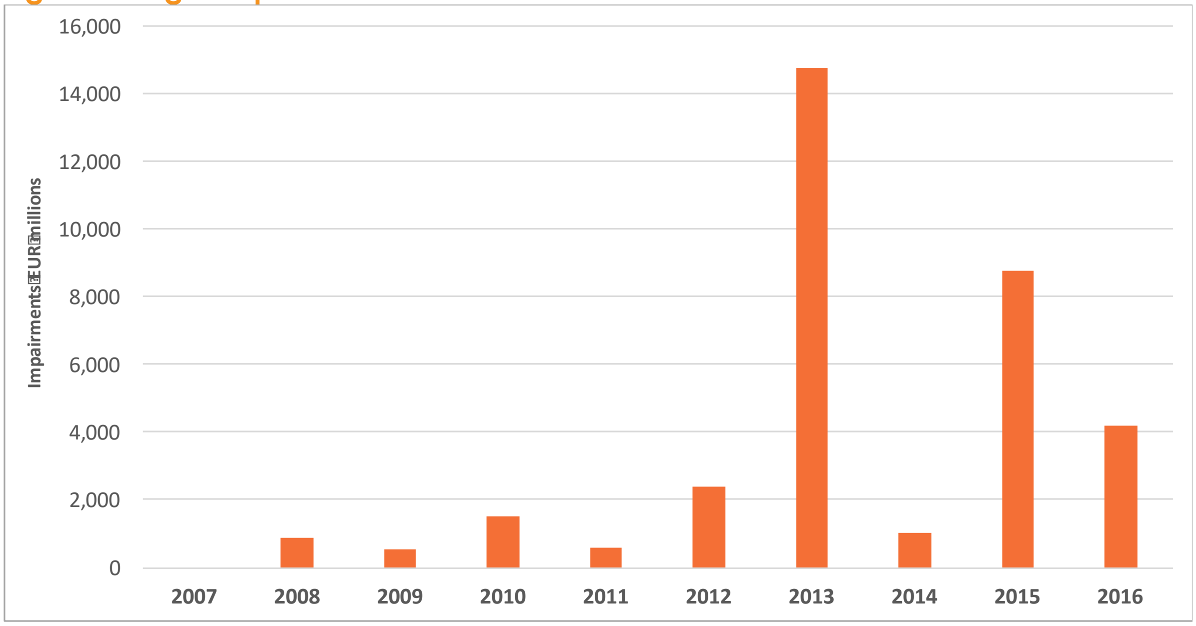
Engie has also been stung by its recent investments in fossil fuel. In 2013, Engie took a €1.7 billion impairment against its Dutch thermal power plants[6]. This didn't stop the company, however, from starting operation of a new coal-fired power plant in Rotterdam in 2015. In its 2016 year-end results, Engie took a €168 million impairment against its thermal power plants in the Netherlands, presumably relating to the effect on its books of the Rotterdam plant[7]. In total, Engie booked impairments totaling €4.2 billion in 2016 including €1 billion for revised nuclear decommissioning provisions. Total impairments for all reasons, including those related to coal and nuclear write-downs, over 2010-2016, totaled €33 billion (see Figure 3 below).

In early 2016, Engie announced a three-year transformation plan aimed at remaking the company into one that could become a world leader in energy transition. Goals include carbon dioxide activities that will total no more than 90 percent of earnings by 2018 and

[5] http://uk.reuters.com/article/uk-internationalpower-gdf-idUKBRE83F07720120416
[6] http://ieefa.org/ieefa-report-dutch-coal-mistake-shows-three-new-plants-netherlands-failing-live-expectations-risk-becoming-climate-risk-stranded-assets/
[7] http://ieefa.org/ieefa-europe-fallout-around-dutch-coal-stranded-asset-mistake/

investment in innovation and new technologies[8]. One of Engie's first moves in its transition was the disposal of 8 gigawatts (GW) of gas-fired and 700 megawatts (MW) of coal-fired generation assets in the Unuted States, as well as the sale of coal-fired power stations in India and Indonesia[9]. In Australia, Engie is ridding itself of its lignite-fired generation units; the Hazelwood power station began shutting down in March 2017 and the nearby Loy Yang B is up for sale, which is likely to be made difficult by banks' unwillingness to finance coal-fired power generation[10]. Engie's coal-fired power generation proposals in South Africa and Turkey have been abandoned. Engie Brasil, the largest private power generator in Brazil, is also looking to sell its coal-fired plants[11].

Figure 3: Engie Impairments 2007-2016



Source: Thomson Reuters, company reports

With the nuclear energy industry dealing with severe headwinds, too, Engie has sold its stake in Britain's Moorside nuclear power project; Toshiba was forced to buy Engie's 40 percent stake in the project after Toshiba's Westinghouse nuclear plant business filed for Chapter 11 bankruptcy protection in the United States.[12]

Engie's transformation plan calls for investing €22 billion in new technologies, including renewable and distributed energy[13].

Developments already underway include:

- In Latin America, winning bids on solar projects in Mexico and Peru.

---

[8] https://cleantechnica.com/2016/02/26/engie-launches-three-year-transformation-plan-lead-world-energy-transition/
[9] http://www.engie.com/en/journalists/press-releases/major-step-transformation/
[10] http://www.afr.com/street-talk/loy-yang-b-discussions-turn-to-banks-and-their-assurances-20170803-gxomgm - ixzz4ojl7fWIl
[11] http://www.reuters.com/article/us-engie-brazil-ceo-idUSKBN1782F2?type=companyNews
[12] https://www.theguardian.com/business/2017/apr/04/toshiba-moorside-nuclear-nugen-engie-reactor
[13] http://www.reuters.com/article/engie-strategy-idUSL5N1E24UV

- In Africa, the 100 MW Kathu project in South Africa has begun[14] and a 50 MW wind power project in Ghana is under development[15].
- Through a stake in Kingo Energy, which provides off-grid solar energy solutions in Africa and Latin America, participation in an initiative to bring renewable energy to 1.5 million people by 2020 who now have no access to electricity.
- In India, the company's Solairedirect SA won an NTPC-conducted auction for a 250 MW solar tender at Kadapa Solar Park,[16] setting what was at the time a record low levelized cost of solar in India. Engie has made it clear that it wants to participate further in India's renewables drive, as the nation aims for an impressive 175 GW of renewable capacity by 2022, and that it intends to invest US$1 billion in Indian solar over the next five years; it will also consider investing in India wind power. It has made these intentions concrete in part by taking a stake in Mere Gao Power, which provides solar micro-grids to villages in northern India[17] and by way of its reported interest in purchasing the Indian renewable energy portfolio of the Singapore-based Equis Energy.[18]
- In Malaysia, China and Indonesia[19], with solar pipelines in the project, with construction of the first Engie geothermal power plant, in Indonesia[20], and with plans to invest US$1.25 billion in other Indonesian renewable projects.[21]
- In China's growing solar sector, where in April 2017 Engie announced the purchase of 30 percent of the Chinese solar firm Unisun Energy Group.
- In Europe broadly, where the company took full ownership of wind and solar developer La Compagnie in April 2017.[22]
- In the Netherlands, where it acquired EV-Box, Europe's largest electric vehicle charging company[23] in March 2017.
- In Germany, where Engie has recently been rumored to be considering a takeover bid for the renewable energy company Innogy (which split off from RWE in 2016)[24].
- In its second green-bond issuance, in two tranches totaling €1.5 billion[25] after its first €2 billion issuance in 2014 (part of which financed the Jirau hydroelectric project in Brazil).

Engie's 2017 first-half results demonstrated remarkable progress on the company's three-year transformation plan. Revenues and profits rose 1.6 percent and 3.5 percent, respectively, as Engie outperformed its major French rival, EDF[26].

---

14 http://www.engie.com/wp-content/uploads/2017/03/cp-engie-fy-2016_ukdef.pdf
15 https://www.esi-africa.com/news/ghana-ada-wind-power-project-inject-50mw/
16 http://www.ntpc.co.in/en/media/press-releases/details/solar-power-tariff-hits-all-time-low-rs-315-unit-ntpc-auction
17 https://www.pv-tech.org/news/2-million-people-to-be-powered-by-engies-double-renewable-energy-investment
18 https://www.dealstreetasia.com/stories/engie-singapore-equis-green-energy-assets-india-78037/
19 https://www.pv-tech.org/news/engie-chief-lauds-prominent-role-for-solar-in-future-energy-systems
20 http://www.engie.com/en/journalists/press-releases/indonesia-geothermal/
21 https://www.pv-tech.org/news/engie-partnerships-to-invest-us1.25-billion-in-indonesian-renewables-agreem
22 https://renewablesnow.com/news/engie-buys-out-renewable-power-jv-564354/
23 http://www.engie.com/en/journalists/press-releases/engie-acquires-ev-box/
24 https://www.bloomberg.com/news/articles/2017-03-13/engie-said-to-consider-bid-for-german-renewables-firm-innogy
25 https://www.environmental-finance.com/content/news/engie-issues-second-green-bond.html?utm_source=050417na&utm_medium=email&utm_campaign=alert
26 https://www.ft.com/content/f7d7c96b-da64-3c1d-8746-835899cfe618?accessToken=zwAAAV2bc0iQkdP318lr2mQ8HdOHRoNYmc_mGA.MEUCIQD5yINDL9Dgl_0GjU4RGLd7GS4GiD6NNx7jr1rMb5qkVwIga4dNbxpF4lzJoOMqUOhAUGzpXYyVIDvCeQH6z7vDcC4&sharetype=gift

Isabelle Kocher, Engie's chief executive, confirmed that low-carbon generation, infrastructure and services now make up 90 percent of the group's earnings before interest, taxes and amortization (EBITDA). (Engie includes natural gas in its definition of low-carbon generation.) At the same time, net debt fell by €2.1 billion to €22.7 billion, and Engie topped an infrastructure finance renewable energy sponsor (by value) league table in Q1 of 2017[27].

While Engie's transition plan is clearly producing positive results, it comes after major destruction of shareholder value and so provides a valuable lesson to fossil-fuel utilities worldwide.

Any power utility that delays a transition toward a future of renewables-based energy generation is mostly likely being derelict in its duties to shareholders.

Enel SpA

Italy-based Enel SpA has a presence in more than 30 countries and a total generating capacity of around 83 GW. It is Europe's largest power company by market capitalization. About half of the electricity Enel generates is from noncarbon-emitting sources, including 36 GW of renewable and hydroelectric capacity, making the company one of the world's leading producers of clean energy with a renewable energy presence in 29 countries. Enel plans to invest €8 billion by 2019 in an initiative to increase its renewable capacity to 46 GW[28]. Enel also plans to cut fossil fuel-based generating capacity by 39 percent by 2019[29] in a campaign to reduce stranded-asset risk. Enel is aiming toward a fully decarbonized portfolio. Like other major European utilities, Enel has suffered from asset impairments, totaling €19 billion from 2010 through 2016.

Enel's leading renewable energy position is a result of its early acceptance of the need for a transition from fossil fuels. The company was included on the Dow Jones Sustainability Index in 2004. In 2008 a subsidiary, Enel Green Power (EGP), was set up to group Enel's global renewable energy interests. While Enel retained 70 percent ownership, EGP was floated on the Italian and Spanish stock exchanges in 2010. In 2016 EGP merged back into Enel SpA, making renewables central to Enel's business model[30].

In addition to being a pioneer in renewable energy, the company was an early adopter of smart meters, a change that many electricity utilities even in developed countries around the world have yet to make. Enel aims to be carbon neutral by 2050.

In its FY2016 consolidated results, the company reported net income of €3.2 billion (up 12 percent on the previous year) and earnings before interest, tax, amortization and depreciation (EBITDA) of €15.2 billion, slightly ahead of target. Net debt was 2.5 times EBITDA in 2016 but is expected to drop to 2.2 times EBITDA by 2019[31]. Enel has outperformed the

[27] IJGlobal, Q1 2017, Infrastructure finance league table report.
[28] http://ieefa.org/italian-utility-invests-renewable-energy-worldwide/
[29] https://www.bloomberg.com/news/articles/2017-01-15/enel-ceo-targeting-renewable-energy-business-in-middle-east
[30] https://www.ft.com/content/fec4ee7a-8de5-11e5-8be4-3506bf20cc2b
[31] Enel Investor Presentation, 2017-19 Strategic Plan, March 2017.

Italian FTSE MIB Index over the last 10 years (see Figure 4). In its latest half-year results to June 2017, the company remained in line with expectations while reaffirming its full-year targets.

Figure 4: Enel Share Performance (Orange) vs. FTSE Milan Italian Bourse (Purple) Index Over 10 Years

Source: Thomson Reuters

At its annual shareholder meeting in May 2017, Enel announced plans to close two large coal-fired power plants by 2018 and to close all coal-fired generation by 2030[32]. Enel's chief executive, Francesco Starace, has made it clear he believes renewables are winning the battle over fossil-fuel- and nuclear-powered electricity and that game-changing battery storage advances will become prevalent far more quickly than most people expect[33]. Starace has expressed a similar view about the pace of uptake of electric vehicles (EVs). Seeing a near future in which EVs help stabilize electricity grids by acting essentially as mobile batteries, Enel is planning a roll-out of 12,000 EV charging points across Italy at a cost of US$341 million.[34]

Enel has been expanding its geographic footprint from Europe into emerging markets[35], especially in Latin America, where several countries have made recent major commitments to renewable energy, including Chile, Mexico, Brazil and Argentina. Through its subsidiary Enel Green Power Mexico (EGPM), Enel is the largest operator of renewables in Mexico, with 675 MW of wind and 53 MW of hydro. The company recently started construction in Mexico of the 754 MW Villanueva solar project, the largest photovoltaic (PV) facility under construction in the Americas and Enel's largest solar project globally[36]. In Chile, Enel operates a renewable portfolio of 1.1 GW, mostly in wind and solar, to which it has recently added South America's

32 http://ieefa.org/ieefa-europe-announcing-coal-plant-closures-enel-biggest-utility-eu-signals-industry-capitulation-new-emission-rules/
33 https://www.ft.com/content/053c9b10-54d5-11e7-80b6-9bfa4c1f83d2
34 https://www.bloomberg.com/news/articles/2017-06-30/electric-cars-are-coming-faster-thank-you-think-enel-chief-says
35 http://www.windpowerengineering.com/clean-energy-standard/enel-betting-developing-economies-will-go-big-wind-solar-hydro-power/
36 https://www.enel.com/en/media/press/d201704-enel-starts-construction-of-don-jos-solar-power-plant-in-mexico-.html

first geothermal plant[37]. This year—2017—Enel began operation of the largest solar PV plant in Brazil, the 158 MW Lapa solar park. Enel has another 649 MW under commission in Brazil.[38]

Outside Latin America, in April 2017 Enel entered the Australian market with the acquisition of the first phase of the 275 MW Bungala Solar project via a joint venture with the Dutch Infrastructure Fund. Purchase of the second phase is expected to be completed before the end of 2017[39].

In the Middle East, Enel is considering opportunities that are emerging from ambitious government renewable energy targets[40].

In Africa, Enel signed a 25-year power purchase agreement in Zambia in April 2017 for a 34 MW solar project[41] — the biggest such project in the sub-Saharan region — in an investment that is emblematic of how much of the continent is starting to leap-frog fossil-fuel modernization entirely and move straight to renewables. In early 2017, the company brought two solar PV plants into operation in South Africa[42] to complement three other solar PV plants and two wind farms it already owns in that country, making Enel the largest privately owned renewables operator in Africa. The company is now also considering expanding into West and East African markets[43] .

In North America, Enel in March 2017 brought online the largest wind farm in its portfolio, the 400 MW Cimarron Bend wind farm in the state of Kansas. The company owns four other wind farms in Kansas. Enel Green Power North America has 3.2 GW of renewable capacity across 23 American states and 2 Canadian provinces[44]. More capacity is under construction, with 300 MW of new wind power projects recently begun in Oklahoma[45] and 300 MW underway in Missouri[46].

Even as Enel has pulled off what would be a difficult feat for any major power utility — transitioning from fossil fuels to renewables — it has outperformed the market. Key to this achievement was the company's early recognition of trends that signaled the prudence of preparing for the new energy economy. The company is similarly advanced in its preparations for the arrival of significant capacity in battery storage and electric vehicles.

Enel has emerged as one the world's leading producers of clean energy while simultaneously outperforming other major European utilities that have not moved as fast and have suffered destruction of shareholder value as a result.

---

37 https://www.enel.com/en/media/press/d201703-enel-and-enap-connect-to-the-grid-first-geothermal-plant-in-south-america-cerro-pabelln-.html
38 https://www.pv-tech.org/news/enel-commissions-158mw-solar-park-in-brazil
39 https://www.enel.com/en/media/press/d201704-enel-lands-in-australia-with-countrys-largest-solar-pv-project.html
40 https://www.bloomberg.com/news/articles/2017-01-15/enel-ceo-targeting-renewable-energy-business-in-middle-east
41 https://www.pv-tech.org/news/enel-signs-ppa-for-34mw-pv-project-in-zambia
42 https://www.enel.com/en/media/press/d201702-enel-brings-two-new-south-african-pv-plants-into-operation--.html
43 https://renewablesnow.com/news/interview-enel-green-power-set-to-expand-business-in-africa-574379/?utm_source=Renewables+Now_subscribers+and+newsletter&utm_campaign=16140df907-Renewables_Now_The_Daily_Newsletter_15_06_15_2017&utm_medium=email&utm_
44 https://www.enel.com/en/media/press/d201703-enel-begins-operation-in-usa-of-its-largest-wind-farm-.html
45 http://www.evwind.es/2017/04/18/enel-starts-building-300-mw-oklahoma-wind-farm/59490
46 http://www.windpowerengineering.com/slider/enel-begins-construction-rock-creek-wind-farm-missouri/

RWE

RWE was once among the largest companies in Germany.

This is no longer the case, as it has had to restructure dramatically in response to German national policy supporting a strong transition to renewable energy, a shift that has damaged RWE's coal- and nuclear-based electricity generation assets. Wholesale power prices in Germany declined 55 percent from 2011 to 2016[47], driven largely by the roll-out of renewable capacity, and resulting in huge industrywide write-downs of electricity generation assets totaling almost €30 billion across the German market[48]. The trend is seen across Europe, as nations legislate for increased renewable capacity in markets with flat or declining electricity demand. RWE is also burdened with liabilities arising from the shutdown of nuclear power stations.

In total, RWE has shut down or mothballed almost 12 GW of capacity since 2012, and the company has had to make significant impairments to the value of its "conventional" power plants due to difficult operating conditions created by low prices. In 2016, RWE total impairments came to €4.3 billion, of which €3.7 billion related to the company's German power plant portfolio. In 2015, the company took total impairments of €3.1 billion, of which €2.1 billion were related to write-downs of German and British power plants in response to the deteriorating earnings potential of those assets. Large impairments were also taken in 2012 and 2013. In all, RWE took impairments of almost €16 billion from 2010 through 2016.

The company has reported declining revenues over the last five years and a net loss in three of those years, driven by impairments. Its debt-to-equity ratio increased to 5.87 in 2016, up from less than 1 in 2007. RWE, as a result, has significantly underperformed the German market after having tracked it closely from 2007 through 2009 (refer to Figure 5).

Figure 5: RWE Share Performance (Orange) vs. DAX Index (Purple) Over 10 Years

Source: Thomson Reuters

47 http://www.ey.com/gl/en/industries/power---utilities/ey-power-transactions-and-trends-q4-2016-europe
48 https://www.bloomberg.com/news/articles/2017-03-13/engie-said-to-consider-bid-for-german-renewables-firm-innogy

Obstacles to the company's coal-fired generation have not been limited to Germany. Value write-downs have occurred on new capacity in the Netherlands[49]. Further, RWE is considering selling its majority stake in the second-biggest power plant in Hungary and its holdings in lignite mines[50] there. (Lignite is a low-grade form of coal.) The company is planning to retrofit its two Dutch hard coal plants to co-fire with biomass.

In response to transition across European electricity markets, RWE spun off its renewable assets into a separate company, Innogy (in which it retained a 77 percent stake) while retaining its troubled thermal and nuclear generation capacity[51]. This move, completed in 2016, positions Innogy to focus on renewables along with its networks and retail businesses, thus allowing investors direct access to the faster-growing businesses — separate from RWE's legacy fossil-fueled and nuclear power plants. RWE remains reliant on coal for more than 50 percent of its electricity generation.

After a net loss of €5.7 billion in 2016, RWE is being kept above water by its 77 percent stake in Innogy, the renewable energy spin-off. Given that Innogy's market value is double that of RWE, it is clear RWE's nuclear and coal-generation assets have a negative value[52]. In April 2017, Innogy approved a dividend of €1.60 a share, a payout ratio of 79 percent and one that provided RWE a healthy cash inflow. Were RWE to sell Innogy, it would be left without a sustainable business model[53]. Reports have surfaced that the French utility Engie, undergoing its own transition toward renewables, is considering making an offer for all or part of RWE's stake in Innogy. E.ON has also been linked to a bid for Innogy.

In its latest results for the six months to 30 June 2017, RWE reported a 7 percent increase in earnings before interest, tax, depreciation and amortization (EBITDA). This increase was due largely to improved performance of the company's trading division, which rebounded from a poor first half of 2016. For what RWE terms "conventional" power generation (i.e., fossil fuel- and nuclear-based), profit margins declined. RWE sells electricity generated from its coal and nuclear power stations on forward contracts; lower 2017 revenues for these plants reflected declining wholesale power prices up to 2016 when the forward contracts were taken up. With the costs of lignite and nuclear fuel stable, and higher-grade hard coal prices increasing in the first half of 2017, margins for the coal and nuclear fleet fell.

RWE's lignite and nuclear division saw EBITDA fall 15 percent to €401 million on lower wholesale electricity prices while the European Power division, which includes the company's hard coal, gas and biomass generation, saw EBITDA decline 30 percent to €222 million, driven by lower hard coal generation margins. Conversely, Innogy saw EBITDA increase 2 percent even with a poor six months of hydroelectric generation performance attributed to dry weather. RWE forecasts additional significant declines in the profitability of its lignite and nuclear power division[54], and states that its "hard coal-fired power stations remain under

[49] http://ieefa.org/ieefa-europe-fallout-around-dutch-coal-stranded-asset-mistake/
[50] http://www.reuters.com/article/hungary-powerstation-rwe-idUSL5N1HD1D7
[51] http://uk.reuters.com/article/uk-rwe-innogy-idUKKCN0ZG1JQ
[52] https://www.bloomberg.com/gadfly/articles/2017-03-14/away-with-the-fairies-innogy-tilt-is-a-franco-german
[53] https://www.bloomberg.com/news/articles/2017-03-13/engie-said-to-consider-bid-for-german-renewables-firm-innogy
[54] RWE Interim Financial Report, January-June 2017

pressure"[55]. The contribution of hard coal to RWE's generation profile fell sharply, by 21 percent, in the first half of 2017[56].

RWE has seen some share-price gains in 2017, as wholesale electricity prices in the first half of the year have risen. With much of Germany's most immediate energy transition focus on closing down nuclear power plants by 2022, coal has had something of a reprieve. That said, the long-term shareholder value destruction displayed in Figure 5 speaks for itself. Once RWE's nuclear power stations are gone, the momentum behind the growth in renewables[57] and energy storage will eat away at coal's place in the longer-term energy mix. Germany's deputy economy minister said very recently, in September 2017, that the country wlll need to shut half its coal-fired generation capacity (25 GW) if it is to meet its 2030 carbon reduction target[58]. New EU regulations on power plant emissions are likely to place further pressure on coal-fired plant operators. In its 2017 interim financial report, RWE noted that new limits on nitrogen oxides and mercury are beyond what is currently possible for RWE plants to meet.

E.ON SE

Like RWE, E.ON SE has been hugely affected by Germany's energy transition, which is driving renewable energy capacity installation and will require the shutdown of all nuclear power stations by 2022. The profitability of Germany's coal-fired power stations, meanwhile, is being squeezed by the continuing roll-out of renewable energy capacity, which, with zero fuel costs, pushes coal down the dispatch merit order in the electricity market. Despite some price recovery in 2017, the outlook for the profitability of many coal-fired power plants in Germany remains depressed.[59]

Once Germany's biggest utility, E.ON's belated response to the nation's electricity-generation transition was to spin off its struggling coal, gas and hydro assets as European wholesale power prices forced E.ON's stock price to record lows[60]. These assets were spun off into a new company, Uniper, in 2016, allowing E.ON to focus since then on renewable energy. This approach contrasts favorably with that of RWE, which spun off its renewable assets into a separate company, Innogy, while holding onto its troubled thermal assets.

That said, the E.ON spinoff didn't come in time to save the company from incurring very significant impairments as its coal-fired power plants struggled in a low wholesale price environment. In 2016, E.ON reported a huge net loss, of €16 billion (one of the largest ever reported in German corporate history), on the back of impairments totaling €3.2 billion and a loss from discontinued operations of €13.8 billion. This latter figure — €13.8billion — came mostly from impairments arising from the Uniper spin-off. E.ON has reported four net losses since 2010. Asset impairments over the period 2010-2016 total €24 billion (see Figure 7).

[55] https://www.rwe.com/web/cms/en/110504/rwe/investor-relations/news/news-ad-hoc-statements/?pmid=4015599
[56] RWE Interim Financial Report, January-June 2017
[57] https://www.bloomberg.com/news/articles/2017-08-15/german-onshore-wind-power-costs-plummet-in-second-auction
[58] http://energy.economictimes.indiatimes.com/news/power/european-power-prices-hit-32-month-high-as-fuels-and-carbon-rise/60381165
[59] https://www.platts.com/latest-news/coal/london/german-coal-margins-for-oldest-power-plants-turn-26784077
[60] http://www.reuters.com/article/us-e-on-uniper-divestiture-idUSKBN0UI0PK20160104

Like RWE, E.ON has significantly underperformed the German stock market (Figure 6) ever since wholesale electricity prices began falling, wreaking havoc on shareholder wealth. Even though government regulations on carbon emissions and nuclear power generation clearly indicated where electricity generation markets were headed, E.ON hesitated in spinning off its thermal assets.[61] The company also missed an opportunity to rid itself of its nuclear obligations, waiting too long on that front as well, as the German government decided that operators of nuclear plants must keep them rather than spin them off (along with their shutdown obligations). Though E.ON is now focusing on renewables, by failing to be proactive, it has been incurred billions of euros in lost value.

E.ON holds 47 percent of Uniper but is now considering a sooner-than-planned sell-off of its stake in the face of the enormous losses reported by E.ON in 2016. Its chief executive, Johannes Teyssen, has said he hopes a well-timed sale may recover some of the Uniper impairment charges taken in 2016[62]. E.ON is also facing costs related to the shutdown of its nuclear capacity.

Figure 6: E.ON Share Performance (Orange) vs. DAX Index (Purple) Over 10 Years

Source: Thomson Reuters

E.ON has started a new energy trading division across a number of markets in Europe that company executives hope will leverage its position in renewable energy. The aim is to take advantage of the flexible nature of E.ON customer's decentralized renewable capacity and storage capabilities[63]. In 2017, E.ON launched a combined solar panel and battery storage product in the British market promoted as a way to save some customers up to 50 percent on their electricity bills[64]. This follows the launch of similar services in Germany and Sweden. E.ON

[61] http://reneweconomy.com.au/utilities-guide-brown-green-transition-34798/?utm_source=RE+Daily+Newsletter&utm_campaign=c94fbefcef-EMAIL_CAMPAIGN_2017_04_20&utm_medium=email&utm_term=0_46a1943223-c94fbefcef-40324105

[62] http://www.reuters.com/article/us-e-on-agm-uniper-idUSKBN1860V4

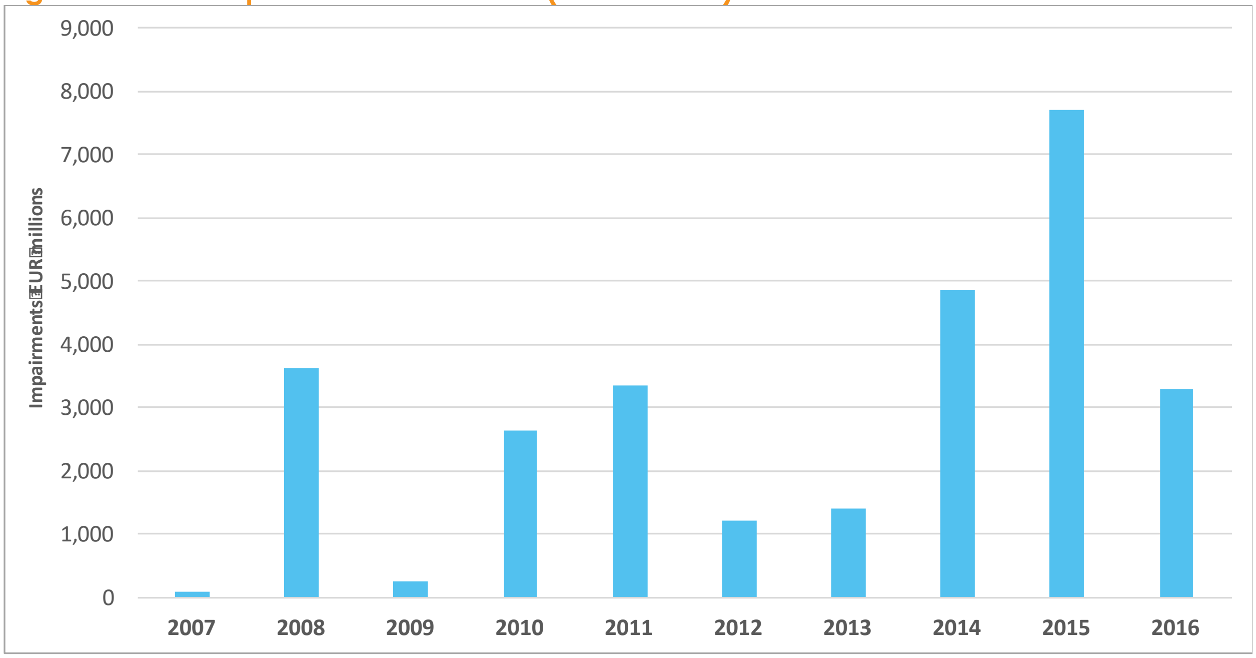
[63] https://www.pv-tech.org/news/e.on-establishes-new-power-trading-division-to-leverage-renewables-assets

[64] http://energy.economictimes.indiatimes.com/news/renewable/e-on-offers-uk-households-solar-panels-with-battery-storage/58272299

has also introduced SolarCloud, which lets customers store surplus solar power in a virtual account for later use.

The company is also expanding its wind capacity with American additions that include 278 MW in Illinois[65] and 228 MW in Texas[66]. E.ON has a 385 MW offshore wind plant under construction in the Baltic Sea[67] and a 400 MW plant approaching completion off the southern coast of Britain.[68]

Figure 7: E.ON Impairments 2007-2016 (EUR millions)



Source: Thomson Reuters, company reports

In its latest half-year financial results, to June 2017, E.ON reported an increase in adjusted net income of 46 percent over the prior comparable period, to €841 million while its net debt declined 18 percent to €21.5 billion over the first six months of the year[69]. Management says it intends to increase the dividend payout ratio to at least 65 percent to bring E.ON into line with renewable-based competitors like Innogy. E.ON's share price is more than 40 percent higher now than its closing year-end 2016 price.

E.ON's balance-sheet improvement was driven in part by a German Federal Constitutional Court decision[70] that the country's nuclear fuel tax was invalid, a ruling that resulted in significant refunds to E.ON (and RWE). This refund will help pay for the company's proposed

[65] https://www.eon.com/en/about-us/media/press-release/2016/eon-is-extending-its-renewables-business-in-the-us-successfully.html
[66] https://www.eon.com/en/about-us/media/press-release/2016/eon-announces-major-onshore-wind-farm-us-investment.html
[67] http://www.offshorewind.biz/2017/02/20/e-on-and-statoil-top-out-arkona-om-base-in-sassnitz/
[68] https://www.eonenergy.com/about-eon/our-company/generation/planning-for-the-future/wind/offshore/rampion-offshore-wind-farm
[69] E.ON Interim Report, January –June 2017.
[70] https://www.reuters.com/article/us-germany-nuclear-court-idUSKBN18Y0PX

dividend increase, letting E.ON increase capital investment and expand its position in what Mr. Teyssen has termed the "new energy world."[71]

Despite its recent performance improvement, the consensus on E.ON is that it simply waited too long to divest from coal and embrace renewables[72].

E.ON — and RWE — clung to conventional-generation assets presumably in the belief that *Energiewende* would not be successful. That said, post spin-off, E.ON is better focused now on the generation technology of the future and is Germany's largest renewable energy generator.

NextEra Energy Inc.

Florida-based NextEra Energy Inc. is a major American electricity generator with about 46 GW of capacity. It has also emerged as a leader in the global transition to a new energy economy and is focused on providing long-term shareholder value through investment in clean energy. Its subsidiary, NextEra Energy Resources, along with affiliated subsidiaries, is the world's largest generator of electricity from wind and solar. Inclusive of repowering projects, the company expects to bring a total of 10.1 GW to 16.5 GW of renewable capacity on line from 2017 through 2020.[73]

The group added a record 2.5 GW of solar and wind capacity to its portfolio in 2016[74] and was ranked No. 1 in the electric and gas utilities industry in Fortune's "World's Most Admired Companies" of 2017[75], an accolade it has won 10 of the last 11 years. NextEra is North America's largest operator of wind power capacity, with a total of 13 GW across 19 American states and four Canadian provinces. The company's wind capacity has quadrupled over the past decade.

NextEra is the owner of Florida Power and Light Co. (FPL), the third-largest electricity utility in the United States. FPL capacity, now dominated by gas-fired generation, has significant solar energy expansion plans: FPL is to complete eight 74.5 MW solar projects by the first quarter of 2018, totaling about 600 MW[76]. FPL has secured land for an additional 4 GW of solar capacity beyond 2018[77].

FPL has regulatory clearance to recover the costs (through customer rates) of the solar farms it is building. This is part of a trend in the U.S.: utilities are now moving away from buying renewable energy via power purchase agreements (PPA), instead building their own renewable capacity and recovering their costs through regulated rates. This allows for

[71] https://www.cleanenergynews.co.uk/news/solar/e.on-doubles-down-on-green-investment-to-extend-lead-in-new-energy-world
[72] http://reneweconomy.com.au/utilities-guide-brown-green-transition-34798/?utm_source=RE+Daily+Newsletter&utm_campaign=c94fbefcef-EMAIL_CAMPAIGN_2017_04_20&utm_medium=email&utm_term=0_46a1943223-c94fbefcef-40324105
[73] NextEra Earnings Release, 2nd Quarter 2017.
[74] http://www.prnewswire.com/news-releases/nextera-energy-named-no-1-in-its-industry-on-fortunes-list-of-most-admired-companies-for-the-10th-time-in-11-years-300409026.html
[75] http://fortune.com/worlds-most-admired-companies/list/filtered?industry=Electric and Gas Utilities&sortBy=industry-rank
[76] https://www.pv-tech.org/news/nextera-energy-and-fpl-keep-adding-to-solar-project-pipeline-in-us-despite
[77] https://www.snl.com/web/client?auth=inherit - news/article?id=41433320&KeyProductLinkType=4

guaranteed profits for utilities. With electrical demand in decline and renewables becoming ever cheaper, owning renewable capacity in this way is becoming increasingly attractive to utilities.[78]

Figure 8: NextEra Share Performance (Orange) vs. S&P 500 Index (Purple) Over 10 Years

Source: Thomson Reuters

FPL has filed a petition for approval to shut down its St. Johns River Power Park, a 1.3 GW coal-fired power plant that FPL owns jointly with Jacksonville Electric Authority (JEA). The plant's retirement, which is occurring ahead of schedule, is the third coal-fired power plant in the past two years that FPL has said it will close. The St. Johns retirement is expected to save the company US$183 million.[79]

A typical FPL residential customer bill is about 15 percent lower today than it was 10 years ago and is now among the lowest in the U.S. According to an agreement with the Florida Public Service Commission, FPL electricity bills will remain below 2006 levels through 2020[80]. Solar PV has been instrumental, providing FPL with a way of maintaining low costs for customers while guaranteeing company profits.

In Arizona, a NextEra solar installation has set an American record low price for large-scale solar. A NextEra 20-year contract signed with Tucson Electric Power (TEP) in May 2017 sets a price of US$30/MWh[81]. TEP notes that the price is less than half what it had agreed to pay under similar contracts in recent years. The project includes 30MW/120MWh of battery storage and the price of the combined output is said to be significantly less than US$45/MWh,

[78] https://www.bloomberg.com/news/articles/2017-07-26/aep-to-spend-4-5-billion-on-the-largest-wind-farm-in-the-u-s
[79] NextEra Earnings Release, 2nd Quarter 2017.
[80] http://newsroom.fpl.com/2016-11-29-PSC-approves-four-year-rate-agreement-keeping-typical-customer-bills-low-through-2020-while-advancing-affordable-clean-energy-and-best-in-class-reliability
[81] https://www.pv-tech.org/news/sub-3-solar-in-arizona-marks-us-lowest-price-for-solar-pv-to-date

far cheaper than what has previously recorded in the U.S. and well below the cost of a gas-fired peaking plant[82].

NextEra clearly sees renewables as the way forward. The company's chief executive, Jim Robo, has said he expects wind energy to be effectively competitive with incumbent generation sources by 2020, even without federal subsidies[83]. NextEra's expansion in wind energy continues: April 2017 saw the company officially commission 400 MW of wind capacity in the state of Kansas[84].

The company's relatively early expansion into renewable energy, and its persistent leadership on that front, has seen NextEra outperform the S&P 500 (see Figure 8) for more than a decade. In the first quarter of 2017, NextEra took over the No. 1 spot in the SNL roster of the top 20 U.S. energy companies by market capitalization[85]. NextEra's market capitalization increased 7.7 percent, to more than US$60 billion, and the company has maintained that it will achieve earnings growth targets of 6 to 8percent through 2020.

In its latest published financial results for the six months through June 2017, NextEra posted adjusted net earnings of US$1.7 billion, up 13 percent year on year. FPL saw adjusted net earnings increase 15 percent to US$971 million, and NextEra Energy Resources earnings increased 55 percent, to US$708 million. Increased revenues and a decline in interest expense of 29 percent contributed to overall results. In a release accompanying its earnings statement, the company said it expects to continue to benefit from clean-energy expansions in what it considers to be one of the best markets for renewables development in history.[86]

Like ENEL, the Italian utility giant, NextEra has seen the prudence in embracing the energy systems of the future. The fact that the company — again, like ENEL — is navigating a complicated transition while outperforming the broader stock market puts it in stark contrast with competitors that remain wedded to coal-fired electricity and whose underperformance has destroyed significant shareholder value.

NRG Energy

NRG Energy is a largely coal-based company that has grown over the last 15 years to become the second-largest power generator in the United States[87]. NRG has more than 46 GW of power generation capacity, in California, Texas and some Eastern states. The company has more than 2.7 million retail customers across 16 states.

In contrast to NextEra's drive toward renewable energy, NRG is retreating from the renewables space after having abandoned a move into clean-energy industries.

[82] http://reneweconomy.com.au/stunning-new-lows-in-cost-of-large-scale-solar-and-battery-storage-13929/
[83] https://www.bloomberg.com/gadfly/articles/2017-02-28/nrg-earnings-renewables-threaten-independent-power-producers
[84] http://wind.cleantechnology-business-review.com/news/nextera-westar-officially-commission-400mw-wind-farms-in-kansas-060417-5780931
[85] https://www.snl.com/web/client?auth=inherit - news/article?id=40330288&keyproductlinktype=4
[86] NextEra Earnings Release, 2nd Quarter 2017.
[87] https://www.greenbiz.com/article/inside-rise-and-fall-nrgs-green-strategy

NRG is among a small number of independent power producers (IPPs) in the U.S. that generate electricity and sell it directly into wholesale markets. IPPs have seen their profitability significantly hurt by the rise of cheap natural gas and renewable energy in markets with flat electricity demand[88]. In some states, nuclear power subsidies are also likely to have an impact on IPPs[89]. The broad outcome of trends is similar to those seen in Germany, where markets have been shaped by declining wholesale electricity power prices.

Little in the way of relief is on the way. UBS has projected weak or negative electricity demand in American markets in the near future because of a sluggish economy, an uptake of energy efficiency and the continuing roll-out of renewable energy capacity[90]. Low wholesale prices will also keep having a major impact on IPPs.

Figure 9: NRG Share Performance (Orange) vs. S&P500 Index (Purple) Over 10 Years

Source: Thomson Reuters

In Texas, one of the largest electricity markets in the U.S., renewable energy has had a particularly strong[91] impact, with Texas wind energy having overtaken nuclear to become the third-largest source of electricity generation (after coal and gas). Though accounting for only 13 percent of electricity generation in the state, wind has had the same merit dispatch order impact that it has had in Europe, pushing fossil fuels down the dispatch ladder. Published reports have all but two of the state's 15 coal-fired generators losing money[92], a trend leading NRG's chief executive, Mauricio Gutierrez, to say in February 2017 that:

> *"The IPP model is now obsolete and unable to create value over the long term."*[93]

[88] http://ieefa.org/ieefa-update-8-things-doe-report-said-u-s-coal-industry-wished-hadnt/
[89] https://www.bloomberg.com/news/articles/2017-08-10/nrg-sale-is-said-to-draw-possible-suitors-including-gip-nextera
[90] UBS, NRG Research Note, 31 May 2017
[91] http://ieefa.org/wp-content/uploads/2016/09/The-Beginning-of-the-End_September-2016.pdf
[92] https://www.bloomberg.com/news/articles/2017-08-10/america-s-other-coal-job-ignored-by-politicians-is-dying-fast
[93] https://www.bloomberg.com/gadfly/articles/2017-02-28/nrg-earnings-renewables-threaten-independent-power-producers

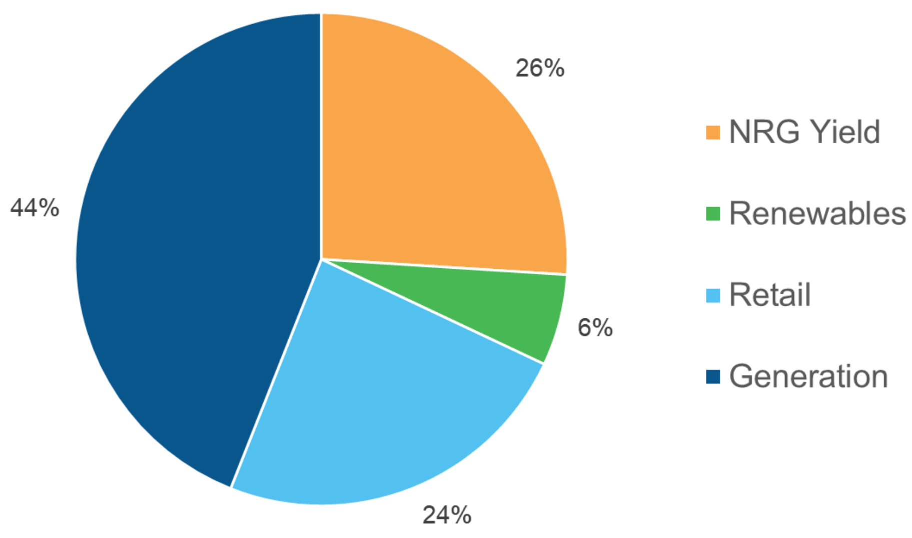
Gutierrez conceded that the utility sector is going through "unprecedented disruption"[94] driven by technological shifts, fuel mix changes, more deployment of distributed energy and new demands in customer preference.

NRG's GenOn unit, which operates 15 GW of mostly gas and coal-fired power plants, entered Chapter 11 bankruptcy in June 2017[95]; GenOn is to be handed over to its senior noteholders. NRG will transfer US$261 million to GenOn and provide a US$330 million letter of credit as part of the bankruptcy proceedings. NRG acquired GenOn in 2012 for US$1.7 billion.

NRG's current standing is the result of managerial missteps. After the 2009 recession, with little or no growth potential and regulatory risks from its aging coal fleet looming on the horizon, NRG decided to move into clean energy and other zero-carbon initiatives. NRG formed NRG Yield, which holds a portfolio of renewable energy assets, had its initial public offering in July 2013. In 2014, NRG publicly committed to achieving 50 percent carbon reduction by 2030 and 90 percent by 2050[96]. NRG's investment in renewables by 2012 made the company one of the biggest operators of wind energy in the U.S. By 2015, it had achieved a diversification that reduced its exposure to the financially risky coal-fired power sector.[97]

By 2016, NRG's renewables business and NRG Yield together made up about a third of the company's adjusted earnings before interest, taxes, depreciation and amortization (EBITDA), totalling US$1.1 billion (see Figure 10).

Figure 10: NRG Sources of Earnings Before Interest, Tax, Depreciation and Amortization 2016



Source: Bloomberg, NRG

However, NRG's capital allocation strategy of reinvesting coal profits into renewables failed to find favor with its traditional investor base, resulting in a significant decline and

[94] http://www.powermag.com/genon-poised-for-chapter-11-restructuring/?pagenum=2
[95] http://www.reuters.com/article/us-nrg-energy-genon-bankruptcy-idUSKBN1952G7
[96] https://www.greenbiz.com/article/inside-rise-and-fall-nrgs-green-strategy
[97] Expert Report of David A. Schlissel, Schlissel Technical Consulting, 2015.

underperformance of NRG's share price relative to its peers and to the market as a whole across 2014 and 2015 (see Figure 9).[98]

Activist investors forced a restructuring; in July 2017, NRG announced a three-year transformation plan targeting up to US$4 billion in asset sales, US$13 billion of debt reduction and US$1 billion in saved costs[99] [100]. The planned asset sales included divestment from 50 to 100 percent of wind and solar power owner NRG Yield, the sale of which has drawn much market interesting, including by rival NextEra[101].

NRG opted to retain a power fleet with significant levels of coal capacity, a high-risk move. Merchant coal plants in the U.S. have been hit hard by low natural gas prices and gains by renewable energy. Two of the company's 15 coal plants are already slated for retirement by the end of 2020, and at least four others face substantial competitive pressures and are performing at distressed capacity levels.

NRG's story is reminiscent of the bankruptcy-bound TXU/Energy Futures Holdings. A decade ago, TXU spent a year or so improving its operations for sale on the market. The sale, a $44 billion private equity deal which was one of the largest in the history of the industry, underwrote a portfolio of old coal plants[102] and an ultimately abandoned effort to build 11 more. The plan was predicated on natural gas prices staying high. When gas prices collapsed, the EFH bankruptcy destroyed tens of billions of dollars in investor value.[103]

Many Texas energy finance players nonetheless cashed in on that deal, leaving large institutional investors holding the bag.[104] (Warren Buffett famously said of the company: "Many of you have never heard of EFH. Consider yourselves lucky, I wish I never had."[105]) The same team of dealmakers on EFH later offered their turnaround skills to Exco, a Texas-based natural gas concern that traded for more than $100 a share five years ago and now trades for less than $2 a share. Many of the same players are involved in the NRG transformation plan.[106]

Going forward, NRG say it intends to focus on maximising the profit margins of its coal-fired generation and retail units. This is a U-turn from 2016, when NRG bought US$1.5 billion of SunEdison clean-energy assets[107]. This new strategy appears to be a move to prioritize cash generation over growth, effectively making NRG a yield stock.[108]

How well this strategy holds up in the energy markets remains to be seen. Bloomberg New Energy Finance (BNEF) forecasts coal's share of the power mix in the U.S. dropping by a half by 2040[109]. Over the same period, gas-fired generation is forecast to rise by 22 perfect and

[98] https://www.greenbiz.com/article/inside-rise-and-fall-nrgs-green-strategy
[99] https://www.snl.com/web/client?auth=inherit - news/article?id=41293346&KeyProductLinkType=4
[100] https://seekingalpha.com/article/4087246-nrg-energy-nrg-business-update-transformation-plan-slideshow
[101] https://www.bloomberg.com/news/articles/2017-08-10/nrg-sale-is-said-to-draw-possible-suitors-including-gip-nextera
[102] http://ieefa.org/wp-content/uploads/2016/09/The-Beginning-of-the-End_September-2016.pdf
[103] https://texasgreenreport.files.wordpress.com/2011/03/the-case-to-retire-big-brown-monticello-and-martin-lake-coal-plants.pdf
[104] https://www.dallasnews.com/business/business/2015/05/09/schnurman-turnaround-titan-takes-his-talents-to-troubled-exco
[105] https://seekingalpha.com/article/4087180-warren-buffett-bought-oncor
[106] https://www.cnbc.com/2017/07/12/hedge-fund-titan-paul-singer-scored-a-big-win-with-this-energy-bet.html
[107] https://www.bloomberg.com/news/articles/2017-07-12/even-the-man-who-tried-to-turn-nrg-green-backs-elliott-on-a-sale
[108] https://www.bloomberg.com/gadfly/articles/2017-07-12/nrg-energy-asset-sale-plan-embracing-the-old
[109] https://www.bloomberg.com/news/articles/2017-06-15/coal-s-share-of-u-s-power-mix-seen-falling-by-half-by-2040

renewable energy by 169 percent. BNEF sees two-thirds of the current coal-generation capacity of around 278 GW closing by 2040. Other analysts predict coal's share of U.S. electricity generation eventually falling to zero[110]. Coal-fired capacity is being retired in every region of the country and replaced with gas and renewables. Coal-dominated power generators like American Electric Power Co. and PacifiCorp are turning increasingly to wind power.[111]

In its latest financial results, for the first six months of 2017, NRG reported a loss from continuing operations of US$70 million, with its retail and NRG Yield segments the only divisions producing a profit. The company's generation segment, which houses NRG's coal-fired operations, saw adjusted EBITDA drop by more than half, to US$205 million.

NRG's U-turn has has a positive impact on NRG's share price. However, Figure 9, above, puts this uptick into context; the recent rise comes after years of underperformance relative to the market representing significant destruction of shareholder wealth. Furthermore, the company's strategic "turnaround" will mostly likely become an exercise in futility as the renewable-capacity growth combined with cheap gas in a no-demand-growth market continue to undermine the profitability and sustainability of the company's coal-fired generation fleet.

Tokyo Electric Power Company Holdings Inc. (TEPCO)

Tokyo Electric Power Company Holdings Inc. (TEPCO) is the largest of the 10 regional electric power companies (EPCOs), monopolies that have historically dominated the Japanese electricity market. With all its nuclear powers stations still offline in the long wake of the 2011 Fukushima disaster, TEPCO power plants today are fired by coal and liquefied natural gas (LNG). Thermal power contributed 95 percent of total generation in the 12 months through March 2017. Hydroelectric power made up 5 percent of generation; renewable energy contributed less than one-tenth of 1 percent[112]. Also in its latest financial results for the 12 months through March 2017, TEPCO disclosed a decline in electricity sales volume of 2.2 percent, on the heels of a 3.9 percent decline. The company forecasts a further reduction this year of 2.7 percent[113].

The finances of all major EPCOs have deteriorated markedly since Fukushima, the meltdown that led to the shutdown of Japan's entire nuclear industry. TEPCO, which owns Fukushima, is in particularly dire circumstances, having seen its share price fall 80 percent since the disaster, an especially spectacular drop in valuation considered against the near-doubling of the Japanese stock market over the same period (see Figure 11). TEPCO was essentially nationalized after Fukushima, and recent market liberalization has put financial pressure on EPCOs; customers are now free to change electricity suppliers and competition in the retail sector[114] is likely drive prices lower.

[110] https://www.bloomberg.com/news/articles/2017-08-10/america-s-other-coal-job-ignored-by-politicians-is-dying-fast
[111] http://ieefa.org/plans-u-s-coal-fired-electricity-expansion-grind-halt/
[112] TEPCO Financial Results April 2016-March 2017 Presentation.
[113] TEPCO Financial Results April 2016-March 2017 Presentation.
[114] https://www.bloomberg.com/view/articles/2017-08-25/japan-s-power-players-are-multiplying

Figure 11: TEPCO Share Performance (Orange) vs. Nikkei 225 Index (Purple) Over 10 Years

Source: Thomson Reuters

According to TEPCO's Revised Comprehensive Special Business Plan, the company is on the hook for a total of 16 trillion yen (US$147 billion) of decommissioning, compensation, decontamination and storage costs from Fukushima[115]. TEPCO is also the defendant in huge lawsuits in both Japan[116] and the United States.[117]

Losses from Fukushima itself and from the idling of TEPCO's other nuclear plants have weighed heavily on the company. TEPCO posted huge losses in the three years following the disaster, and while it managed after Fukushima to edge its way back to profitability, the company's revenues and net profits have been declining over the past two years. The company's net debt of US$46 billion is seven times its equity market capitalization.

TEPCO's difficulties are further complicated by the fact that Japan is at a turning point on energy policy. The country — and its utility industry — are hobbled by sluggish economic growth, a shrinking population and declining electricity demand, down 11.5 percent in 2016 from its 2010 peak. These trends are unlikely to change. Japan's population will continue to decline in numbers and to age, a demographic drift that will restrain economic growth and energy demand. The growth of energy efficiency, in which Japan is a world leader, will also take a toll as Japan focuses on national energy security, now at risk because the country must import all of its fossil and nuclear fuels.

Government policies since 2011 favoring replacement of nuclear baseload with imported fossil-fuel baseload have left Japan missing out on increasingly available opportunities in the development of renewable energy, a sector that is seeing technology gains drive rapid

---

[115] TEPCO's Revised Comprehensive Special Business Plan Presentation, May 2017.
[116] https://www.bloomberg.com/news/articles/2017-08-17/how-a-harley-riding-ex-ally-of-villains-is-leading-a-nuke-revolt
[117] https://www.reuters.com/article/us-tepco-fukushima-lawsuit-idUSKCN1B40TG

declines in costs. That said, Japan has shown some signs of life on this front, in April 2017 passing a 100 GW of renewable capacity landmark.

Japan has 42 new coal-fired power plants in its electricity-generation pipeline but most are still in the planning stages; because of Japan's declining electricity demand, in IEEFA's view many will never reach the construction phase. TEPCO alone plans new coal-fired power capacity of 5.8 GW in addition to the 6.6 GW it now operates[118]. Whether its proposed coal fleet expansion will add capacity or merely replace existing thermal capacity is unclear, and because TEPCO has excessive financial leverage already, momentum for the initiative is fading. A recent report by the Japan Renewable Energy Institute forecasts that, if all of the planned coal-fired power plants come into operation, the utilization of coal-fired plants — a measure of how much the fleet would actually be used — could drop below 50 percent.[119]

Because the calculus of coal-fired electricity is changing, Japan's EPCOs have recently begun to reassess their coal-fired generation plans. In January 2017, citing declining electricity demand, Kansai Electric Power Company halted its program to switch Ako power station Units 1 and 2 from oil-fired to coal-fired generation. In total, four proposed coal-fired power plants with a combined 2.3 GW of capacity have been cancelled in 2017[120].

One notable response in 2015 to the post-Fukushima energy reality was the founding of JERA (Japan's Energy for a new eRA) in 2015, a 50/50 joint venture between TEPCO and Chubu Electric Power Company, the third largest EPCO in Japan. In 2017, the two parties agreed to combine their fossil-fuel power plants under the JERA umbrella; the joint venture will operate 68 GW of capacity[121]. Combining operations will result in cost cuts of US$910 million a year within five years[122], helping TEPCO in its objective of remaining profitable enough to pay the enormous cleanup costs associated with Fukushima.

JERA is already handling all of TEPCO and Chubu's fuel-procurement needs and is the world's largest importer of liquefied natural gas (LNG), with an annual purchase of around 40 million tonnes. JERA also invests in overseas power generation, particularly gas-fired capacity. It is looking to invest more in renewables to buttress its balance sheet. In February 2017, JERA acquired a 10 percent stake in the Indian renewable energy company ReNew Power for US$200 million[123]. ReNew has 3.2 GW of solar and wind power operational or under construction and intends to reach 11 GW by 2022. This acquisition is part of a trend of Japanese companies investing in renewable energy overseas.[124]

JERA's expansion in overseas renewables is one of the initiatives noted in TEPCO's new business plan that the company hopes will allow it to finance its Fukushima clean-up obligations. Another is the restart of the Kashiwazaki-Kariwa nuclear power station (KK). With a capacity of 8 GW, KK is the world's largest nuclear power plant. But it has been idle for six

[118] http://www.renewable-ei.org/en/activities/reports_20170720.php
[119] http://www.renewable-ei.org/en/activities/reports_20170720.php
[120] https://www.theguardian.com/environment/2017/aug/24/coal-in-decline-an-energy-industry-on-life-support
[121] http://www.reuters.com/article/japan-power-ma-idUSL3N1H52YK
[122] http://www.reuters.com/article/us-japan-power-m-a-idUSKBN18Z0Z2
[123] http://www.livemint.com/Companies/1wn4XC3jYDpwwacxsUmFfI/Japans-JERA-acquires-10-stake-in-ReNew-Power-for-200-mill.html
[124] http://ieefa.org/ieefa-update-japan-investing-heavily-overseas-renewables/

years, and there remains considerable public and local government opposition to its restart. TEPCO will find the process of bringing it back on line very difficult[125].

On the domestic front, even with the winding back of generous feed-in-tariffs that drove rapid solar expansion in the years after Fukushima, renewables uptake is still a strong value proposition because of its diversification benefits and the declining costs of wind and solar power.

Thermal electricity generation — from coal, gas and oil — remains at risk of losing market share to renewable capacity, which, as it comes online, will cut into the demand for thermal. Such trends have been apparent now for some time in China and India, where drives to install both thermal and renewable capacity concurrently have had the effect of seeing overall coal-fired utilization rates drop in 2016 to 47 percent in China and 56 percent in India. This effect has taken root even as electricity demand has risen in China and India.

Because of its central role in the Fukushima disaster, TEPCO, among all Japanese EPCOs, is in the most precarious position. Much of what applies to TEPCO applies to other EPCOs, however. The combined effects of declining demand, energy efficiency, market liberalization, excessive financial leverage and expanding renewable energy will continue to undermine the sustainability of incumbent coal and LNG-fired generation capacity. Japanese utilities would do well to increase their focus on domestic renewables.

AGL Energy (Australia)

AGL (formerly known as the Australian Gas Light Company) owns the largest portfolio of electricity generation assets in Australia and is a major electricity and gas retailer. Much of AGL's recent electricity capacity expansion has been through the acquisition of coal-fired power stations. In 2012, AGL acquired the 2.2 GW Loy Yang coal-fired power station in Victoria and its associated lignite mine. AGL made this acquisition on favorable terms because of the financially distressed nature of the sale by TEPCO of Japan. The mine supplies both the Loy Yang A and the 1,050 MW Loy Yang B power stations. (The latter is now for sale as its owner, Engie, moves away from coal-fired power.)

In 2014, AGL expanded further into coal assets by buying the New South Wales state-owned generator Macquarie Energy, for AU$1.5 billion.[126] The deal gave AGL a coal-fired generation portfolio of 4.6 GW, making it Australia's largest producer of carbon dioxide. The acquisition has been "value accretive" — since 2014, wholesale electricity prices have risen substantially and a key competitor, Engie's Hazelwood plant, has ceased operation.

However, the early 2015 arrival of a new chief executive, Andrew Vesey, marked a change in direction for the company. AGL released a new greenhouse gas policy in April 2015, committing to stop purchases of coal-fired power stations unless those plants were outfitted with carbon capture and storage systems. The company also stated that all its coal-fired

[125] https://www.bloomberg.com/news/articles/2017-01-29/japan-s-unresolved-disaster-sways-symbol-of-nuclear-opposition
[126] http://www.reuters.com/article/us-australia-macquarie-agl-idUSBREA1A26Y20140212

plants would operate beyond their expected lifetimes and that all would be closed by 2050[127].

After the Australian government in June 2017 published the Finkel Review — a set of recommendations for reform of the Australian electricity system — Vesey was vocal in his support for the review's central idea, its "Clean Energy Target" (CET). Vesey has also said that coal should not be included in the CET[128] and that coal will not be able to compete with renewables in the long term[129]. Vesey is just one of a number of Australian utility executives who don't see how new coal-fired power stations can be economically viable in the face of the declining cost of renewables.[130]

AGL executives have also made clear that they don't see natural gas as a needed transition fuel from coal to renewables. AGL does see a role for peaking gas plants — those that run only during times of peak demand — but not any role for baseload gas plants in the company's future. Rather, AGL will move straight from "big coal to big renewables"[131]. In Australia, wind and solar are now cheaper than baseload gas generation even if the costs of peaking gas plants designed to fill gaps are included. AGL acknowledges an increasing role for distributed battery storage as well.

The company has become a major investor in renewable energy in Australia, owning several wind farms and two solar PV plants. It has taken its positions in renewables even as solar PV development has been held back by government policy uncertainty[132]. AGL also started the Powering Australian Renewables Fund with an initial equity injection of AU$200 million, and the fund has attracted substantial additional capital. In July 2016, the Queensland Investment Corporation invested AU$800 million.[133] The first project the fund financed was the AU$450 million, 200 MW Silverton Wind Farm in New South Wales, which sells power to AGL for AU$65/MWh.[134] In August 2017 the fund financial closed on the proposed AU$850 million, 453 MW Coopers Gap Wind Farm project in Queensland.[135]

The fund aims to finance the development of 1 GW of new renewable capacity — one-fifth of the federal government's national renewable energy target for 2020.

AGL is also researching and developing electricity systems that will take advantage of the declining cost of battery storage. In South Australia, AGL has begun a trial of a virtual power plant linking domestic and business battery storage with the aim of cutting consumer costs and improving grid stability[136]. AGL is pioneering the use of blockchain technology that allows owners of domestic rooftop solar panels to trade surplus electricity with each other[137]. AGL is

---

[127] http://reneweconomy.com.au/agl-plans-to-shut-down-coal-decarbonise-generation-by-2050-2050/
[128] http://www.smh.com.au/business/energy/energy-giant-agl-urges-no-coal-in-governments-clean-energy-target-20170721-gxfqjz.html
[129] http://www.theaustralian.com.au/business/opinion/coal-cant-compete-with-renewables-in-long-term/news-story/f3b376b9ec7a3c9e80e3675ed8907ec1
[130] https://www.theguardian.com/australia-news/2017/aug/09/energy-chiefs-tell-turnbull-they-arent-interested-in-prolonging-life-of-coal-plants
[131] http://reneweconomy.com.au/agl-kills-idea-of-gas-as-transition-fuel-wind-solar-storage-cheaper-63013/
[132] https://www.agl.com.au/about-agl/how-we-source-energy/renewable-energy
[133] http://www.afr.com/business/energy/electricity/qic-joins-agl-energy-in-3bn-renewable-energy-fund-20160725-gqdgch
[134] http://reneweconomy.com.au/agls-new-200mw-silverton-wind-farm-to-cost-just-65mwh-94146/
[135] http://aglblog.com.au/2017/08/agl-and-parf-achieve-financial-close-on-coopers-gap-wind-farm/
[136] http://reneweconomy.com.au/agl-goes-live-with-virtual-power-plant-linking-household-battery-storage-16810/
[137] http://www.afr.com/business/energy/electricity/agl-energy-to-trial-peertopeer-household-energy-trading-20170525-gwd3zn

also exploring Investments in large-scale battery storage, acknowledging that technology will continue to transform electricity systems.[138]

While coal-fired power still contributes 85 percent of AGL's total electricity generation[139], AGL has not suffered the value destruction seen by European utilities that held onto coal-fired generation assets too long. Despite underperforming the Australian market for much of the past 10 years, AGL has more recently significantly outperformed the index of the top 200 Australian listed companies (see Figure 12) on the back of a near-doubling in wholesale electricity prices in Australia. These price increases are due in part to a tripling of wholesale gas prices that resulted from a series of energy policy failures by the Australian government.

Figure 12: AGL Share Performance (Orange) vs. ASX 200 Index (Purple) Over 10 Years

Source: Thomson Reuters

Uncertainty surrounding government energy policy has also allowed a utility so dependent on coal to outperform. After Engie unexpectedly closed its Hazelwood plant in March 2017 as part of its global move away from coal, the resulting decrease in electricity supply pushed up wholesale prices, with AGL profiting from the situation. Policy uncertainty has stalled renewable investment, which means the Hazelwood capacity has not been replaced. Utility-scale solar has been especially slow to emerge in Australia, providing relief to operators of coal-fired power stations who have yet to have their daytime generation viability slashed by solar PV. The government's reversal of its carbon-pricing policy has also benefited operators of coal-fired power stations.

In its financial results for the first six months of 2017, AGL reported a 14.4 percent increase in underlying profit after tax and a A$947 million rise in statutory profit and tax[140], in part — as

[138] http://reneweconomy.com.au/agl-looks-to-large-scale-battery-storage-as-alternative-to-gas-15426/
[139] http://reneweconomy.com.au/agl-cashes-in-on-coal-splurge-renewable-investment-drought-25338/?utm_source=RE+Daily+Newsletter&utm_campaign=4c75cced31-EMAIL_CAMPAIGN_2017_08_09&utm_medium=email&utm_term=0_46a1943223-4c75cced31-40324105
[140] http://www.afr.com/business/energy/electricity/agl-energy-profit-rises-on-higher-electricity-prices-20170808-gxs78n

Morgan Stanley analysts have noted — because the wholesale electricity price AGL received nearly tripled, from A$34/MWh to A$83/MWh.[141]

In IEEFA's view, the good times for coal-fired generation in Australia are ending as utility-scale renewables[142] begin to assert their presence. In 2016, 12 utility-scale solar projects received development grants from the government agency ARENA. Those projects will triple Australia's utility solar capacity[143], and they are just the start. New solar PV projects are being announced regularly,[144] even in the face of policy uncertainty. All of the 12 projects given clearance in 2016 were smaller than 110 MW, but in August 2017, the 1,000 MW Equis Energy project was announced in Queensland.[145] May 2017 saw a new record low wind energy price when Origin Energy agreed to offtake electricity from the 530 MW Stockyard Hill Wind Farm at AU$52-55/MWh.[146]

With renewables now finally taking hold in a country with excellent wind and solar resources, AGL—by clinging to its coal holdings—is at risk of following the same value-destruction path as the transition laggards in Europe and America. Operators of Australian coal plants will inevitably and increasingly see their daytime generation demand undercut by solar.

Apparently committed to an orderly coal-fired power phase-out by 2050 at the latest, AGL's current pivot toward renewables and its proactive development of battery storage suggest that the curtain will come down on coal-fired electricity before then.

China Energy Investment Corp. (China)

In August 2017, China announced that its No. 1 coal producer was to be merged with one of China's "big five" power utilities.

The absorption of the China Guodian Corp., by the coal-fired power plant operator Shenhua Group will produce the world's largest power company by installed capacity, about 225 GW. The merged company is to be called the China Energy Investment Corporation.[147] With an estimated combined staff of 326,000, the new company will have a work force almost four times larger than that of the entire U.S. coal-fired power sector.[148]

Shenhua produced 290 million tonnes of coal last year, and the company has expanded "downstream" into coal-fired power generation, with 82 GW of capacity. China Guodian itself has 145 GW of capacity.

Importantly, by absorbing China Guodian, Shenhua is no longer as reliant on coal as it was,

141 http://reneweconomy.com.au/agl-cashes-in-on-coal-splurge-renewable-investment-drought-25338/?utm_source=RE+Daily+Newsletter&utm_campaign=4c75cced31-EMAIL_CAMPAIGN_2017_08_09&utm_medium=email&utm_term=0_46a1943223-4c75cced31-40324105
142 https://www.bloomberg.com/news/articles/2017-08-25/shell-joins-solar-push-in-coal-country-of-world-s-top-exporter
143 http://www.smh.com.au/environment/climate-change/largescale-solar-handed-huge-boost-from-arena-funding-20160906-gr9yqe.html
144 http://reneweconomy.com.au/powering-north-queensland-renewables-coal-country-11725/
145 http://www.afr.com/news/politics/equis-energy-to-build-australias-largest-solar-project-20170803-gxp4ih
146 http://reneweconomy.com.au/australia-leaps-up-global-renewable-energy-investment-rankings-54557/
147 https://www.bloomberg.com/news/articles/2017-08-28/china-approves-guodian-shenhua-group-to-merge
148 https://www.reuters.com/article/us-china-power-shenhua-guodian-factbox/factbox-shenhua-and-guodian-chinas-latest-state-marriage-idUSKCN1B918I

since Guodian brings significant clean energy assets with it. The generation capacity of the merged company will include 23 percent from renewables, including hydroelectric.[149] (Shenhua was dependent on coal for 90 percent of its generation capacity.[150]) Given that the generation hours of renewables, nuclear and hydro are guaranteed by regulators, the absorption of such capacity is advantageous to Shenhua, whose coal capacity must increasingly compete in more liberalized wholesale markets[151]. Meanwhile, China Guodian gains firmer access to low-cost domestic coal supply from Shenhua's output.

Even with market liberalization, power prices are still firmly regulated and the recent surge in coal prices (brought on largely by China's own coal mining capacity restrictions) has led to significant profit downturns for generators that are dependent on coal[152]. At the same time, overcapacity brought on by a debt-financed build-out above the rate of demand growth means that generators now have higher interest costs as utilization of their plants declines.

Shenhua Group's subsidiary, the coal-dependent China Shenhua Energy Corporation, is listed on the Shanghai and Hong Kong stock exchanges. Its shares closely tracked the Hang Seng index until 2013, when the company started to significantly underperform the market. Its dependence on coal has been increasingly at odds with the energy direction being pursued by the Chinese government.

In addition to its own portfolio of thermal, hydro and renewables power generation, China Guodian owns China Longyuan Power Group Corp (Longyuan), a Hong Kong-listed power generation company that has been adding 1.5-2.0 GW of new wind annually in China this decade.

Figure 13: China Shenhua Energy Corp Share Performance (Orange) vs. Hang Seng Index (Purple) Over 10 Years

Source: Thomson Reuters

---

149 https://www.bloomberg.com/news/articles/2017-08-28/china-approves-guodian-shenhua-group-to-merge
150 https://www.ft.com/content/ff8c98de-ae4f-3c34-b37d-f90b6d41320c
151 https://www.bloomberg.com/news/articles/2017-08-28/china-approves-guodian-shenhua-group-to-merge
152 http://www.scmp.com/business/companies/article/2110326/why-chinas-power-sector-restructuring-game-mergers-and-demergers

Longyuan focuses on the development, construction and operation of wind farms. At the end of June 2017, Longyuan had installed capacity of 19,542 MW, of which wind power comprised 17,417 MW. The company is also a domestic leader in off-shore wind farm development. Longyuan holds smaller capacities in solar, biomass and tidal power as well.

Longyuan is advancing an expansion overseas similar to that of many other Chinese power companies[153] and has made it clear that it intends to accelerate its pace of "going-out" into international markets in line with the Chinese government's "One Belt, One Road" initiative. Longyuan's expansion began in Canada with the 100 MW Dufferin wind project in Ontario[154] in one of the earliest moves by a Chinese, state-owned power major into overseas renewables markets. Longyuan also won two bids totalling 244 MW to build wind farms at De Aar in South Africa under the third round of the South African government's renewable energy procurement program[155]. More recently, Longyuan has partnered with the Czech engineering firm SWH Group to invest in US$600 million of green energy investments throughout central and eastern Europe[156].

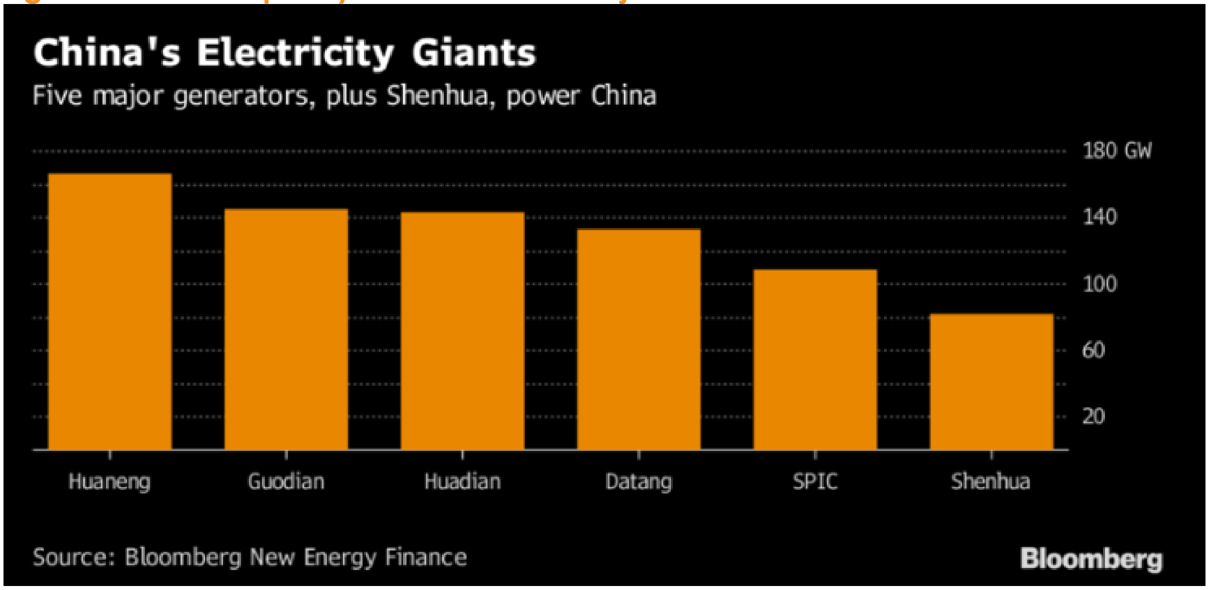
The merged company will have total wind generation capacity of 33 GW, including the assets of Longyuan, those owned by its parent China Guodian and the 7 GW owned by Shenhua. The combined entity will be the largest developer of wind power in the world.[157]

In addition to producing 290 million tonnes from its own mines, Shenhua is an important coal trader, selling almost 400 million tonnes in total last year. Such is Shenhua's coal market power, the merger could have significant implications for coal markets, both domestically and in seaborne thermal coal trade[158]. However, at this early stage it is not clear just how much market disruption will occur.

What is clear is that China's coal use has peaked and the domestic build-out of renewable energy continues at an astonishing pace. China added an extraordinary 24 MW of solar capacity in the first six months of 2017 after having added 30 GW in 2016[159]. Almost 150 GW of wind power was in place at the end of last year. In September 2017, China announced 13 new unsubsidized wind projects with prices at parity to coal-fired generation for the first time[160]. The International Energy Agency, which has chronically underestimated the pace of change in global electricity markets, now accepts that China's coal use peaked in 2013[161].

153 http://ieefa.org/ieefa-report-china-set-dominate- global-renewable-energy-boom-expands-lead-u-s/
154 http://renewables.seenews.com/news/china-longyuan-puts-online-100-mw-wind-farm-in-canada-449485
155 Boosting the Power Sector in Sub-Saharan Africa: Chinese Involvement, International Energy Agency, 2016
156 http://renewables.seenews.com/news/china-longyuan-czech-swh-to-pour-usd-600m-in-european-wind-520825
157 https://www.reuters.com/article/us-china-power-shenhua-guodian-factbox/factbox-shenhua-and-guodian-chinas-latest-state-marriage-idUSKCN1B918I
158 https://www.bloomberg.com/gadfly/articles/2017-08-29/chinese-coal-global-tremors
159 https://www.bloomberg.com/news/articles/2017-07-19/china-adds-about-24gw-of-solar-capacity-in-first-half-official
160 http://www.scmp.com/business/companies/article/2110228/gone-wind-china-determined-end-wind-power-subsidies-2020
161 http://www.theaustralian.com.au/business/mining-energy/indias-appetite-for-coal-is-waning/news-story/f9b78e50ec8cd754a273eaad8776e757

Figure 14: Total Capacity of China's Five Major Power Utilities and Shenhua



Source: Bloomberg, BNEF

This merger is one of many signals that China is serious in its policy initiatives to bring financial discipline and curb industrial overcapacity, lowering its reliance on coal as it expands renewables, gas, hydro and nuclear capacity. Overcapacity in the coal-fired generation sector led to utilization rates dropping to a record low 47 percent in 2016, and China could now have as much as US$200 billion in stranded coal-fired power assets[162]. The National Development and Reform Commission (NDRC) intends to stop or postpone construction of coal-fired capacity totalling 150 GW, with another 20 GW of old capacity to be shut down.[163]

Further mergers involving the large power generators (see Figure 14) are expected. China Huaneng Group is reported to be in talks with the State Power Investment Corporation (SPIC)[164].

China is undeniably past peak coal, and the government is determined to reduce dependence on a fuel that is responsible for much its air pollution crisis. The pace of the renewables build-out in 2017 and issuance of new clean energy certificate rules for coal-fired generators are testament to this.

NTPC (India)

The Indian energy conglomerate NTPC Ltd. (formerly known as National Thermal Power Corporation Limited) is among the top 10 coal-fired power generators in the world. The government of India is the majority shareholder, holding 63 percent of the company. NTPC passed the 50,000 MW generation-capacity milestone on March 31, 2017, of which the great majority (44,000 MW) was coal-fired. The company provides 25 percent of India's electricity supply and plays a critical role in India's economy.

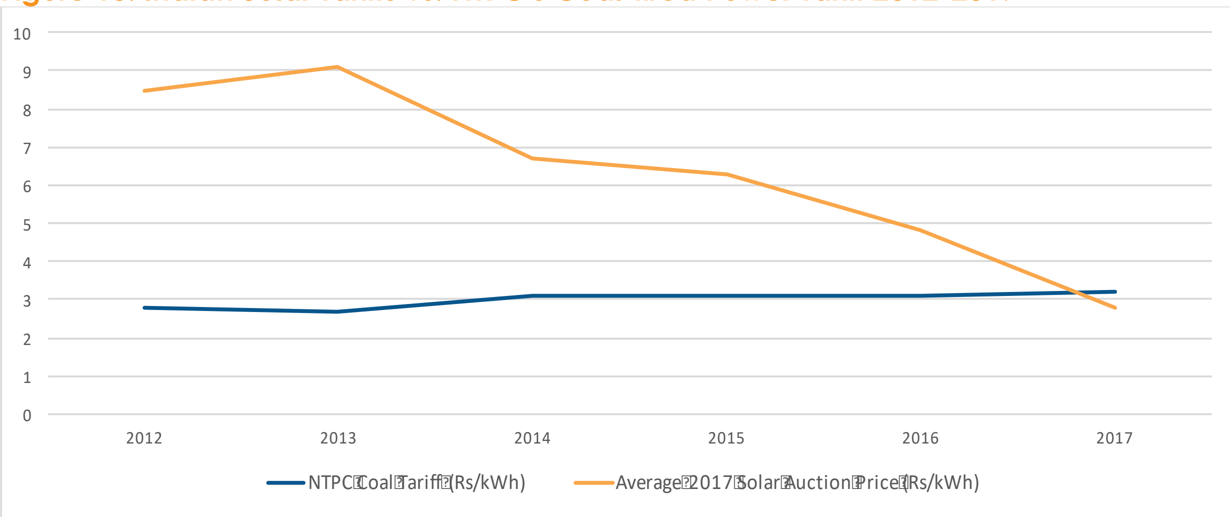
[162] https://www.theguardian.com/environment/2017/aug/24/coal-in-decline-an-energy-industry-on-life-support
[163] https://www.bloomberg.com/news/articles/2017-08-29/china-s-1-trillion-power-industry-overhaul-is-just-starting
[164] https://www.bloomberg.com/news/articles/2017-08-28/china-approves-guodian-shenhua-group-to-merge

Historically dependent on coal-fired electricity generation, India's power sector has been moving in recent years in a different direction. Indian Energy Ministry policy is driving this trend, pushing the nation toward targets that are highly ambitious but that in IEEFA's view are entirely achievable.

The government has set a target of 175 GW of renewable energy in India by 2022, including 100 GW of solar and 60 GW of wind[165], up from just over 50 GW (not including 44 GW of large hydro) today. The government is planning by 2022 for 275 GW of renewable energy capacity. Current solar capacity stands at 12 GW (out of a total current national generating capacity of 320 GW) although solar is expected to cross the 20 GW mark in 2018, driven by impressive cuts in tariffs.

In a landmark moment, record low Indian solar tariff bids accepted in May 2017 (R2.44/kWh or US$38/MWh) mean that solar tariffs are now lower than NTPC's average tariff for its existing domestic coal-fired fleet (R3.20/kWh) (see Figure 13). While a case could have been made in the past that coal-fired power was vital for India's economic development, it is now clear that renewable energy is a cheaper, more sustainable way to meet the country's rapid growth in electricity demand.

Figure 13: Indian Solar Tariffs vs. NTPC's Coal-fired Power Tariff 2012-2017



Source: NTPC, Bloomberg New Energy Finance, Livemint, Bloomberg Gadfly, IEEFA estimates

India's draft Third National Electricity Plan (NEP3), which covers two five-year periods, to 2027, unambiguously concludes that beyond the half-built plants already under construction, India requires no new coal-fired power stations. The 50 gigawatts (GW) of coal power now under construction nationally will operate at just 50-55 percent capacity, according to NEP3. Where these new plants don't replace retiring end-of-life capacity, they will become stranded assets operating largely as reserve capacity. NTPC has 15 GW of coal-fired capacity in development but plans to retire 11 GW of older capacity. The utility is planning a reduction in

[165] http://energy.economictimes.indiatimes.com/news/renewable/renewables-to-account-for-over-60-per-cent-of-indias-power-capacity-piyush-goyal/57821397

capital spending over the first six years of NEP3 because of oversupply and lower-than-anticipated demand.[166]

NTPC, as its original name suggests, has historically been a fundamentally coal-based power generation utility, but is changing as it rapidly rolls out in-house, utility-scale solar projects and signs power purchase agreements for offtake of solar power from private solar operators. It is even starting to enter the electric vehicle sector by setting up charging stations.[167]

NTPC has committed to contributing 10 GW of solar capacity to the overall 100 GW[168] government national solar target. The company also has an initial wind power target of 1 GW, up from no wind capacity at all until very recently[169].

Further, NTPC has stated a long-term ambition to achieve 128[170] to 130 GW[171] of total capacity by 2032, of which 28 percent would be renewable capacity (around 36 GW), up from just over 1 percent currently. Although this is a long-range target, scaling up toward 36 GW of renewable capacity from a very low base is a major move for NTPC.

NTPC, in short, stands to be a cornerstone facilitator of India's national electricity transformation.

Figure 14: NTPC Share Performance (Orange) vs. S&P BSE Sensex Index (Purple) Over 10 Years

Source: Thomson Reuters

[166] https://www.bloomberg.com/news/articles/2017-08-09/india-ntpc-plans-lower-capex-this-year-as-demand-growth-slows
[167] http://timesofindia.indiatimes.com/business/india-business/ntpc-forays-into-electric-vehicles-charging-stations/articleshow/58975961.cms
[168] http://www.livemint.com/Industry/6ZnJZuEye8TOXRURxHcWRM/NTPC-Group-targets-50000-MW-installed-capacity-by-March-201.html
[169] http://economictimes.indiatimes.com/news/industry/energy/power/ntpc-to-explore-more-addition-of-renewable-energy-to-portfolio/articleshow/52629261.cms
[170] http://economictimes.indiatimes.com/news/industry/energy/power/ntpc-to-explore-more-addition-of-renewable-energy-to-portfolio/articleshow/52629261.cms
[171] http://www.firstgreen.co/2017/03/ntpc-commissions-45-mw-capacity-at-rajasthan-solar-project/

The utility has maintained a five-year average EBITDA margin of 25 percent and an average return on equity of 13 percent. However, return on equity, although still above the industry median of 10.8 percent, has declined from levels achieved in the early part of the decade, to 11.3 percent for FY 2016-17. NTPC's average utilization rate dropped below 70 percent for the first time in FY 2015-16, down from more than 90 percent in FY 2009-10.

This fall-off in utilization has been driven by lower-than-expected electrical demand, which has failed to keep pace with excessive thermal power capacity additions[172]. The Central Electricity Authority (CEA) is now forecasting that peak demand by FY 2021-22 will be 235 GW, 17 percent lower than previously forecast. For FY 2026-27, 317 GW is forecast, 21 percent lower than the previous forecast. This lower-than-expected demand is already calling into question the viability of thermal power plants in parts of India[173].

The increasing penetration of renewable energy in India is a significant factor in driving down coal-fired capacity utilization rates. Importantly, with renewables targeted to reach 175 GW by 2022 and 275 GW by 2027, there appears to be no immediate respite for declining coal-fired plant capacity factors. NTPC's thermal capacity factors are unlikely to rebound even beyond the near future unless end-of-life coal plant closures actually occur.

All that said, NTPC is in a better position than private coal-fired power generators in India, whose average utilization rates are 10 to 15 percent lower than NTPC's.

Although NTPC has materially underperformed on a 10-year view (see Figure 14), over the last few years its rate of underperformance relative to the overall market has narrowed. IEEFA sees NTPC accelerating its transformation over the next decade, and sees its share price relative to performance having the potential to match the performance of Enel or NextEra if its chairman, Gurdeep Singh, is able to deliver on NTPC's targets.

Institutional investors seem to consider NTPC on a long-term path to value creation. The government of India recently put 7 percent of its holding in NTPC up for sale in an offer to institutional investors; the offer was 1.4 times oversubscribed.[174]

NTPC brings a strong balance sheet and earnings profile that can underpin the tens of billions of dollars of investment required to modernize India's energy infrastructure. The company's contribution to the rise of renewables in India will be magnified by its role as a key off-taker of power from private renewable-energy installations. NTPC's underwriting of payments for such projects improves bankability, facilitating further tariff cuts on renewables as clean generation technology leaves coal-fired power further behind on cost.

It should be noted here that coal will continue to play a major role in NTPC's electricity generation even as India ramps up renewables. Whereas a continuation of coal plant operations has been a proven value destroyer for other global utilities, NTPC can avoid this outcome because of its fundamental differences from other utilities in this report. As a fast-developing nation, and absent the continuation of its thermal power capacity overbuild, India has electricity demand growth of 5-6 percent annually, a level of demand that will help support coal-fired generation even as renewables become commonplace. For utilities in

172 http://www.bridgetoindia.com/indias-problems-coal-sector-continue/

173 http://energy.economictimes.indiatimes.com/news/power/wavering-power-demands-scare-upcoming-projects-in-andhra-telangana/58440497

174 http://economictimes.indiatimes.com/markets/stocks/news/ntpc-disinvestment-gets-off-to-flying-start/articleshow/60272833.cms

Europe, the U.S., Australia, Japan and even South Africa, sluggish or declining electricity demand means that zero-marginal-cost-of-production renewables will eat into coal's generation profile, further reducing utilization, as the surge in renewable capacity continues.

Eskom (South Africa)

Eskom, South Africa's unlisted, state-owned electricity company, generates about 95 percent of the nation's electricity and about 45 percent of the electricity generated on the entire continent of Africa. Coal-fired generation produces 90 percent of South Africa's electricity.

In recent years, South Africa has run a successful but limited renewable energy procurement program: 2.2 GW of renewable capacity has been completed, attracting more than US$14 billion in investment. Enel and Engie are among the international investors in South African renewables, and developers are waiting on Eskom to sign further offtake agreements for the next round of approved projects, which total 2.4 GW.

Eskom, unfortunately, has recently stonewalled on this front, refusing to sign the deals while claiming that renewable energy is too costly.[175] The company makes this assertion in spite of the fact that Eskom has benefited financially and operationally from its renewables program[176].

One result of this intransigence is that an electricity utility has effectively been determining national energy policy.

With solar PV and wind now significantly cheaper than new coal-fired generation in South Africa, Eskom may have unspoken motives for blocking additional renewables development[177]. One clue as to why the utility is resisting is that Eskom has an institutional commitment to a major coal generation build-out in the face of a declining South African electricity market. The utility is building two huge coal-fired plants, Kusile and Medupi, each with 4.8 GW of capacity and at a combined cost to completion estimated at ZAR448 billion[178] (US$34 billion).

Meanwhile, higher electricity prices and sluggish economic growth have resulted in declining electricity demand. In its 2017 financial results, Eskom disclosed a 3.7 percent drop in electricity sales to the industrial sector and a 5.7 percent slide in sales to the agricultural sector. Eskom now has more than 5 GW of excess capacity[179] — even before most Medupi and Kusile units become operational. Expansion of competing renewable energy will further increase the utility's coal-fired overcapacity, which is slated to grow needlessly as Eskom add another 8 GW of capacity by 2022 when all Medupi and Kusile units come online[180].

---

175 https://www.bloomberg.com/news/articles/2016-07-27/biggest-africa-renewable-power-plan-endangered-by-utility-review

176 http://m.engineeringnews.co.za/article/eskom-has-over-recovered-r76bn-in-renewables-related-costs-since-2014-2017-07-07

177 https://www.businesslive.co.za/bd/companies/energy/2017-06-29-what-experts-say-about-eskoms-excuses-for-renewable-delays/

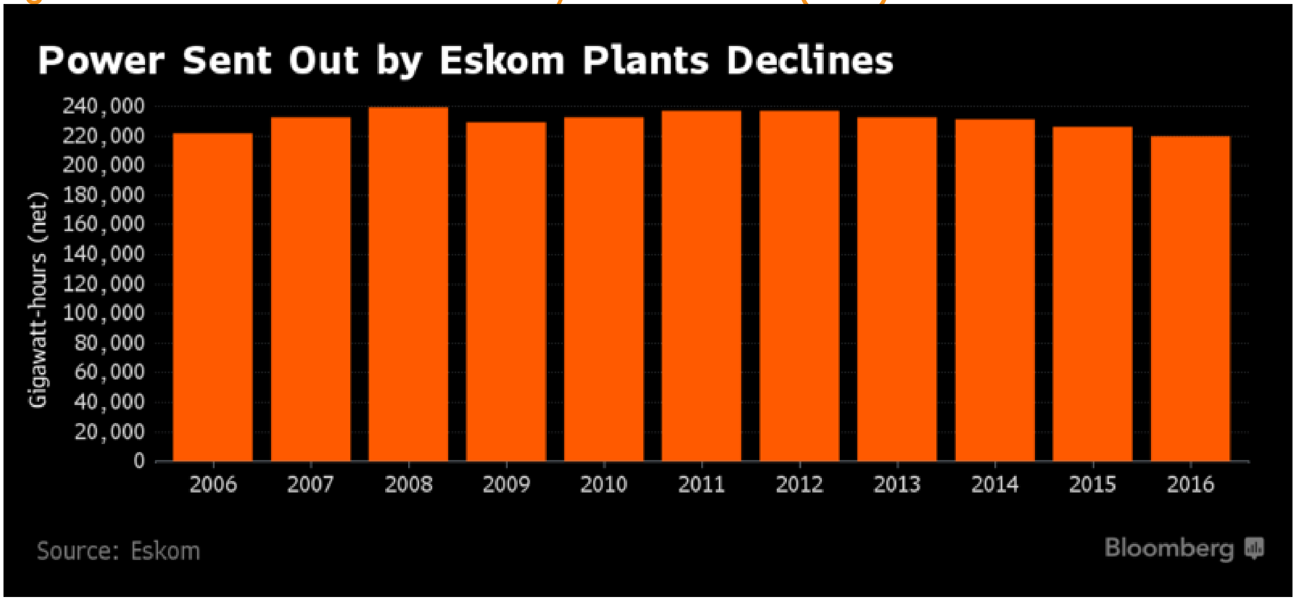
178 http://www.ee.co.za/article/massive-cost-time-overruns-eskoms-medupi-kusile-power-stations.html

179 https://www.businesslive.co.za/bd/companies/energy/2017-07-07-eskom-reserves-boosted-as-medupi-and-kusile-units-plug-in/

180 Eskom group integrated results presentation: year ending 31 March 2017, p. 19.

Eskom's growing overcapacity and its failure to grasp the role of renewable energy in the new energy economy places the utility at serious financial risk, especially since its hugely expensive new coal plants must be paid for regardless of how much electricity the utility can sell from them. Eskom reported total debt securities and borrowings of ZAR355 billion (US$26.8 billion) in its March 2017 annual report, with finance costs increasing 82 percent to more than ZAR14 billion. In addition, ZAR18.2 billion (US$1.4 billion) of deferred finance costs relating to continuing project construction were capitalized, a figure that dwarfs the net profit for the year of just ZAR888 million (US$68.3 million)[181]. Clearly, Eskom's financials are set to deteriorate significantly as Kusile and Medupi are commissioned and as currently capitalized interest and depreciation costs start to be expensed even as Eskom's overall utilization rate declines materially.

Figure 15: Generated Power Sent Out by Eskom 2006-16 (GWh)



Source: Eskom, Bloomberg

In its latest annual financials, Eskom also reports an 83 percent decline in net profit to ZAR888 million (US$68.3 million), on an asset base of ZAR710 billion (US$54.6 billion). This has meant significant value destruction for shareholders, which in essence are households and business in South Africa. These results are complicated by a threat by the Development Bank of South Africa to recall a ZAR15 billion loan. Barclays Africa and Rand Merchant Bank are also seeking more accountability from Eskom[182]. In addition, a ZAR2.4 billion (US$184 million) loan from the New Development Bank (formerly the BRICS Bank) has been put on hold, and the only New Development Bank loan to South Africa so far was meant to finance transmission lines to connect new renewable capacity projects (even though Eskom's antirenewables stance has stymied completion of the loan until 2018).[183]

[181] Eskom Annual Financial Statements 31 March 2017, p. 96.
[182] https://www.businesslive.co.za/bd/companies/energy/2017-07-31-lenders-time-for-eskom-to-clean-house/
[183] https://www.businesslive.co.za/bd/companies/energy/2017-08-17-eskoms-brics-bank-loan-on-ice-until-2018/

Eskom has said it will take on an additional ZAR327 billion (US$25 billion) of debt up to 2021[184]. With its debt set to double, then, over this period, the utility's interest expenses will also see a significant increase. As electricity demand declines and as renewables take up market share, Eskom stands a good chance of generating too few sales to be profitable. Furthermore, because the South African government has provided guarantees on Eskom debt of ZAR350 billion (US$27 billion), of which ZAR210 billion (US$16 billion) has been drawn down[185], Eskom is in position of slipping into a default that would create a major burden on the state. This would only worsen the problems the South Africa economy faces already for being so dependent on Eskom electricity.

The rise of rooftop solar is creating additional trouble for Eskom. South African rooftop solar stands to grow by 8 GW of capacity over the next decade, further eroding the utility's sales[186]. Eskom could respond by increase electricity tariffs, if the government allows it to, and it may begin to address its overcapacity problem by closing older generating capacity in favor of expensive new plants. Such moves would only undermine Eskom's assertions that coal-fired electricity is the affordable alternative in South Africa.
Eskom is maintaining its resistance to renewables despite the Council for Scientific and Industrial Research (CSIR) having shown that wind and solar are now 40 percent cheaper than new coal-fired power in South Africa.[187]

Eskom's campaign against renewables and its insistence on building out coal-fired capacity in a market with declining demand will see Eskom's borrowing and interest costs balloon, eliminating profits and crippling the utility's ability to generate cash[188]. Efforts by Eskom to rectify management missteps through large tariff increases will mean yet more financial pain for the South African public, for whom electricity prices have quadrupled since 2007[189].

As Eskom begins to lose that public, more customers will seek other sources of power in a scenario that is already starting to play out. The city of Cape Town is now seeking permission to purchase electricity directly from private producers.

Eskom has stated that its financial ratios will improve over the next few years, letting the company achieve an investment-grade credit rating within five years[190]. There seems to be little in the way of fact to support this narrative, though. In April 2017, Standard and Poor's downgraded Eskom's foreign and local currency long-term corporate debt, moving it deeper into junk status, to B+, with a negative outlook on concerns that the South African government's ability to support Eskom's huge debt has weakened[191]. Moody's downgraded Eskom to the second rung of junk status in June 2017.[192]

Eskom in fact is likely to be in deep financial trouble in five years.

---

184 http://city-press.news24.com/Business/eskom-debt-to-rise-to-r500bn-plus-20160713
185 https://www.businesslive.co.za/bd/economy/2017-05-10-state-guarantees-of-r466bn-unlikely-to-explode/
186 https://www.dailymaverick.co.za/article/2017-04-02-op-ed-eskoms-electricity-surplus-and-self-inflicted-death-spiral/ - .WOXUc1dlw-J
187 https://www.businesslive.co.za/bd/companies/energy/2016-10-19-renewables-cheaper-than-coal-says-csir/
188 http://www.politicsweb.co.za/opinion/digging-eskom-out-of-its-financial-hole
189 https://www.bloomberg.com/news/articles/2017-07-13/south-africa-to-deepen-support-for-eskom-in-economy-revival-plan
190 Eskom group integrated results presentation: six months ending September 2016, p. 16.
191 https://www.businesslive.co.za/bd/companies/energy/2017-04-06-sampp-downgrades--eskom-corporate-credit-ratings/
192 https://www.businesslive.co.za/bd/companies/energy/2017-06-14-moodys-downgrades-eskom/

Conclusion

Electricity utilities around the world are in varying states of readiness for sea changes that will see markets continue to shift toward the uptake of renewable energy and that will continue to be affected by energy-efficiency initiatives.

Figure 16 below summarizes the financial position and outlook for the utilities in this report. The two renewable-energy leaders in this group have outperformed the market and are in the strongest current positions. At the other end, companies that have failed to recognize or act on the technology disruption spreading across the industry have negative outlooks, by IEEFA's lights (these conclusions are for public-interest purposes only; IEEFA does not offer investment advice.)

Figure 16: Summary of Current Financial Position and Outlook

Company	Current Financial Position	Outlook	Notes
Enel (Italy)	Strong	Positive	Renewable energy leader
NextEra (U.S.)	Strong	Positive	Renewable energy leader
Engie (France)	Weak	Positive	Belated transition underway
RWE (Germany)	Weak	Uncertain/Positive	Belated transition underway
E.ON (Germany)	Weak	Uncertain/Positive	Belated transition underway
AGL (Australia)	Strong	Positive	Coal capacity supported by energy policy uncertainty
NTPC (India)	Strong	Positive	Coal capacity supported by India's growing electricity demand
CEIC (China)	Sustainable	Uncertain/Positive	Vertically integrating and adding renewables via M&A
NRG (U.S.)	Weak	Negative	Failure to act on technological disruption
TEPCO (Japan)	Weak	Negative	With nuclear capacity offline, overdependency on thermal power
Eskom (South Africa)	Weak	Negative	Failure to recognise technological disruption

Electricity utilities still considering how and when to embrace the global shift toward renewables would do well to accelerate their transition if they are to avoid the financial damage typically incurred in stranded-asset write-downs of late movers. Electricity markets of the future will be dominated by renewable energy.

Annexure I

Market Capitalization Gains and Losses FY 2007-2016 (US$m)

NB: Eskom is unlisted and excluded from this analysis.

Company	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007
Engie	34,600	46,568	55,300	48,040	43,713	55,667	71,111	79,899	93,659	48,562
RWE	8,648	8,571	18,774	19,473	22,865	19,862	31,686	43,162	40,237	64,254
E.ON	15,575	18,211	28,653	26,729	28,059	33,174	45,640	58,168	56,569	96,039
Enel	50,694	43,574	41,380	35,535	35,132	35,200	41,872	45,315	33,311	59,900
NRG	3,867	3,698	9,073	9,299	7,417	4,123	4,830	5,997	5,468	10,260
NextEra	55,907	47,893	47,086	37,245	29,337	25,326	21,881	21,848	20,581	27,610
TEPCO	6,349	9,013	6,626	6,058	3,713	3,029	6,786	30,546	30,156	32,674
AGL	13,300	10,351	8,344	6,891	6,382	6,437	5,396	5,283	4,806	5,062
NTPC	21,418	16,625	18,947	14,220	16,836	19,303	22,902	24,580	21,331	23,317
Total	210,358	204,504	234,183	203,490	193,454	202,120	252,105	314,798	306,117	367,678
			Gain/loss 2007-2016							
			US$m	%						
Enel, NextEra, AGL	119,902		27,330	29.5%						92,572
All excluding Enel, NextEra, AGL	90,457		(184,650)	-67.1%						275,106
Total	210,358									367,678

Source: Thompson Reuters

Institute for Energy Economics and Financial Analysis

The Institute for Energy Economics and Financial Analysis (IEEFA) conducts research and analyses on financial and economic issues related to energy and the environment. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy.

More can be found at www.ieefa.org.

About the Authors

Tim Buckley

Tim Buckley, IEEFA's director of energy finance research, Australasia, has 25 years of financial market experience covering the Australian, Asian and global equity markets from both a buy and sell side perspective. Tim was a top-rated Equity Research Analyst and has covered most sectors of the Australian economy. Tim was a Managing Director, Head of Equity Research at Citigroup for many years, as well as co-Managing Director of Arkx Investment Management P/L, a global listed clean energy investment company that was jointly owned by management and Westpac Banking Group.

Simon Nicholas

Simon Nicholas is a research analyst with IEEFA in Australia. Simon holds an honours degree from Imperial College, London and is a Fellow of the Institute of Chartered Accountants of England and Wales and has 16 years' experience working within the finance sector in both London and Sydney at ABN Amro, Macquarie Bank and Commonwealth Bank of Australia.

Important Information

This report is for information and educational purposes only. The Institute for Energy Economics and Financial Analysis ("IEEFA") does not provide tax, legal, investment or accounting advice. This report is not intended to provide, and should not be relied on for, tax, legal, investment or accounting advice. Nothing in this report is intended as investment advice, as an offer or solicitation of an offer to buy or sell, or as a recommendation, endorsement, or sponsorship of any security, company, or fund. IEEFA is not responsible for any investment decision made by you. You are responsible for your own investment research and investment decisions. This report is not meant as a general guide to investing, nor as a source of any specific investment recommendation. Unless attributed to others, any opinions expressed are our current opinions only. Certain information presented may have been provided by third parties. IEEFA believes that such third-party information is reliable, and has checked public records to verify it wherever possible, but does not guarantee its accuracy, timeliness or completeness; and it is subject to change without notice.