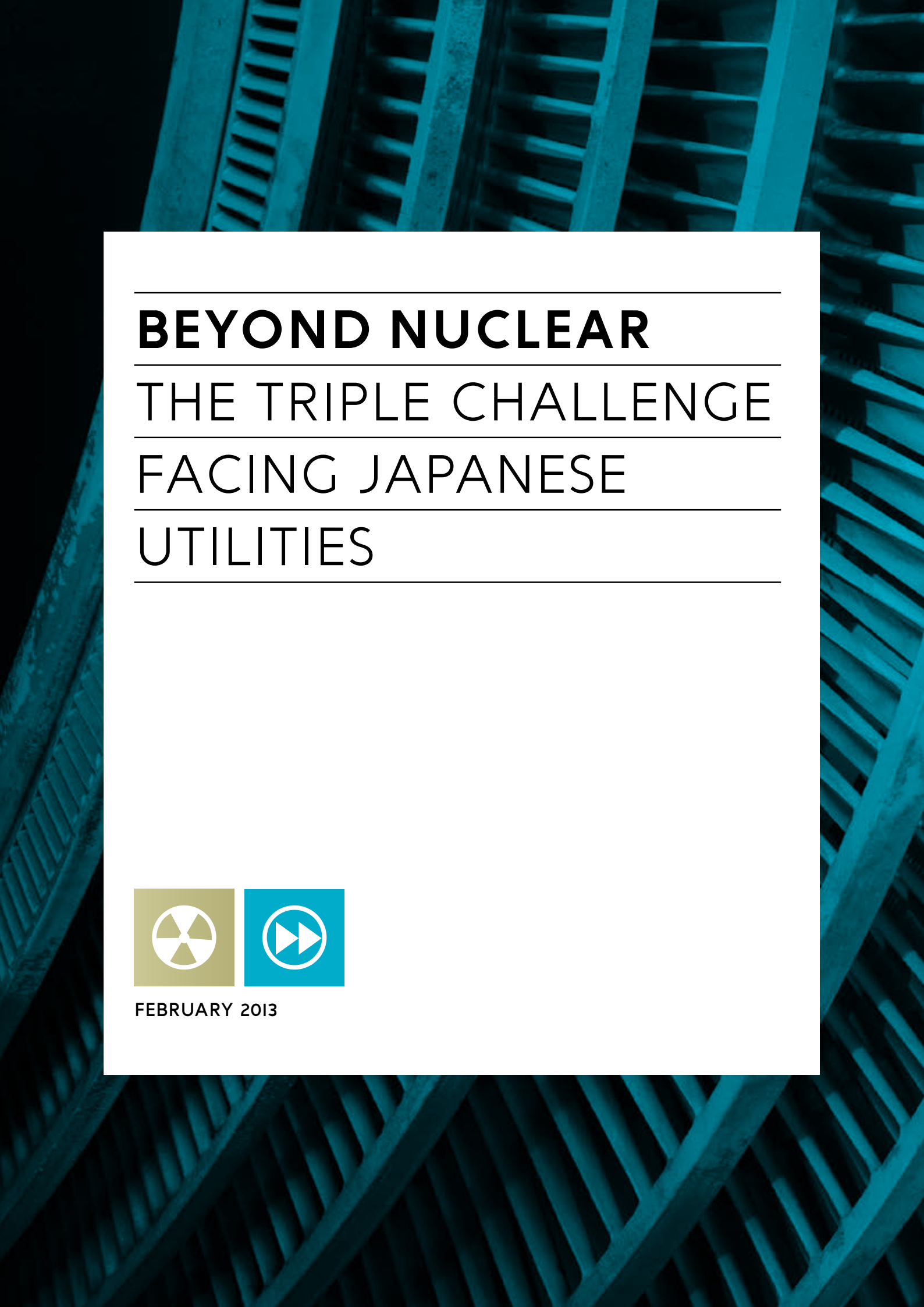

BEYOND NUCLEAR

THE TRIPLE CHALLENGE FACING JAPANESE UTILITIES

FEBRUARY 2013

"THE FORTUNES OF JA
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PAN'S NUCLEAR
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THE PRO-NUCLEAR
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REMAINS BLEAK IF IT
EE NEW CHALLENGES:
KET DEREGULATION,
NUCLEAR ASSETS,
S IN RENEWABLE

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EXECUTIVE SUMMARY

After decades of market dominance, high profitability and the creation of strong shareholder value, Japan's nuclear utilities saw their fortunes turn in the wake of the Fukushima nuclear disaster. They suffered large declines in returns and share prices, and have experienced only limited recovery, with 48 out of 50 nuclear reactors remaining offline.

Japan successfully avoided major blackouts over the summer of 2012, mainly thanks to high reserve margins of electricity and consumer efforts at energy savings. However, this came at a large cost to utilities, and has demonstrated that their preparations to adapt to major external changes have been inappropriate to say the least.

The coming years are likely to be turbulent, with market liberalisation, a renewables revolution, and – despite a pro-nuclear government coming into power in late 2012 – a decreasing share of nuclear energy driven by an overwhelming public demand for a nuclear-free future. Utilities will soon have to face these challenges head on, but in much weaker positions than they were 20 months ago. However, by learning lessons at home and abroad, and accepting that old strategies no longer work, Japanese utilities can improve their positions in both the short term and the long term.

This report is an overview of the triple challenge Japanese utilities face, with examples illustrating how European and other utilities have addressed these challenges. It also proposes strategies for Japanese utilities to prepare themselves more effectively for similar market changes than they have done so far.

The three main challenges that the utilities need to face are a **new wave of market deregulation**, the **devaluation of nuclear assets**, and **breakthroughs in renewable deployment**. These challenges will have a larger combined impact on utilities than they would have individually, and they will be compounded by the expectation that the energy market in Japan will contract considerably in the coming decades. If utilities are not able to adapt to these changes and continue to passively resist them, as they have been doing for decades, they will lose out to new market entrants in their franchise areas, and will ultimately remain at the mercy of expensive fossil fuels, and regulatory and political changes.

The experiences of European utilities offer substantial and relevant lessons for Japanese utilities in all three of the major challenge areas. For example, Germany was in a similar situation around 2000, in terms of deregulation, renewable energy development, and nuclear market share. European utilities addressed electricity deregulation and the emergence of independent system operators and regulators by reducing investments in baseload non-flexible coal and nuclear plants; fast consolidation; diversifying geographically and beyond power; and by putting more emphasis on efficiency and improved services.

In terms of renewables, many European and US utilities went through phases of resistance and passivity, and never really got to the stage of exploiting renewable opportunities. They simply gave over the initiative to communities and independent power producers. But some, like Iberdrola, understood early on the need to be proactive with renewable investments in order to keep control of they own markets. By doing so, they could enjoy the good risk/return profile of supported renewable projects, and also the capacity of renewables to work as risk management tools for their whole portfolios.

Japanese utilities could also learn a lot from the mistakes of US utilities that kept on initiating new nuclear projects for decades, with systematic negative consequences for all their investments from substantial downgrading of credit and higher financing costs. European utilities answered government decisions to quickly phase out nuclear power by withdrawing from new nuclear projects at home and abroad, and by freeing up capital through divestments and reduced capital expenditure.

Based on international experience, Japanese utilities can improve their positions by making their power portfolios more resistant to political, regulatory and market changes, as well as by shifting their attitude from passivity and resistance to proactivity and adaptability.

	KEY CHALLENGES	LESSONS LEARNT	POSSIBLE STRATEGIES FOR JAPANESE UTILITIES
DEREGULATION	• Full market opening • Unbundling of T&D and generation • Increasing competition in a shrinking market (TEPCO lost 20K corporate customers)	• Fewer investments in baseload plants • Efficiency, scale and consolidation • Diversified portfolios: beyond power, new markets • New capabilities	• Reduce investments in inflexible baseload capacity (coal and nuclear) • Merge utility grids to create a (by utilities) jointly owned and controlled national TSO, and float a minority stake to ease current financial difficulties • Consolidate, strengthen scale and financial power, diversify • Increase efficiency, become more service oriented, build trading savvy
DEVALUATION OF NUCLEAR ASSETS	• Delayed restarts with fewer reactors • Safety investments, growing costs • Higher waste management and decommissioning costs • Unsolved site for radioactive waste • Less government support and other privileges • Exposure to high and volatile fossil fuel prices	• US utilities pushed new nuke projects despite downgradings • German utilities implemented divestment programmes, reduced capital expenditure, and withdrew from nuclear reactor investments • Argue for smoother transition	• Stop new nuclear projects • Improve thermal efficiency in existing generation by converting oil to gas, SCGTs to CCGTs, and to combined heat and power • Reduce high demand volatility and the need for peak energy by investing in smart grids/metres and other technologies; and through demand side management tools and improved tariff structures (for example, dynamic pricing) • Reduce exposure to high and volatile fossil prices by diversifying sources: improving physical-financial hedging, pooling LNG sourcing, delinking LNG prices from oil etc • SCGT: Single Cycle Gas Turbine • CCGT: Combined Cycle Gas Turbine
RENEWABLE REVOLUTION	• New FiT: +2.6GW in 3-4 months, doubling annual renewable investment • Government supported programmes • New RE entrants to utility areas, including large corporations • Limited good and cheap locations • Decentralisation of supply	• While German utilities resisted change and let the initiative slip away, Spanish utilities and others kept control of wind • Argue successfully for inclusion of utilities to RE support programmes • Support useful decentralised projects	• Keep control over the best large-scale renewable energy investments – at least in own franchise areas • Argue for FiT inclusion for utilities • Argue for a new tariff structure that helps to reduce demand volatility • Use scale and partnerships to reduce costs of renewable equipment into Japan and help rebuild Japanese positions in RE technology markets • Adapt to utilise decentralised renewables: for example, solar energy helps reduce the need for expensive peak-load plants during the summer peaks • Cooperate with small-scale producers instead of fighting them


02

UTILITIES IN THE POST-FUKUSHIMA ENVIRONMENT

THE GOOD TIMES BEFORE THE FUKUSHIMA MELTDOWNS ARE GONE FOREVER

For decades before the Fukushima disaster, Japanese utilities were comfortably profitable, with easy financing and regular dividend payments. They produced over 85% of Japan's electricity, while other producers only had 3.5%[1] (in FY2010), after 17 years of "market liberalisation" (the rest is self-production by large industrial companies).

The utilities charged much higher electricity prices to their customers than those in the US, South Korea, and Europe, and their lobbyists successfully opposed and diluted any ambitious government renewable energy goals[2] for two decades.

The result was a meagre solar share of 0.5% PV and 0.4% wind in FY2011[3]. Their political influence kept the regulatory processes favourable, and held back both electricity deregulation and the breakthrough of renewable energy. These moves – beyond their negative macroeconomic consequences[4] – now threaten to hit back on the utilities themselves.

Following the Fukushima Daiichi meltdowns, TEPCO – which controlled a quarter of the Japanese electricity market, and had been the largest private utility in the world – practically went bankrupt within months, and was eventually nationalised. All utilities with nuclear power plants saw their costs explode as nuclear capacity was replaced by plants burning expensive oil, LNG, and coal.

LARGE LOSSES ON FOSSIL FUELS

Major financial losses were driven by high LNG, oil, and gas volumes, and increasing global fuel prices[5,6]. Demand beyond Japan is also strong, but Japan has a large share of the global LNG market, with around 35%, and its increased demand contributes to price hikes. Between Q1, 2011 and Q1, 2012 the volumne of Japan's LNG imports increased by 24% and the average price grew by 30%[7,8,9,10]. If TEPCO substitutes the capacity of its Fukushima plants purely with LNG, that would already correspond to 12-15 billion m^3/year or 5% of the global LNG market, or 20% of the liquid LNG supply that is not committed under long-term contracts[11]. In the case of the shutdown of Kashiwazaki-Kariwa, LNG accounted for half of the replaced capacity.

Different utilities accounted for different levels of operating losses, and have shown different resistance to these hard circumstances. However, they all proved to be sensitive to crude oil price increases. In late 2011, a JP Morgan analysis showed that a $1/barrel increase in the price of crude oil price decreased the operating profits for Chubu Electric Power by ¥7.8bn; for Kansai Electric Power by ¥4.4bn; and for Kyushu Electric Power by ¥3.0bn[12].

For the period between April and September 2012, eight out of ten Japanese utilities announced losses, in total reaching ¥670bn. Of these, the utilities with a high dependence on nuclear power – Kansai Electric Power, Kyushu Electric Power, and Hokkaido Electric Power – reached record high losses[13]. Okinawa Electric Power, with no nuclear plants, and Hokuriku Electric Power, with less nuclear capacity, announced profits for this last half-year.

The financial consequences of such large losses are dire. During the fiscal year ended March 2012, total debt[14] increased at all nine utilities beyond TEPCO, in the case of Chubu Electric, for example, by ¥480bn (+19%). TEPCO lost half of its equity, while Tohoku Electric lost 29%. Even without TEPCO, the other nine utilities lost more than ¥1 trillion from their common equity, within a year. Debt/equity ratio increased for TEPCO to above 1,000% by March 2012, and for Tohoku Electric to 417%. In comparison, E.ON is around 80%, and RWE is at 150%.

Utilities must become less dependent on political and market changes and fluctuations.

LARGE LOSSES FOR UTILITY SHAREHOLDERS

Utilities' share prices have suffered in the 20 months since the nuclear disaster – particularly TEPCO and other utilities with large nuclear capacity. The shareholders of non-nuclear utilities, such as Okinawa Electric Power and Chugoku Electric Power (11% nuclear capacity) suffered less.

Several analyses have shown abnormal and substantially negative returns for all Japanese nuclear utility shares after Fukushima. For example, one study[15] found significant negative returns not only for Japanese nuclear utilities, but also for French and German nuclear utilities. Alternative energy stocks, on the other hand, exhibited a strong positive share price reaction. A second study[16] found that the adverse share-price impact was largest among Japanese utilities, and this effect was homogenous and apparently long-lasting among utilities. A third[17] and fourth[18] study discovered that the more a power company depended on nuclear energy, the more its stock price dropped after the disaster.

The earthquake and tsunami had a much larger impact on nuclear and fossil power plants than it did on renewable facilities. After the earthquake, some 9.7GW of TEPCO, Tohoku Electric Power and Japan Atomic Power nuclear plant capacity was automatically shut down, along with 9.5GW of coal, gas and oil-fired capacity[19].

On the other hand, according to the Japanese Wind Power Association: "There has been no wind facility damage reported by any association member, from either the earthquake or the tsunami."[20] Almost all the 190 wind turbines in the Tohoku region survived, and only a few suffered any damage from the earthquake and the tsunami. All were back in service within days[21]. Even the Kamisu semi-offshore wind farm survived[22]. TEPCO lost 90% of its share price, while the Japan Wind Development Company's share is consistently trading around ¥90-100 thousand compared with ¥43,000 on 11 March 2011[23].

Japanese utility share prices fell significantly in the first three months following the disaster. They remained more or less stable from summer 2011 for nearly a year, and they started to become more volatile around the 2012 restart discussions. The restart of KEPCO's Ohi nuclear reactors did not bring relief for utility shareholders, despite the expectations of investors and analysts[24,25,26]. Between the restart discussions between May/June and mid-September 2012, utility share prices fell significantly. In the case of KEPCO, its share price fell from ¥1,134 on 31 May to ¥497 on 12 September 2012. Restarting two KEPCO reactors simply has not led to a jumpstart of its share price, and the situation has been equally gloomy for virtually all of the Japanese utilities.

The mid-September 2012 announcements about a zero nuclear national energy objective, and about completing the construction of two new nuclear reactors, have changed share price dynamics. On 14 September 2012, then Prime Minister Noda announced that "every policy resource will be brought to bear" to phase out nuclear power by the 2030s[27]. On 16 September, then Minister of Economy, Trade and Industry Yukio Edano communicated a somewhat contradictory message about the continuation of the construction of two reactors – the 98% ready Shimane-3 plant, and the Ohma plant. On the first trading day after these two major announcements, utilities with large nuclear capacity saw their share prices grow the fastest, while Shimane owner Chugoku Electric Power's share price grew by less[28].

Utility share prices continued to grow until the end of September 2012, and showed several major ups and downs in October, for example when KEPCO cancelled its dividend for the first time since 1980[29].

The election win by the pro-nuclear Liberal Democratic Party (LDP) of Japan on 16 December 2012 gave a significant one-time push to utility share prices in the first day after the election. By the second day, however, a correction poured cold water on this optimism, and financial experts warned that the gain may only prove temporary[30]. Despite the landslide LDP victory, most utility shares still traded at minus 40-50% of their pre-Fukushima prices in mid-December 2012, while the Nikkei index has nearly recovered to its March 2011 level.

Since the 11 March 2011 triple disaster at Fukushima, expectations for short-term share prices have been proven wrong again and again. Most investors and analysts underestimated the share price implications of the nuclear disaster. Then, they were overly optimistic about the Ohi reactor restarts. Finally, in autumn 2012, they became quite confused by the government's nuclear phase-out plans. Following the 2012 election they appear to have over-reacted again, but it is too early to call. What really matters for the long-term share price is how the 10 utilities will be able to prepare for, and adapt to, the three main challenges of the near future.

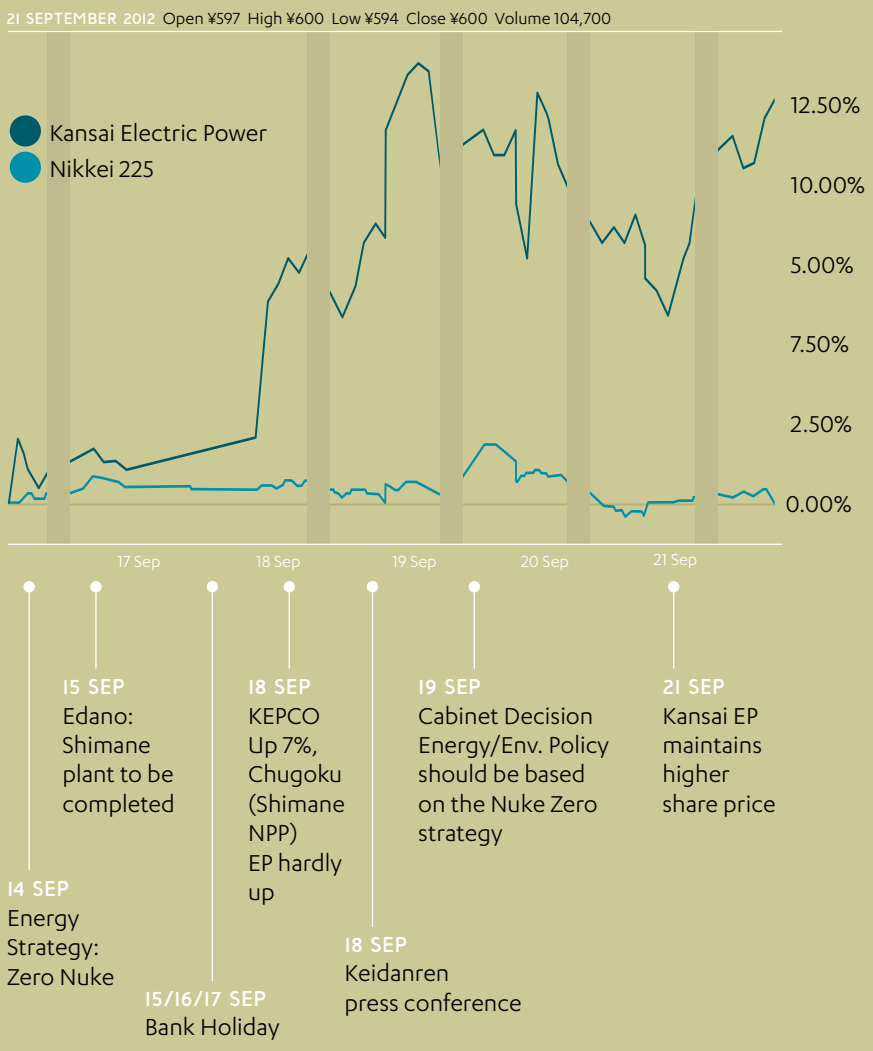
FINANCING JAPANESE UTILITIES

Japanese utilities mostly financed themselves from bonds over recent decades[31]. However, following the Fukushima disaster they were unable to issue bonds for at least a year. Domestic banks helped them through these hard times, but the government is now considering preventing utilities from offering senior collateral claims on their debt – they would no longer be able issue debt secured by all of their assets[32,33].

In the summer of 2012, the situation improved, as the utilities could issue bonds again[34,35] thanks partly to the sense of security in the market since TEPCO's nationalisation, and partly to recent quantitative easing by the Bank of Japan[36]. Seven nuclear utilities issued bonds between July and September 2012, and Hokkaido Electric Power in late December. Only TEPCO was left out. Quarterly volume is close to pre-Fukushima levels, and interestingly retail buyers dominate as larger investors are more wary[37]. Utilities have returned to the bond markets with lower credit ratings[38], and around 0.5% higher spreads[39,40], but they can still finance themselves at low cost in the current zero interest rate environment.

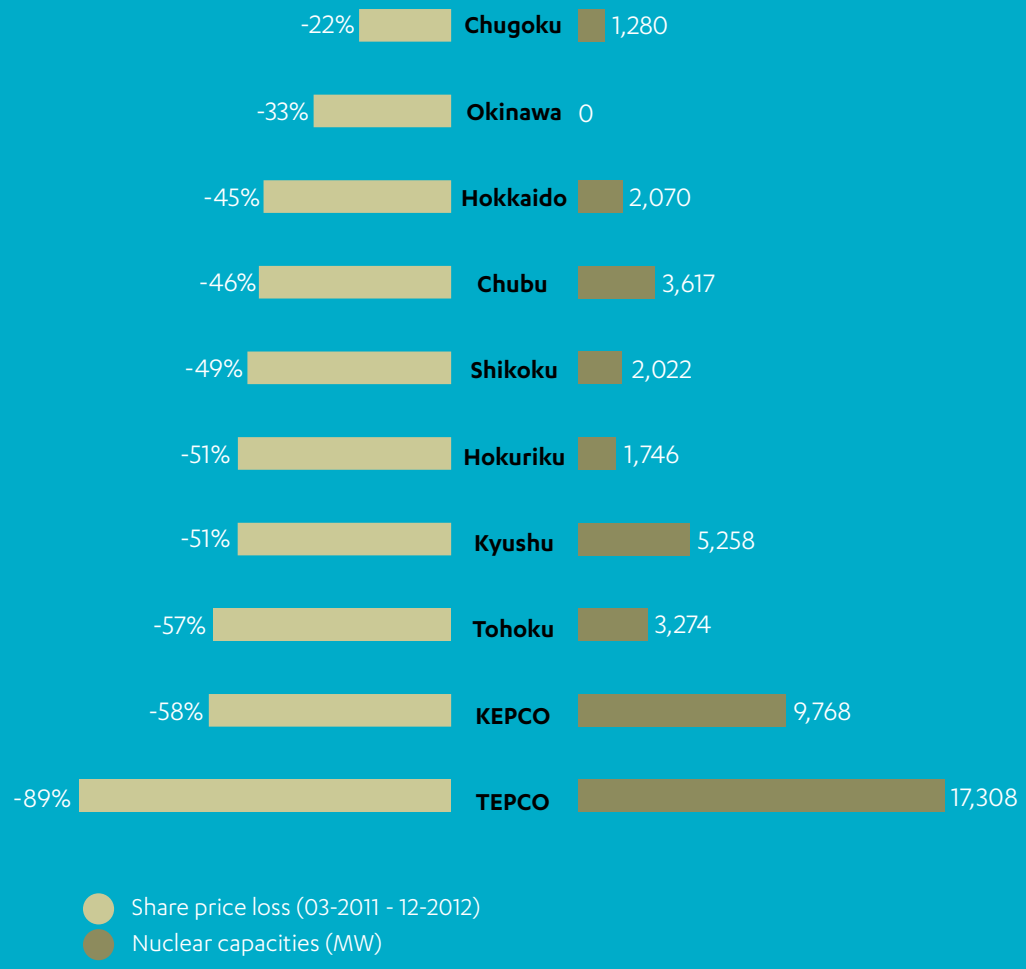
"RESTARTING TWO KEPCO REACTORS HAS NOT LED TO A JUMPSTART OF ITS SHARE PRICE, AND THE SITUATION HAS BEEN EQUALLY GLOOMY FOR VIRTUALLY ALL OF THE JAPANESE UTILITIES."

HISTORY OF A STORMY WEEK – KANSAI ELECTRIC POWER'S SHARE PRICE AND THE ANNOUNCEMENT OF THE NUCLEAR PHASE-OUT STRATEGY



Source: www.reuters.com/finance/stocks/overview?symbol=9503.T

SHARE PRICE LOSSES BETWEEN THE FUKUSHIMA DISASTER AND THE AFTERMATH OF THE LDP LANDSLIDE VICTORY (19 DEC 2012)



Source: Bloomberg and Walls Street Journal

"DESPITE THE LANDSLIDE LDP VICTORY MOST UTILITY SHARES STILL TRADED AT ~40-50% OF THEIR PRE-FUKUSHIMA PRICES IN MID-DECEMBER 2012, WHILE THE NIKKEI INDEX HAS NEARLY RECOVERED TO ITS MARCH 2011 LEVEL."


03

THREE MAJOR CHALLENGES IN FRONT OF UTILITIES

The Fukushima disaster has taken its toll on Japanese utilities, and the coming years could be even more difficult given the substantial acceleration in electricity market liberalisation, the devaluation of nuclear energy, and renewable energy gaining a more substantial share of the market. Even as utilities come to grips with these radical shifts, they must also contend with the fact that the overall electricity market in Japan is projected to shrink in the coming decades[41], and that oil, LNG, and coal prices are expected to remain high and volatile. These challenges are already very demanding individually, but in combination they will result in massive changes in the energy landscape.

ELECTRICITY MARKET LIBERALISATION

Japanese market liberalisation officially began in 1995 with wholesale competition, and then in 2000 with the largest industrial and commercial users becoming eligible to choose. But, for a decade, utilities effectively slowed down the process.

In 2012, 62% of the market was, in principle, "competitive" but the wholesale power exchange was negligible and independent power suppliers only have 3.5%[42,43]. The low number of customer switches happened mostly in the Tokyo and Kansai areas, and there are very few examples of customers switching between utilities. Fewer than one in 20 large institutional customers left utilities in favour of independents. Based on 2011 volumes, utilities still have an 85% market share, with TEPCO holding 29.2%, KEPCO 16.5%, Chubu Electric Power 14.3%. and Kyushu Electric Power 9.6%.

This may soon change, in no small part due to the Fukushima nuclear disaster and its consequences. Even the president of TEPCO, Naomi Hirose, acknowledges liberalisation is inevitable[44]. Discussions to change the Electricity Business Act have started, in order to introduce full market opening to retail consumers and much stricter unbundling rules for transmission and generation businesses. Currently, several network-generation unbundling models are being discussed[45], from accounting to legal[46] unbundling. Also, several system-operator models are under consideration, including the ISO (independent system operator) and the TSO (transmission grid operator) models.

Some, like the Japan Fair Trade Commission[47], also suggest separating retail from generation and wholesale, while others would see utilities split further, into resource acquisition, generation, transmission, and retail distribution[48]. Experts, such as former industry regulator Hirokazu Okumura[49], argue for cutting utilities' generation business into "baby utilities"[50].

The specific form of the unbundling has a large degree of significance for the utilities. For example, a full ownership unbundling would bring substantial changes to this ¥16 trillion market[51], despite grid constraints and physical separation from other markets. Utilities could lose their scale and scope advantages, and see their financing capacity and purchasing power weaken. They could lose a significant part of their asset base, and see their already high indebtedness grow even further. The threat of stranded assets and weakened balance sheets could deteriorate their credit ratings[52] and impact their access to abundant and cheap financing, which all assumes a "strong franchise" and the "effectively limited competitive factors on the industry"[53], as Moody's summarised it.

The expected slow shrinking of the Japanese power market will also magnify the impact of increased competition on utilities. The recent successful energy-savings efforts by both industry and households may have longer-term impacts on energy efficiency. For example, analyses – one of TEPCO daily load curves[54], and one of KEPCO's summer peak load[55] – suggest that electricity demand may not return to pre-disaster levels. The steady decline in population (projected to dip below 100 million by mid-century[56]), and the decline in the number of households, will further add to falling electricity consumption[57]. Deregulation on a shrinking market is especially challenging, as the Japanese utilities can learn well from the Japanese insurance market.

"ANALYSES – ONE OF TEPCO DAILY LOAD CURVES, AND ONE OF KEPCO'S SUMMER PEAK LOAD – SUGGEST THAT ELECTRICITY DEMAND MAY NOT RETURN TO PRE-DISASTER LEVELS."

DEVALUATION OF NUCLEAR ASSETS

Before Fukushima, Japan was planning to increase nuclear energy's share from 30% to 50% over the next two decades. After Fukushima, the public and political appetite for nuclear power has diminished, with its share of total generation potentially decreasing permanently. In 2011, then Prime Minister Noda made it clear that "to build new reactors is unrealistic ... and we will decommission reactors at the end of their life spans."[58] The conclusions of the Energy and Environment Council[59] were in line with this. Noda confirmed an effective nuclear phase-out mid-September, and the cabinet approved it on 19 September 2012 – even after intense lobbying by major industrial alliances[60]. After the LDP landslide in the December 2012 election, the utilities reacted quickly, demanding the incoming LDP government change the energy policy.[61] However, even the staunchly pro-nuclear LDP and its junior coalition partner, the Buddhist New Komeito[62], cannot ignore the strong anti-nuclear sentiment of the majority of Japanese people.

In the short term, the questions are: Which reactors will be permanently closed down? Which will be restarted? When? At what cost? After what, and whose, investments? And how long they will be allowed to operate?

In Japan, the nuclear waste problem can also become a short-term challenge. New-builds have a limited chance, not only for political reasons, but also because competitive markets rarely tolerate nuclear investments, as European and US wholesale market liberalisation has shown. It is also important how fast the indebted government reduces its earlier very generous support to the nuclear industry, which includes its large support for TEPCO in post-Fukushima clean-up period.

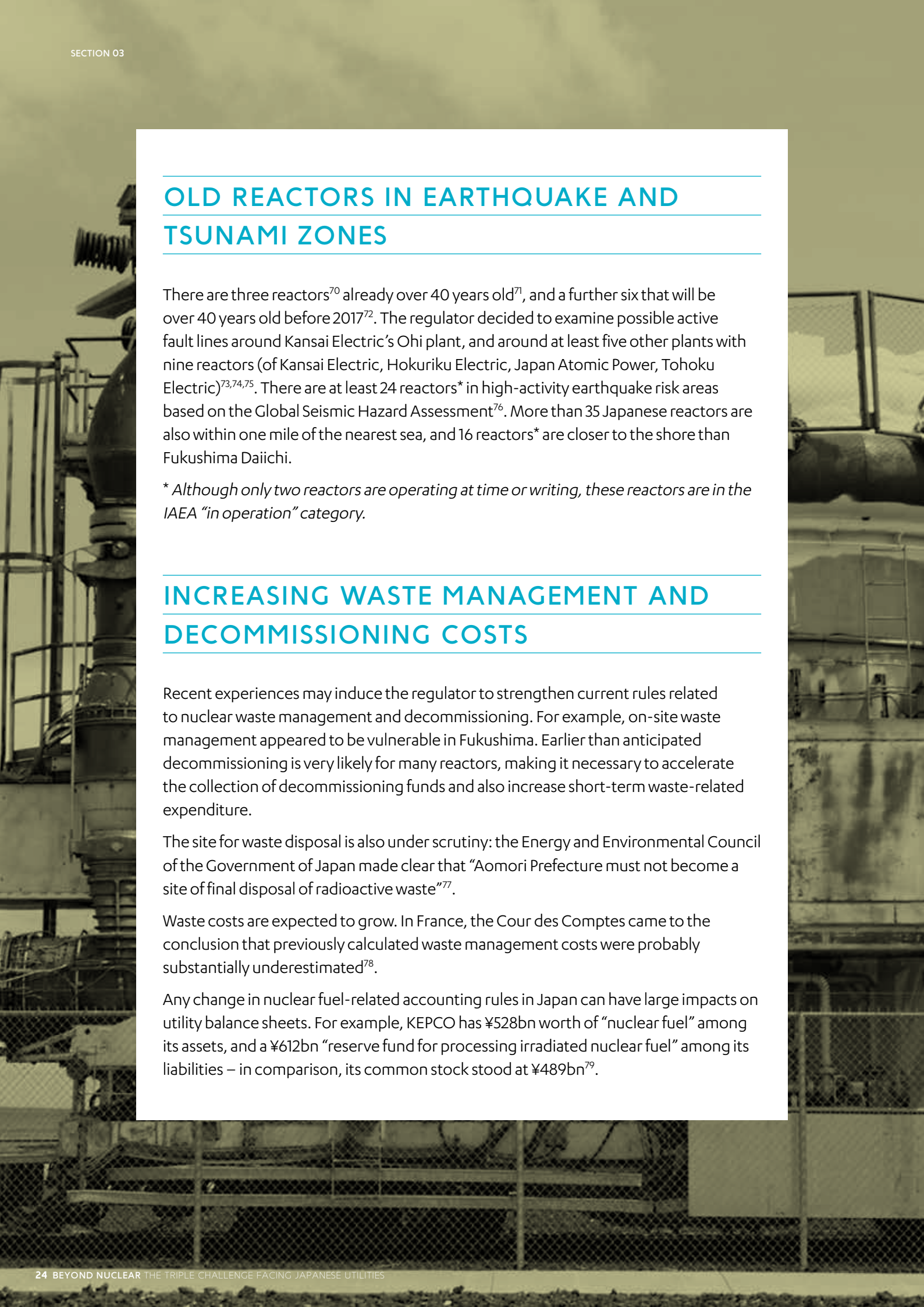
SHORT-TERM CONSEQUENCES: DELAYED NUCLEAR RESTARTS

As of 1 January 2013, all but two of Japan's 50 remaining reactors were still offline, and the newly set up regulator, the National Regulation Authority (NRA)[63], is not expected to publish its new set of criteria for reactor restarts until April, with applications for the finalised criteria starting[64] in July 2013[65]. Utilities may need years and billions of Japanese yen to fulfil these criteria, as demonstrated by recent discussion between the LDP and the regulator about whether three years are enough to decide upon restarts[66].

The criteria remain unclear, but one already expressed regulatory precondition is expanded emergency procedures, to be worked out by communities living within 30 kilometres[67] of nuclear plants – that is, 130 municipalities[68]. The regulator is also examining earthquake faults around reactors. Other nuclear regulatory questions are also under discussion, including evacuation rules, changes in liability regulations, and compensation rules. These and other requirements will certainly delay restarts, causing further financial strain especially for KEPCO (28% nuclear capacity in total), Shikoku Electric (29%), Hokkaido Electric (28%), and of course for TEPCO. All of these rely heavily on nuclear energy[69].

LONG-TERM CONSEQUENCES: FEWER NUCLEAR REACTORS AND HIGHER COSTS

As of November 2012, the Japanese government was planning a nuclear phase-out by the late 2030s. The new LDP government may bring changes in this respect, but – regardless of policy changes – inevitably, there will be a substantial decrease in the number of Japan's 50 reactors that will operate due to deteriorating economics, aging, earthquake and tsunami risks, local resistance etc.



OLD REACTORS IN EARTHQUAKE AND TSUNAMI ZONES

There are three reactors[70] already over 40 years old[71], and a further six that will be over 40 years old before 2017[72]. The regulator decided to examine possible active fault lines around Kansai Electric's Ohi plant, and around at least five other plants with nine reactors (of Kansai Electric, Hokuriku Electric, Japan Atomic Power, Tohoku Electric)[73,74,75]. There are at least 24 reactors* in high-activity earthquake risk areas based on the Global Seismic Hazard Assessment[76]. More than 35 Japanese reactors are also within one mile of the nearest sea, and 16 reactors* are closer to the shore than Fukushima Daiichi.

* *Although only two reactors are operating at time or writing, these reactors are in the IAEA "in operation" category.*

INCREASING WASTE MANAGEMENT AND DECOMMISSIONING COSTS

Recent experiences may induce the regulator to strengthen current rules related to nuclear waste management and decommissioning. For example, on-site waste management appeared to be vulnerable in Fukushima. Earlier than anticipated decommissioning is very likely for many reactors, making it necessary to accelerate the collection of decommissioning funds and also increase short-term waste-related expenditure.

The site for waste disposal is also under scrutiny: the Energy and Environmental Council of the Government of Japan made clear that "Aomori Prefecture must not become a site of final disposal of radioactive waste"[77].

Waste costs are expected to grow. In France, the Cour des Comptes came to the conclusion that previously calculated waste management costs were probably substantially underestimated[78].

Any change in nuclear fuel-related accounting rules in Japan can have large impacts on utility balance sheets. For example, KEPCO has ¥528bn worth of "nuclear fuel" among its assets, and a ¥612bn "reserve fund for processing irradiated nuclear fuel" among its liabilities – in comparison, its common stock stood at ¥489bn[79].

New reactor builds are not a safe bet. While Chugoku's Shimane-3 is almost complete, Electric Power Development Co's Ohma reactor[80] is far from completion. And not everything is going so well with Shimane-3: the planned commercial start, for example, had to be delayed after significant faults were discovered in the control-rod drive mechanism[81].

Even if reactors are allowed to restart and operate up until 40 years of age, utilities will be facing large additional safety investments (earthquake and tsunami protection etc.). In France, for instance, additional safety improvements will cost EdF – which has 58 reactors – between €10bn and €15bn[82,83]. EdF would need to spend between €40bn and €50bn to extend the life of its reactors, and it is not at all clear if 20 extra years will be approved. The total EdF investment necessary is in the range of €1bn per reactor, very different from the €400-500m range in 2008.

The earlier, widely praised reactor life extension and power uprate strategies look much less attractive when these large investments and potentially shorter extension periods are taken into account. Japanese utilities may need to spend even more on their reactors, given these are located in earthquake and tsunami zones, and Fukushima Daiichi-1 was granted life extension just one month before the disaster.

As Moody's summarised: "the overall costs for operating nuclear plants in the environment after the 11 March earthquake, while unclear, is expected to increase substantially ... Such changes could substantially erode or even eliminate the economic benefits of nuclear power."[84]

The impact of deteriorating nuclear economics could be further aggravated if the exceptionally high government support for the nuclear sector is lowered. The Japanese government has always been generous with the nuclear industry. Its nuclear energy budget was around ¥500bn annually for the last decade[85], and it also subsidised communities hosting nuclear plants. Prefectures paid ¥7.6bn to one million households living around nuclear plants, but the number of households that reject these benefits has doubled during the last year[86]. The government has also been maintaining a high publicly financed energy R&D budget[87] (for example, $3.6bn US dollars in the late 2000s), of which 62% went to nuclear, but only 7% for all types of renewable energy. All this is expected to change due to the anti-nuclear feelings of the majority of Japanese people, and sovereign debt crises – for example, Germany and Belgium introduced nuclear fuel taxes in place of government subsidies.

RENEWABLE REVOLUTION

Japan is starting from a low level of renewable energy. Hydro power had an 8.3% share of electricity production in FY2011, while all other renewable energy sources had less than 2.2%. This stands in stark contrast to countries such as Germany or Spain. At the end of 2011 Japan had 2.5GW wind capacity, while China had 63GW, the US 47GW, Germany 29GW, and India 16GW[88].

EXPANDED FEED-IN TARIFF (FIT) SYSTEM

From July 2012, the feed-in tariff was substantially expanded[89]. Utilities are now obliged to purchase renewable energy on a fixed-term contract, at fixed prices both in the case of small-scale renewable and large-scale renewable facilities, for example ¥42/kWh in case of solar PV[90].

Bloomberg estimates that clean energy investments in Japan may double from the $8.6bn in 2011 to $17.1bn[91], as these prices guarantee 44% to 51% return on investments[92].

In just three to four months, Japan's new feed-in tariff system helped 2.56GW of new capacity get approval, which in itself can have a tangible effect, during summer mid-day peaks for example.

Currently, utilities cannot benefit from the feed-in tariff (FiT) system, or at least they cannot directly sell their own renewable electricity at FiT tariffs, according to the relevant rules (but utility subsidiaries can).

Traditionally, utilities were unwilling to make substantial investments in renewables, but this may change even without being included in the FiT system. Solar and wind energy will soon be at grid parity, especially given high electricity prices[93]. New wind plants may already offer better returns than CCGTs at current high LNG prices[94], at favourable locations, and assuming EU wind and CCGT capital and operating costs.

The government is also willing to contribute ¥84 trillion to energy efficient technologies, ¥6tn to co-generation systems, and plans are afoot to pump about ¥38tn into renewable energy including, but not limited to, solar and wind energy[95,96]. The government would also like to see PV panels on 10 million rooftops by 2030, 3GW/year new PV, and 2GW/year new wind capacities. A recently introduced environmental tax on fossil fuels[97] will also help renewable energy gain share.

Although Japanese utilities were dominated by renewable resources – namely hydro – in the 60s, and important inroads to exploit Japan's geothermal capacity were made in the 70s/80s, the last decades have brought very limited advancement in this area.

Lately, Japan has entered a critical phase in its renewable energy development. Within years it will become clear who is playing a leading role in its wind and solar developments. Will it be the utilities that will be dominant, like wind utilities in Spain? Or will it be municipalities, communities and small IPPs, as in Germany? The first indications are less than encouraging. Beyond hydro and geothermal, Japanese utilities have only just started to explore wind and solar opportunities, and TEPCO reduced its shares in two of its renewable subsidiaries recently[98].

In principle, in addition to installing and operating large-scale wind, Concentrating Solar Power (CSP), geothermal and renewable facilities, Japanese utilities could also play other important and profitable roles in renewable energy. As the Boston Consulting Group described in the case of the German utilities and the Energiewende[99]: "Conventional utilities will need to create new business models suited to this environment."

The Boston Consulting Group goes on to explain that utilities could, for example,

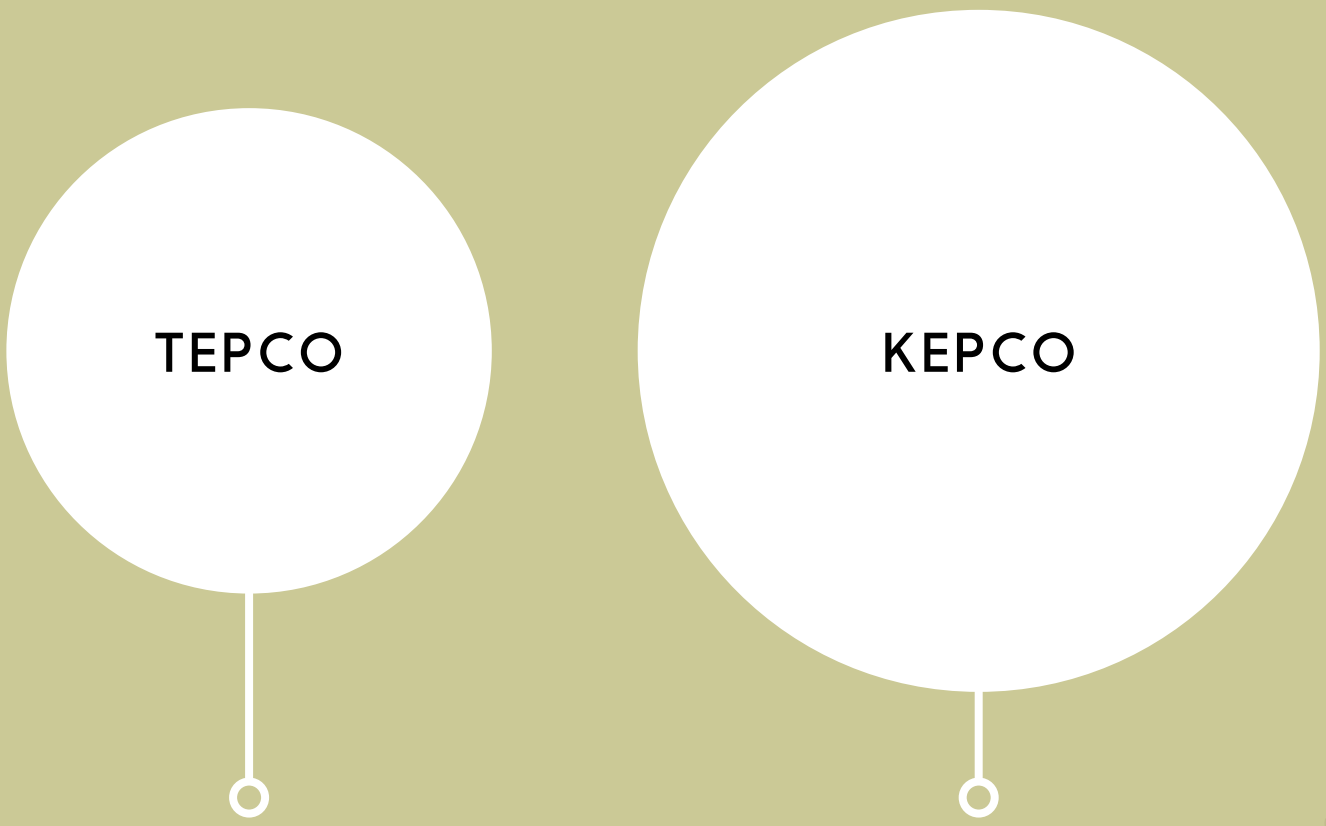
- "Build up a 'flexibility portfolio' to profit from the increasing volatility of supply;
- Sell energy generated by local wind and solar plants directly to the local community;
- Be agents for decentralised energy 'prosumers' (that is, producers and consumers) who balance power supply and demand; or
- Sell service and maintenance contracts to residential and commercial customers who have installed rooftop solar-PV panels."

If utilities are slow to assume some of these roles, or to grab the best locations for solar and wind facilities, new market entrants will do so. Marubeni Corporation, for example, leads a consortium that is building a floating wind farm off the coast of Fukushima (with the goal of adding 1GW by 2020). It is also building an 81.5MW solar power plant in the Oita Prefecture. Kyocera is setting up a 70MW plant in Kagoshi-ma[100]. Softbank[101] is also investing in commercial-scale solar energy around the country.

Japanese utilities may want to think twice before making their capital expenditure allocations, and committing themselves to potentially future stranded assets, such as the 18GW new gas-fired plants and 5GW new coal-fired plants they plan to add during the next decade[102].

JAPANESE UTILITIES CURRENTLY HAVE LIMITED RENEWABLE INVOLVEMENT

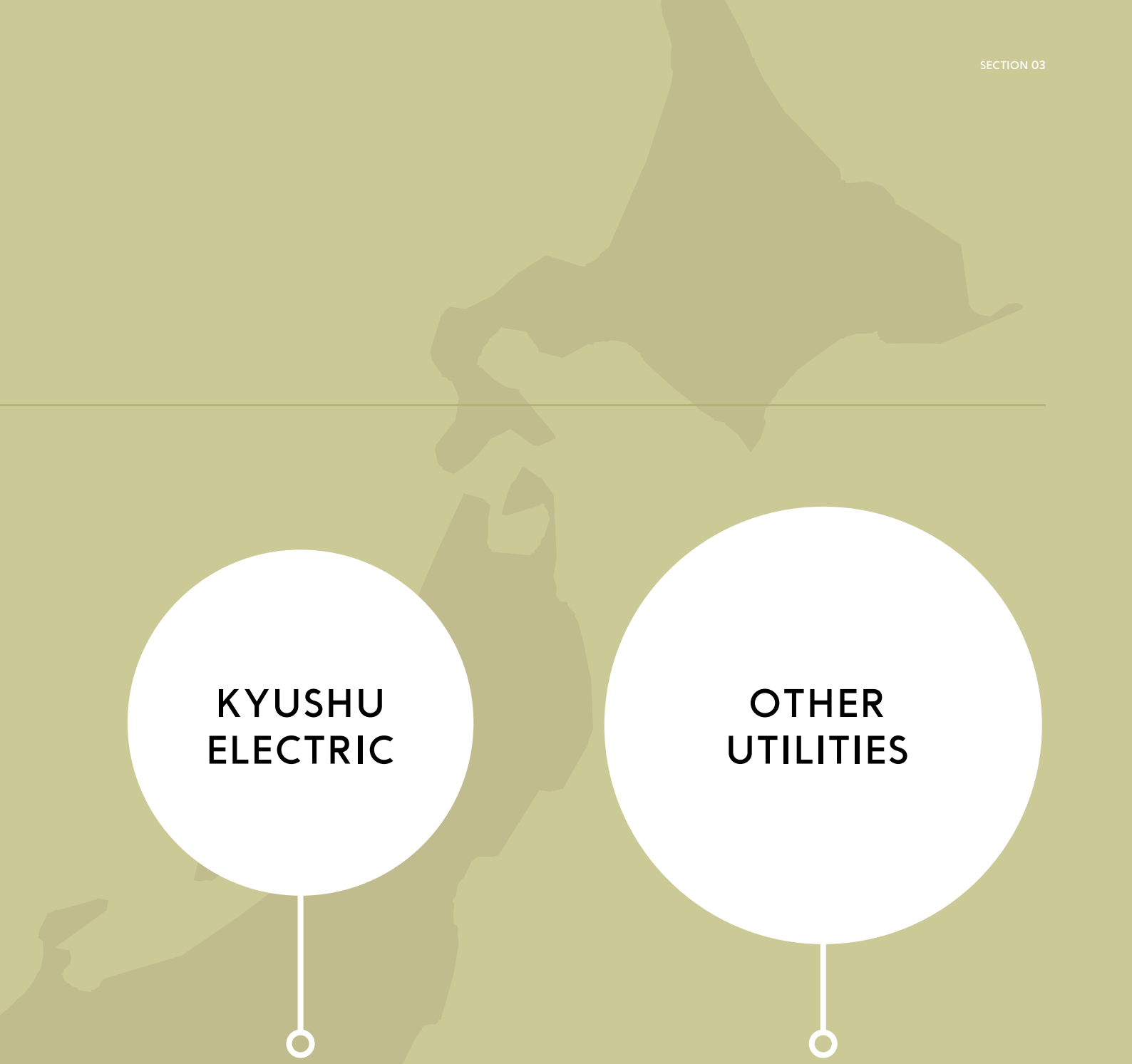
UTILITIES



CURRENT RENEWABLE INVOLVEMENT

- GOT INVOLVED IN WIND IN 2000
- TODAY HAS INTERESTS IN SEVERAL SMALLER WIND FARMS
- A SOLAR PLANT IN KAWASAKI CITY
- REDUCED SHARES RECENTLY IN A 45MW SOLAR PLANT IN CALIFORNIA AND IN EURUS ENERGY HOLDINGS
- SHARES IN ECO POWER
- 10MW SAKAI SOLAR PROJECTS
- SMALLER WIND PROJECTS IN THE CHUBU ELECTRIC POWER AREA

SOURCE: reuters, bloomberg, asahi shimbun, etc



KYUSHU ELECTRIC

- OMURA SOLAR PROJECTS
- ONGOING GEOTHERMAL DEVELOPMENTS
- WIND PROJECTS IN CHINA

OTHER UTILITIES

- SHIKOKU ELECTRIC SOME SOLAR INVOLVEMENT
- CHUBU ELECTRIC INTERESTED IN BOTH SMALLER WIND AND SOLAR PLANTS
- CHUGOKU ELECTRIC STARTED TO GET INVOLVED IN SMALLER SOLAR PROJECTS

COMBINED EFFECTS

Japanese utilities face significant change not individually, but in combination, as they have close interrelations and can easily amplify each other's effects.

Devaluation of nuclear = more competition. The Fukushima disaster, the shutdown of nuclear reactors, and the national debate about the future role of nuclear energy in Japan have all led to the review of the national energy policy in Japan. This has contributed to a renewed momentum about deregulating the electricity markets. Also, the disaster and TEPCO's corporate tariff hike of 17% that followed substantially increased the number of corporate clients leaving TEPCO. For example, between March 2011 and March 2012 TEPCO lost 15,450 of its corporate contracts (4.2GW), and lost an additional 3,350 contracts between April 2012 and September 2012.[103] This gave a range of electricity and gas utilities and independent market entrants the opportunity to establish positions in TEPCO's franchise area.

Devaluation of nuclear = renewables revolution. The closedown of nuclear reactors created strong interest in both energy efficiency and renewable energy solutions. Consumer energy saving efforts played a key role in avoiding blackouts during the last two summers. The restarted discussions on energy policy led to a significantly renewed feed-in tariff law, which has already delivered strong results.

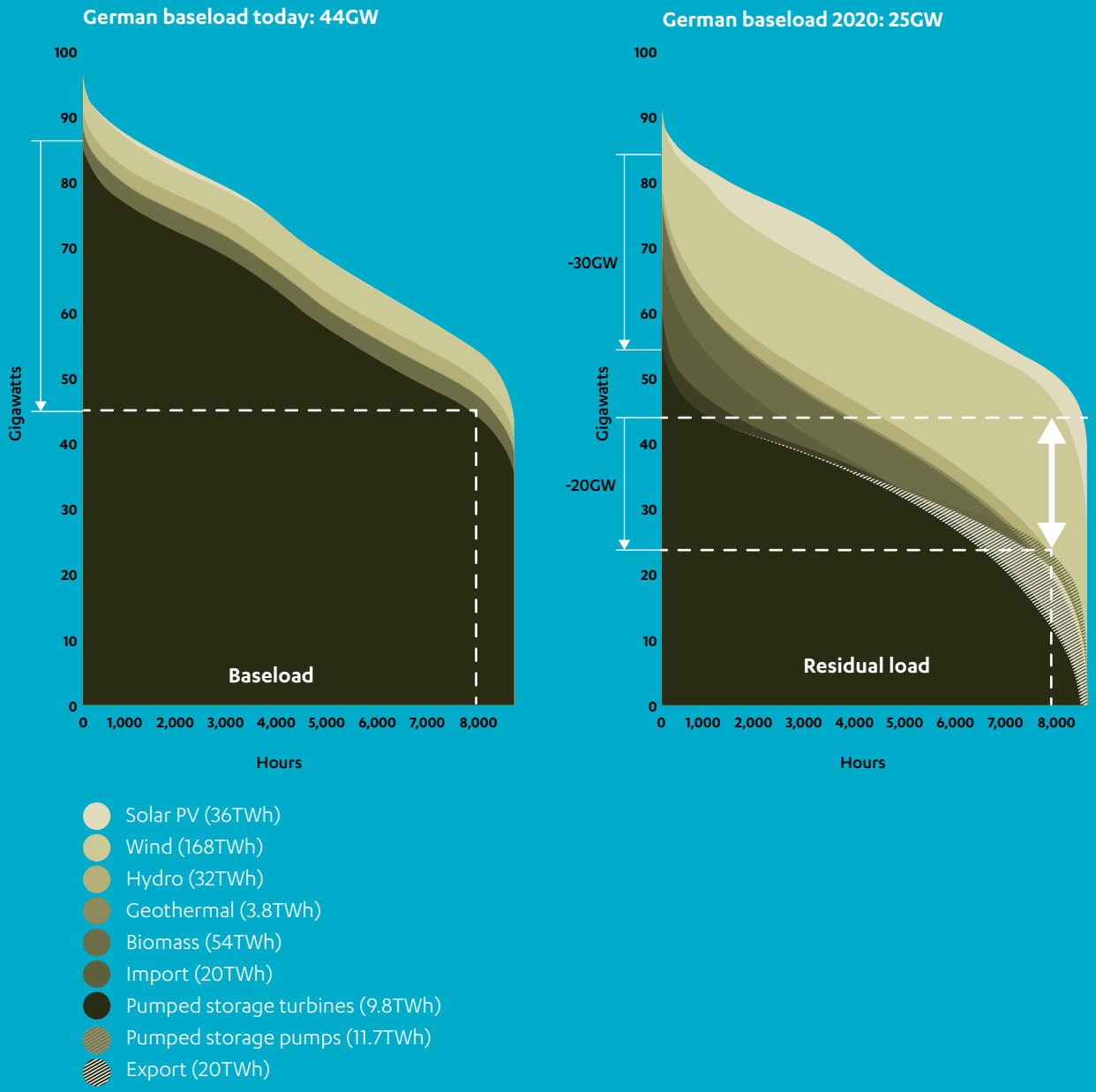
Renewables = more competition. Renewable energy also has substantial impacts both on competition and on the viability of nuclear energy. Household-level and other small-scale renewable solutions help transform consumers into "prosumers", which reduces the need for specific utility services and creates the need for other services (for example, balancing). This can have a large impact on utility power-plant utilisation. The newly approved 2 to 3GW solar capacity could soon have a tangible impact on reducing the peak needs during the summer, which influences the competitive positions of peak plant owners.

Renewables = devaluation of nuclear. Renewable energy can substantially contribute to the demise of baseload plants, such as nuclear plants. Renewables reduce price levels and lower baseload utilisation rates. These two effects are so significant that they have already created heated discussions in Germany on how to ensure appropriate capacities if lower prices and low load factors make new coal or gas plants difficult to build and operate economically.

Indeed, the increasing share of close-to-zero marginal cost wind/solar energy has already contributed to lower baseload prices in Germany. In terms of baseload utilisation rates, the Fraunhofer Institute[104] modelled the impacts of increasing renewable energy share on the German merit order (see page 31).

The analysis showed that the need for baseload plants (nuclear and lignite in Germany, for example) would decrease from 44GW in 2010 to 25GW in 2020. This not only strengthens a nuclear phase-out, but may even affect the utilisation rates of remaining and planned lignite and brown-coal power plants. On the other hand, as the share of renewable energy increases, the need for quickly dispatchable power plants also grows, for example for CCGTs that are used today in medium and peak load.

RENEWABLES ARE SQUEEZING OUT BASELOAD PLANTS
SHIFTING THE SUPPLY CURVE TO THE RIGHT – REDUCING REALISED PRICE



Source Fraunhofer: Dynamische Simulation der Stromversorgung in Deutschland nach dem Ausbauszenario der Erneuerbaren-Energien-Branche, December 2009: http://www.beeev.de/_downloads/publikationen/studien/2010/100119_BEE_IWESSimulation_Stromversorgung2020_Endbericht.pdf


04

LEARNING FROM EUROPEAN UTILITIES

EUROPEAN UTILITIES OFFER RELEVANT LESSONS IN ALL THREE MAJOR CHALLENGES

Around 2000, Germany was in a similar situation to Japan today, in terms of deregulation, renewable energy, and nuclear shares. Germany chose to fully open its electricity market in 1998, and Japan may move there in 2013. In Germany, renewable and hydro had a 7% share of electricity supplies in 2000, and nuclear had 29%. Meanwhile, in Japan this was 9% and 30% respectively in 2010. In 2011, Germany's renewable and hydro share was 20% (or 123TWh on 66GW capacity)[105], and in 2012 it reached 25%. Japan is planning to reach a 20% renewable and hydro share by 2020. Germany had 11GW of renewable capacity in 2000, and had installed an additional 55GW by 2011. Japan may need to install 70GW by 2020 to reach its objectives.

SELECTED DEREGULATION LESSONS FROM EUROPE

DEREGULATION BRINGS NEW STRUCTURES

Electricity exchanges, independent regulators, or market-based balancing systems to allocate transmission capacity are all examples of new structures from deregulation. Electricity exchanges (such as the European Energy Exchange[106]) play a much larger role in Europe and in the US than in Japan today. Spot turnover often reaches 20% to 70% of the total demand, while it remains insignificant in Japan. An independent regulator was important in each deregulated market, and Japanese utilities may soon receive one authority, which is what happened with the nuclear sector (NRA).

Independent system operation, transparent access to grid capacities, and market-based balancing systems were important to establishing liberalised EU and US markets. These are still missing from Japan, due to the fact that Japanese utilities are geared towards self-sufficiency and have a low capacity for interconnection[107]. This is contrary not only to market liberalisation, but also to security of supply, as Japan has no interconnections to other electricity systems, and its demand is more volatile than in most other markets.

Unbundling has also been a key feature of deregulating EU and US markets. When system operations and grids were unbundled from generators/suppliers new balancing systems were developed. This helped to increase cross-regional traffic and competition among generators and created savings. For example, there has been less need for operational reserves and also additional revenues (for example, through system/ancillary services) for successful utilities.

"JAPANESE UTILITIES ARE GEARED TOWARDS SELF-SUFFICIENCY, AND HAVE A LOW CAPACITY FOR INTERCONNECTION. THIS IS CONTRARY NOT ONLY TO MARKET LIBERALISATION, BUT ALSO TO SECURITY OF SUPPLY"

As renewables gain market share, independent system/grid operators in more advanced markets need to adapt to the coming end of the baseload/peakload planning paradigm[108].

LESS INVESTMENT IN BASELOAD GENERATION AND MORE DIVERSIFICATION

In most deregulated markets, investments in conventional generation capacity have declined substantially, and in some cases this was so extreme it led to substantial supply problems, like in California. There has also been a shift from investments in inflexible baseload nuclear and coal to more flexible natural gas plants, with lower capital costs, and also to more decentralised and/or renewable capacities. Nuclear has proven less compatible with liberalised electricity markets, and in the US no new reactors have been built for decades. The situation is similar in the EU, with only two exceptions – Olkiluoto in Finland and Flamanville in France – as cost increases, delays, and financing problems keep expensive nuclear reactors out of the market.

EU and US utilities also tried to build positions beyond their original electricity franchise markets, with many becoming involved in natural gas trading, storage and supply, and other geographical markets. Japanese utilities are generally much less diversified beyond power than E.ON, RWE, GDF Suez or the larger US electricity utilities, and they also have much less overseas involvement. This may soon change, as Japanese utilities already face challenges from the largest gas utilities[109].

EFFICIENCY IMPROVEMENTS, CONSOLIDATION AND LOWER PRICES

Ensuring scale is critical in liberalised markets, and consolidation happened very rapidly in several European markets. Germany, for example, was dominated by eight major utilities in 1998. Four years later only four remained: E.ON, RWE, EnBW and Vattenfall. Some of the Japanese utilities are also sub-scale and – especially on Honshu – a push for consolidation can be reasonably expected.

Most utilities on deregulated markets go through regular cycles of cost reductions. This is unavoidable for the Japanese utilities in the short term, since the government expects cost reductions from them once they ask for its permission to hike rates. Several Japanese utilities are already working on costs. TEPCO, for example, has implemented a cost-cutting programme. For one thing, it was forced to lower the annual average income of employees by more than 20% to ¥5.5m, while KEPCO is planning to cut ¥180bn[110].

Cost reductions may have unfavourable effects. One danger is delaying power plant maintenance, which can hit back hard in the mid to longer term. Another example is reducing R&D spending, which has been the case in the US, Japan, and with many European utilities. In the US, annual private energy R&D decreased from $4n to $1bn between 1980 and 2005. Similarly, both European and Japanese utility R&D spending decreased significantly during the 2000s. For example, E.ON reduced R&D spending by 86% (2000 to 2010), RWE by 66% (2002-2010), ENEL by 30%. However, EdF's R&D spending remained stable, and Dong Energy, GdF-Suez, and Vattenfall increased R&D investments[111].

Prices often declined after deregulation, especially for large customers. Japan starts from a high basis, as it has the second highest average electricity price of 28 International Energy Agency (IEA) member countries in the industrial segment, and the seventh highest of 30 IEA member states in the household segment. In New Zealand, another island nation, the average industrial electricity price is 59% lower than in Japan[112]. In South Korea, consumers pay a third of what Japanese consumers do, and in the US, half.

THE LARGE CONSOLIDATION WAVE IN EUROPEAN ELECTRICITY AROUND 2000

EdF

ENBW, VIVENDI ENERGY, LONDON ELECTRICITY, EOS, ETC

E.ON

POWERGEN, RUHRGAS, ZCE, SYDKRAFT, EAM, HEINGAS, ETC

RWE

SE, THYSSENGAS, THAMES WATER, VEW, STADTWERKE ESSEN, ETC

ENEL

SOUTHERN WATER, COLOMBO GAS, VIESGO, ETC.

ELECTRABEL
(SUEZ-GDF TODAY)

HIDROCANTABRICO, SCOTTISH POWER, ALP ENERGIE ITALIA, ETC

ENDESA
(ENEL TODAY)

RED ELECTRICA, NRE, SNET, ENERGIAS DE ARAGON, ETC

VATTENFALL

HEW, STRÖM, GOTEBORG ENERGI, VLE ETC

LESSONS FROM NUCLEAR PHASE-OUTS

Utilities all over the world have faced sudden changes in nuclear policies and nuclear economics. Most of these were connected to utilities that had been in monopolistic situations at the time. For example, the leading utility of Austria, Italy or the Philippines had to accept that completed new nuclear power plants would never be operated. Also, most of the earlier phase-out decisions happened before deregulation began (for example, Austria in 1978, Sweden in 1980, and Belgium in 1999). So, perhaps more relevant are the experiences of US utilities in the 1980s-2000s, and the German experience since the 2000 decision.

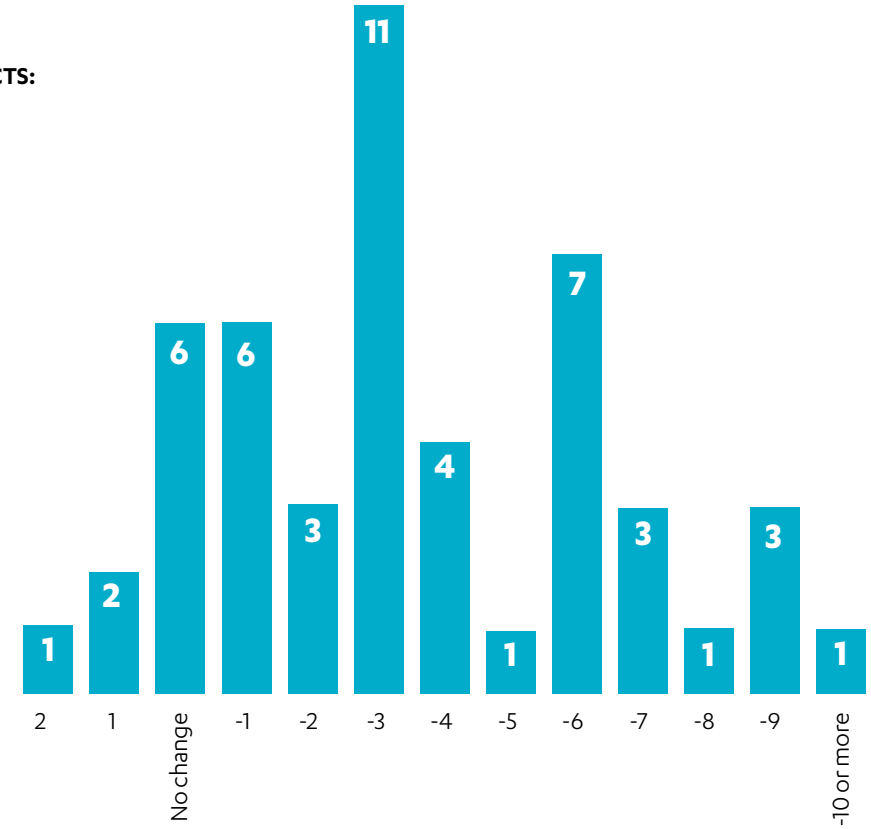
Following the Three Mile Island accident and the Chernobyl disaster, deteriorating nuclear economics made the financing of new reactors in the US particularly difficult. Although no new reactors have been built in recent decades, and despite negative signals from financial markets, utilities have kept pushing new reactor projects. Moody's analysis[113] (see figure below) looked at 48 debt issuers (mostly utilities) seeking to build new nuclear reactors. Of these, only two achieved an upgrade in credit rating for the longer term, and on average the utilities were downgraded by four notches, with significant consequences to the financing costs for all of their debt. A more recent study by the Texas Institute confirmed these findings, after looking at 52 investors and discovering higher bankruptcy rates among nuclear power sponsoring utilities than among a larger class of global corporate issuers[114].

IN THE US, UTILITIES SUFFERED, ON AVERAGE, DOWNGRADES OF 3-4 NOTCHES IF THEY STARTED BUILDING NEW NUCLEAR REACTORS

US UTILITIES NEW NUCLEAR PROJECTS: CHANGE IN RATING (IN NOTCHES)

"Historical rating actions have been unfavorable for issuers seeking to build new nuclear generation. Of 48 issuers that we evaluated during the last nuclear building cycle (roughly 1965-1995), two received rating upgrades, six went unchanged, and 40 had downgrades. Moerover, the average downgraded issuer fell four notches. All of these ratings were evaluated on the senior secured or first mortgage bond ratings."

(Moody's: New Nuclear Generation: Ratings pressure increasing, June 2009)



In 2000, Germany decided to close down all of its 19 reactors by 2023, and shutdown eight of them immediately in August 2011. The utilities could negotiate a phase-out structure that would give them substantial flexibility; they could allocate output among their plants, for example by shutting down one plant ahead of schedule and transferring its remaining kWh to another plant.

Despite the Merkel cabinet's U-turn with regards to nuclear phase-out, German utilities have spectacularly withdrawn from new nuclear investments, including abroad. Both E.ON and RWE have abandoned their Horizon project in the UK[115], and E.ON has given up on its nuclear-reactor plans for Finland. Although RWE bought a 30% share in EPZ and the Borssele nuclear plant in the Netherlands[116], it has withdrawn plans for a second reactor on that site.

The nuclear phase-out has put substantial financial burden on all four nuclear utilities in Germany, and the companies have reacted with asset-disposal programmes (for example, RWE upscaled its asset sales plans from €8bn to €11bn[117]), and by cutting further costs, reducing capital expenditure, and generally strengthening their balance sheets. Three of the four utilities also recently filed claims for damages[118,119], although the phase-out was originally decided upon in 2000 by the Schröder government.

LESSONS FROM THE EUROPEAN UTILITIES' APPROACH TO RENEWABLES

Utilities often embrace hydro or geothermal energy, as Japanese utilities have done in the past, but they tend to fight, or at least dilute, government efforts to support solar or wind energy. For decades, Japanese utilities successfully "deactivated" government renewable energy efforts (for example, investment subsidies, the Sunshine programme, the Renewable Portfolio Standard, tradable renewable energy certificates, a constrained FiT etc.). Indeed, after three decades of renewable energy support programmes, wind and solar is below 1% of total demand. Japan has even lost its status as a world leader in solar technology[120].

UTILITIES TEND TO BE LATE FOR THE RENEWABLE REVOLUTION

Utilities have strong comparative advantages in a range of renewable energies[121] (onshore and offshore wind, CSP, biomass and geothermal plants etc.) thanks to their financial strength, access to cheap financing, lower equipment-sourcing costs[122], and operating cost efficiency[123]. They enjoy better positioning for enjoying tax and investment credits and other incentives. Utilities are also better equipped to combine different renewable sources, for example wind and solar, whose feed-in patterns are weakly correlated.

They also have relevant regulatory, licensing, construction and operational experience, as larger-scale renewable projects are generally similar to traditional power-plant projects. Utilities have long-time relationships with local authorities and franchise customers in a region. This advantage should be exploited in Japan and used to build trust for large-scale RE projects through careful planning and intensive consultation with local stakeholders.

Utilities often realise quite late that actively participating in large-scale renewable investments, rather than giving competitors a head start, has several advantages:

- Early entry into renewables helps utilities to protect their market shares, and to occupy the best available locations – a factor even more important in Japan than elsewhere.
- Early support systems are the most generous often at no/low risk.
- Renewable costs are decreasing quickly, so much so that they will soon become the cheapest source of electricity. Germany saved €6.7bn in energy imports through renewables in 2010[124].
- Solar helps peak shaving during summer days in Spain, Italy, and Germany – even more in Japan. This can help save on expensive oil, gas-peaking plants, or pumped storage for utilities.
- Renewable energy is an opportunity for utilities for differentiation, reputation building and improved price realisation. TEPCO, for example, was allowed to apply a photovoltaic generation sub-charge on all customer electricity bills from 2010.
- Supporting decentralised renewable investments helps to improve a company's local image and to change its internal culture towards a more client-orientation.

Despite these obvious advantages, utilities often start out with resistance and passivity towards renewable energy. They not only miss opportunities, but may also suffer substantial strategic backlashes. They may also miss the chance to play a leading and defining role in the renewable revolution, even in their own franchise markets.

This stubbornness can also hit back on their core business. Moody's recently warned that further expected increases in wind and solar power will continue to erode the credit quality of European thermal generation companies (mostly large utilities) in the near to medium term[125]: "Large increases in renewables have had a profound negative impact on power prices, and the competitiveness of thermal generation companies in Europe ... what were once considered stable companies have seen their business models severely disrupted."

The growing share of renewables affects every utility's traditional generation portfolio, but only some of them enjoy the benefits of having their own renewable businesses. For example, the large German utilities were hostile and defensive towards renewables for decades, which led them to giving over the lead to energy cooperatives, municipalities and smaller corporations. They are now being forced to run after the developments. The Spanish and Portuguese utilities, on the other hand, seem to have kept closer control of renewable developments, and have been able to benefit from them in the long run.

DEFENSIVE GERMAN UTILITIES

German utilities were sceptical about the financial viability of renewable energy from early on[126], and reacted to the first FiT law ("StrEG" in 1990) defensively[127]. Small independent wind producers who took advantage of the new policy and wind capacities started to grow, but only slowly[128] – partly because the utilities were not happy to transmit wind energy on their grids, and were lobbying the regulator relentlessly.

The 2000 new FiT law ("EEG") and its amendments substantially improved renewable economics. PreussenElektra (one of E.ON's predecessors) challenged the EEG in court and went all the way to the European Court of Justice, which ruled in 2001 that feed-in tariffs did not constitute "state aid"[129]. Electricity deregulation laws also made access to grids easier and more transparent for third parties, and in 2000 the German government decided to phase out nuclear energy. Large utilities were on the losing side in three main areas (deregulation, nuclear phase out and renewable energy), but they did not change their ways or start to seriously exploit renewable opportunities for many years.

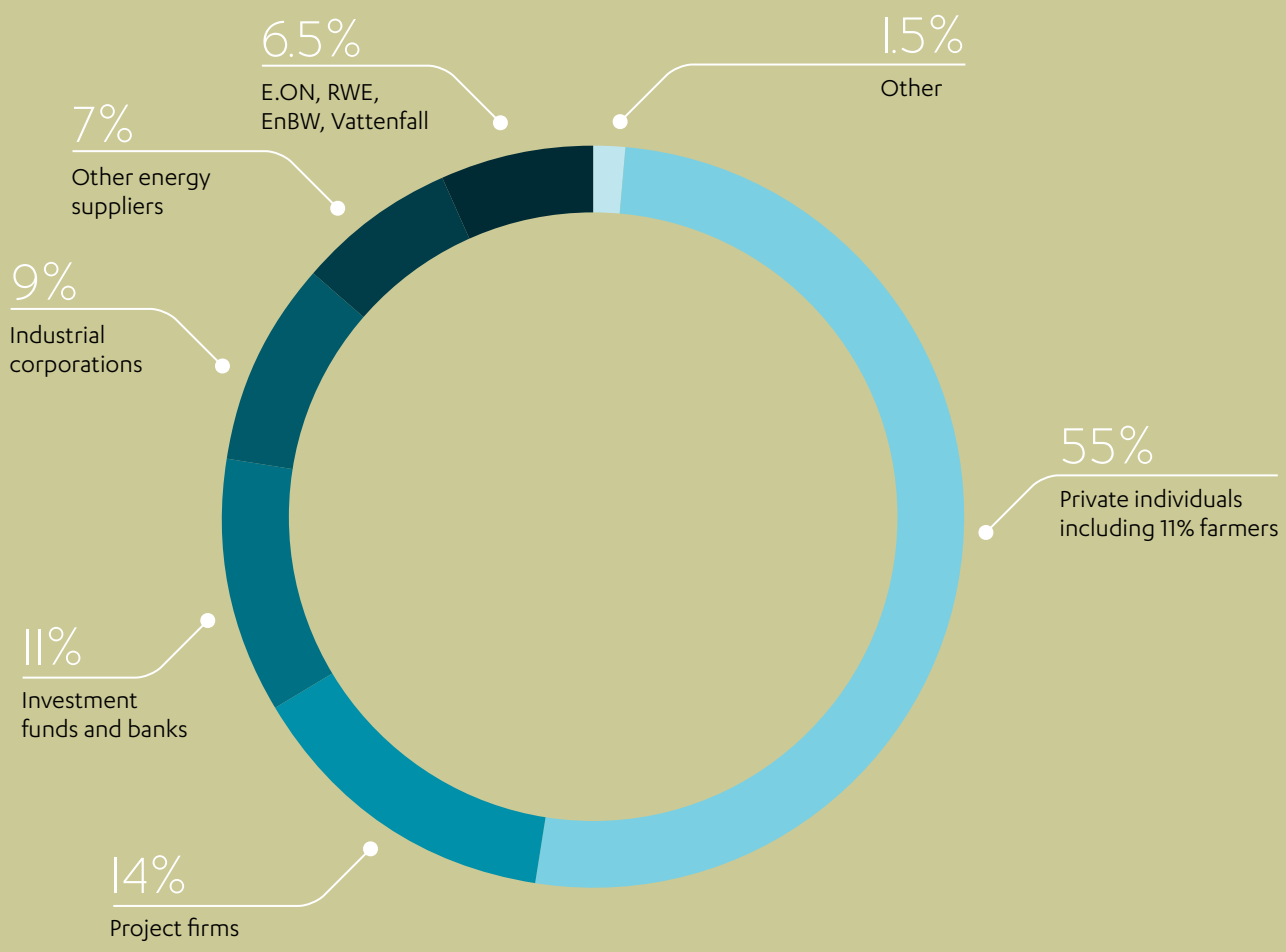
In 2005, the four large utilities only controlled 1% of German wind capacity, while dominating the German wholesale generation market with 70% of capacity. They refocused their lobby efforts on the details of renewable support systems[130], but did not get involved in investments in a serious manner. By 2009, in Germany 90TWh, more than 16% of the country's electricity, came from renewables, and the four large utilities only controlled 20TWh (of which, 17TWh was hydro)[131].

In Germany, E.ON produced 1.1TWh from non-hydro renewables, both RWE and Vattenfall had 0.8-0.8TWh and EnBW had 0.3TWh. Interestingly, in the same year, they produced more renewable power in their foreign subsidiaries: in 2009, E.On produced 4.1TWh, RWE 2.3TWh, and Vattenfall 2TWh of non-hydro renewable electricity abroad.

During the last few years they started to move faster. E.ON, for example, doubled its renewable production between 2009 and 2011 worldwide, and reached 10.2TWh (including hydro-energy). It plans to triple this by 2020. EnBW announced its renewable strategy and plans to double to 14TWh by 2020[132], with nearly all growth coming from non-hydro renewables.

The four large utilities also got involved in mega-projects, such as the Desertec (RWE and E.ON) and a few major offshore wind[133] projects (for example, E.ON, Dong Energy and Masdar with the London Array).

OWNERSHIP OF INSTALLED RENEWABLE POWER CAPACITITES IN GERMANY, 2010



Source: www.energytransition.org

RECENT E.ON AND RWE EFFORTS IN RENEWABLE ENERGY

At the end of 2011 E.ON had 4.2GW of renewable capacity (without large hydro) – mostly wind. Half this was in the US[134]. The company made €661m in EBITDA[135] from renewables during the first half of 2012. Half of this came from hydro, and the other half from wind, solar and other renewables. The company invested €731m in renewable energy, 27% of total investments and a 74% increase from the first half of 2011 during these six months. It plans to invest €7bn in renewable energy in the next five years, including €2bn in large offshore wind[136]. E.ON is also looking to invest in storage technology, and has started the construction of a 2MW hydrogen electrolysis plant in Germany.

At the end 2011, RWE had 2.4GW renewable capacity (some of it is large hydro). This was around 5% of its total capacity and expects by 2020 renewable capacity to grow to 4.5GW by 2014, and to 9GW, 20% of total capacity. RWE's renewable company, RWE Innogy, generated €338m in EBITDA during 2011. It plans to invest €3.6bn in renewables between 2012 and 2014[137].

PROACTIVE SPANISH UTILITIES ARE MORE SUCCESSFUL AT KEEPING CONTROL

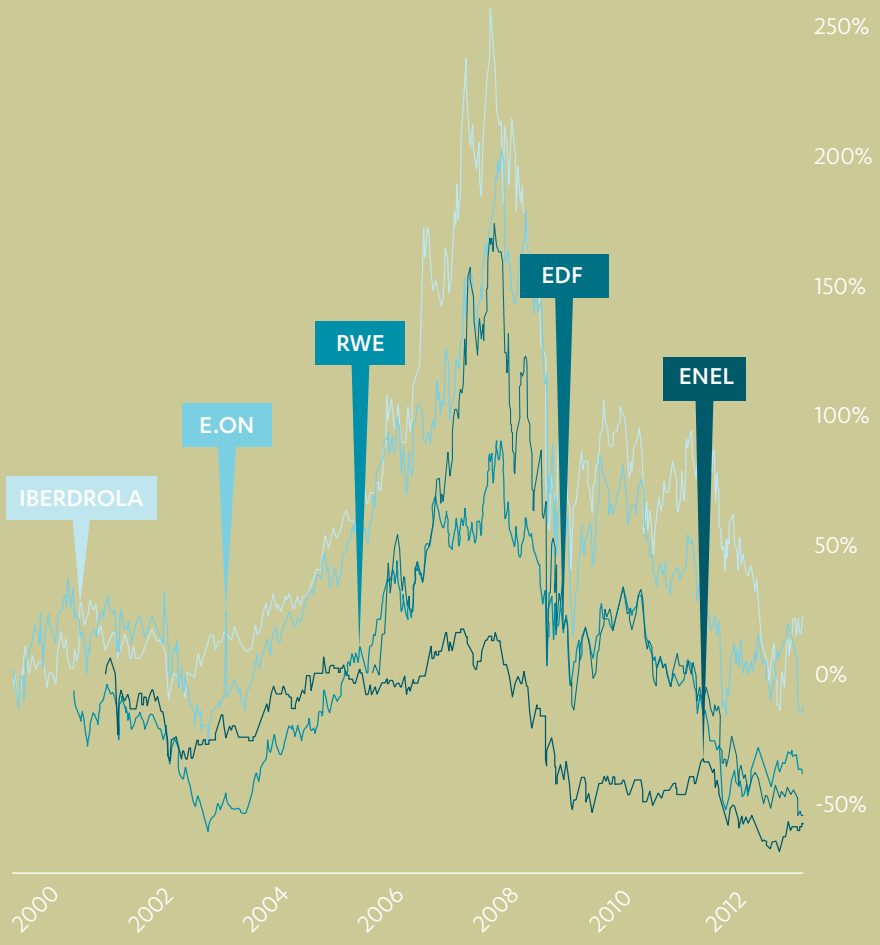
After the FiT law was introduced in Spain in 1994[138], Spanish utilities made sure they kept control of developments: in 2005 they controlled 58% of Spanish wind production against the 1% of German utilities. Iberdrola, in particular, has been a forerunner in renewable energy development among the larger European utilities. Its strategy has included proactive engagement on renewable regulations, building good relationships with licensing authorities, and developing in-house resources, capacities and know-how through a range of local/regional partnerships.

For example, the company started to build up its capabilities in 1994 by installing six wind farms in Navarra. Its subsidiaries invested in building their own capacities in the design and manufacture of wind turbines (Gamesa, for example), installation, and grid connection. Today, Iberdrola has expertise along the whole wind-value chain. In addition to the domestic market, Iberdrola is also involved in foreign projects, including in the US, Brazil, Eastern Europe and the UK, through its subsidiary ScottishPower Renewables.

While Iberdrola has continuously increased its total worldwide capacities, it has increased its renewable share energy even faster. At the end of 2011 the company had 13.7GW in non-hydro renewables and 9.7GW in hydro – 51% of its total capacity. Its renewable share of generation output increased from 12.8% hydro and 10.7% renewable in 2007, to 12.2% hydro and 19.8% renewable in 2011[139]. The Portuguese EdP was also catching up, with an increase in wind production from 4.3% in 2006 to over 15% in 2010, for example, while maintaining a 22-24% hydro share.

In terms of global positions by 2010, Iberdrola became the largest wind-plant owner with close to 12GW capacity, followed the by the American NextEra Energy Resources (8GW) and the Portuguese EdP Renovaveis (6GW)[140].

SINCE EARLY 2000, IBERDROLA HAS MOSTLY OUTPERFORMED OTHER LARGE EU UTILITIES



WEEK OF 10 JAN 2000

- IBE.MC **3.16**
- EOAN.DE **16.50**
- RWE.DE **51.75**
- EDF.PA **31.76**
- ENEL.MI **7.25**

Source: uk.finance.yahoo.com


05

POSSIBLE STRATEGIES TO ADDRESS THE TRIPLE CHALLENGE

Change in the face of new market deregulation, the devaluation of nuclear assets, and breakthroughs in renewable deployment has already started, and it is expected to become more intense during the coming years. Change is inevitable in Japan, and the previous "successful" strategy of conserving the status quo – by avoiding effective market liberalisation and slowing down renewable developments – is no longer a useful guide.

Indeed, there are signs that Japanese utilities "are taking their tentative first steps to embrace competition that may end the regional monopolies that have supplied electricity since World War Two ... Resistance from the monopolies stalled deregulation in the 1990s, but that is changing as the government pushes through measures from simplifying procedures for building power stations to introducing subsidies for renewable energy."[141]

As Reuters has reported, Tokyo Gas, Chubu Electric Power, Electric Power Development, and seven other unidentified companies, approached TEPCO "on potential alliances" in power-plant construction, fuel purchases and retail. It is not clear if these utilities and others want to grab some of TEPCO's market, or genuinely want to build an alliance in order to limit future competition, or even potentially to start a consolidation process that can move very fast, as happened in the case of European and US utilities. It is also not clear why TEPCO is trying to seduce other utilities into new joint venture coal-plant projects with large financial risks, exposure to highly volatile coal prices, and changing environmental regulations; and, incompatibility with both deregulation and the renewable developments given coal's inflexibility[142].

These steps may seem to be purely tactical games. What is needed is much more. By learning from European and other experiences, Japanese utilities can improve their positions and make their portfolios more resistant to political, regulatory, and market changes. The following sections introduce eight potential strategies with this objective.

REDUCE INVESTMENTS IN CENTRALISED, INFLEXIBLE BASELOAD GENERATION

- As the EU and US experiences have shown, **baseload plants are potential stranded assets in deregulated deregulating markets**. In addition, as the share of renewables increases, there is less space for these inflexible capacities.
- Building new nuclear or coal plants takes too long, so they are **no real help to short-term capacity needs** in Japan. By the time they are completed, market specifics can change considerably.
- Before 2011, the Japanese electricity system operated with substantial reserve margins and Japanese nuclear reactor capacity factor (60-70% during last decade) was way below the 85% OECD average.
- **Generation capacity investments have been exaggerated**. An equally good supply security could have been maintained with less investment in power plants, and with more done to reinforce networks between regions, for example by easing the problems of the 50/60 Hz division and by strengthening interconnectors.
- The rolling blackout in Tokyo in March 2011 has shown the value of demand-side management tools and the need to improve inter-regional transmission[143]. A good step forward is the upcoming ¥300bn grid development project[144], with government support and the participation of TEPCO, Hokkaido Electric Power, Tohoku Electric Power, and wind companies, in order to link the windy coastal areas of Hokkaido and Tohoku to the transmission network.

UNBUNDLE INTO A JOINTLY UTILITY-OWNED TSO, POTENTIALLY SELL MINORITY SHARES IN TSO

- Utilities could unbundle all their grids into one national TSO, jointly owned by them. Or, they could merge only transmission grids and interconnectors to a jointly owned TSO, letting the regional utilities keep control over their distribution networks (for example, <110 kV).
- Additionally, they may float (on the Tokyo Stock Exchange) or sell a minority share, say 25%+1. This could help to significantly improve currently weak utility finances.
- This structure can meet ownership unbundling criteria, but keep utilities in control (collectively).
- Such a unified transmission grid would make financing grid/interconnector developments easier.
- It could be also worth looking at the deregulation model of the former Japanese telecom monopoly, NTT (with covenants). NTT was not broken up into pieces like AT&T, but was reorganised under a holding company and competition was introduced into each area.

FLOATING/SELLING MINORITY SHARES IN UTILITY GRIDS COULD FREE UP LARGE AMOUNTS OF CAPITAL

In the case of KEPCO, the transmission, transformation and distribution facilities had a combined book value of ¥2.3 trillion ($28bn US dollars) at the end of March 2012[145]. Selling a 25%+1 minority share would free up around ¥560bn (or $7bn) of capital for KEPCO, at book value.

TEPCO's network business has a book value of ¥4.9tn. Selling a minority stake could help consolidate TEPCO's balance sheet and could help finance its compensation account. The company applied for additional government support in November 2012 as clean-up costs escalated, and may even double from the previous estimate of ¥5tn[146]. The government has already injected at least ¥2.5tn into TEPCO for compensation and decontamination.

IMPROVE THERMAL EFFICIENCY IN EXISTING GENERATION PORTFOLIO

- In 2010 the **average thermal efficiency of Japanese thermal plants stood at 41%**. Today, it is likely to be worse, as mothballed plants with substantial problems have been restarted[147,148]. By comparison, the latest GE CCGT blocks for Chubu Electric have efficiency rates of 62%[149].
- Japan also has a **very low share of capacity in efficient co-generation** plants.
- Oil's share of power generation has decreased from 30% in 1990 to around 10%, but this is still significant and concentrated in old, low-efficiency facilities. TEPCO has more than 18GW of oil and LNG capacity over 30 years old. **Converting selected oil-fuelled plants** to LNG-fuelled plants may have a short payback. In Europe ENEL, an Italian utility, was the largest oil importer for decades until it converted most of its fleet into to gas.
- **Converting condensation plants to combined-cycle units** is another possibility. Kansai Electric Power[150] has already started to upgrade two gas plants[151], while Shikoku Electric is also working on upgrading the Sakaide plant and Tohoku Electric its Niigita plant.

REDUCE EXPOSURE TO COAL AND OIL PRICES, IMPROVE PHYSICAL AND FINANCIAL HEDGING

- Japan's[152] – and generally Asia's – high and increasing share of the LNG markets, and its increasing demand are pushing up prices[153]. There is a need to explore a range of options to reduce LNG prices, including demand reduction, demand pooling, arbitraging, source diversification, and hedging.
- **Demand reduction** has substantial opportunities. These include flattening load curves, supporting consumer energy efficiency with DSM tools, increasing renewable capacities, improving thermal efficiency of older gas power plants etc.
- **Demand pooling**. Strengthen buyer-side negotiation positions by coordinating purchases among electricity utilities, Japanese natural gas suppliers, industrial buyers and also other large international LNG buyers. Some of this has already started, for example TEPCO buys 60% of its long-term LNG contracts jointly with other utilities[154]. Utilities also work with Osaka Gas and Tokyo Gas, not only in building joint terminals, but also in sourcing LNG.
- **Arbitraging** between long-term contracts and spot markets, and timing of purchases, are important.
- **Diversify sources geographically**: Traditional LNG sources include Qatar, the United Arab Emirates, Malaysia, Indonesia, and Brunei. It is worth searching for alternative regions, for example in countries with LNG projects coming up between 2013 and 2020[155] such as Australia – see TEPCO, KEPCO and Tohoku Electric, which have already started to invest in Australian gas.
- **Work on decoupling LNG prices from oil** products, and making spot markets more liquid. Current LNG prices for Japan are around 5 times higher than US natural gas spot prices, and long-term contract prices are mostly linked to volatile oil prices[156].

- **Strengthen financial and physical hedging.** If properly hedged, the large increase in fuel costs would have resulted in substantial gains on derivatives, which does not seem to have been the case, based on a preliminary analysis of utility financial statements for the FY ended March 2012[157].
- **Physical hedging:** Utilities have started to directly invest in LNG producing facilities, for example KEPCO bought into an Australian LNG project in 2007, and TEPCO has been involved with Darwin LNG since 2001 and in Wheatstone LNG since 2009. Japanese industrial companies such as Mitsui and Mitsubishi also invested in Australian LNG production[158]. Chubu Electric Power is building a US LNG plant together with Osaka Gas, and Hokkaido Electric Power is building 1,600MW of LNG capacity.

KEEP CONTROL OVER THE BEST LARGE-SCALE RENEWABLE INVESTMENT OPPORTUNITIES (AT LEAST IN OWN FRANCHISE AREAS)

- **Speed**: Wind turbines and even large-scale solar have short lead times for installation, in comparison with thermal plants that need seven to ten years. Solar helps peak shaving during summer days.
- **Potential**: So far, only a small fraction of Japan's renewable potential is utilised, for example 2 to 3GW of the 1,880GW theoretical wind potential[159].
- **Risk management**: Controlling large-scale renewable energy facilities can help diversify supply portfolio and mitigate overall portfolio risks.
- **Regulation-proof**: Renewable investments are "regulation-proof" through their zero fuel costs, zero environmental costs, locational flexibility, investment reversibility etc[160].
- **Utilities also have strong comparative advantages** in large-scale renewable investments, thanks to their financial strength, access to cheap financing, lower equipment sourcing costs[161], etc. (see Chapter 4).
- **Utilities are also better equipped to combine different renewable sources**, for example wind and solar, whose feed-in patterns are weakly correlated.
- **Few good locations**: Early entry into renewables helps utilities to protect their market shares and to occupy the best available locations, and early renewable support systems are the most generous.
- **Costs**: Renewable costs are decreasing rapidly. They will soon be the cheapest source of electricity.

ARGUE FOR FIT INCLUSION FOR UTILITIES AND A NEW TARIFF STRUCTURE TO REDUCE DEMAND VOLATILITY

- **FiT inclusion**: Currently, utilities do not enjoy the benefits of the FiT system (similar to German utilities during the first FiT years). FiT inclusion could be in the interest of Japanese utilities.
- **FiT efficiency standards**: Strengthening the FiT through introducing certain minimum conversion efficiency requirements could also favour utilities. A good example is the "Top-Runner" programme, which stimulated energy efficiency[162] by setting mandatory efficiency standards based on the most efficient on the market.
- **Flexible tariff structures**: Current tariffs are flat without differentiation for peak and off-peak hours, and even recent utility requests for tariff hikes do not seem to challenge this[163,164]. More flexible tariff structures could help in saving electricity and shaving peaks, by introducing such DSM[165] tools as reducing fixed tariff elements, using "load curtailment" systems or dynamic pricing[166] to strengthen incentives for energy savings, and smoothing utilities' load curves.

ONGOING EXPERIMENTS WITH MORE ADAPTIVE/FLEXIBLE TARIFFS

There are many existing systems in the EU, the US, China and elsewhere, and useful experiments underway in the US with both hourly pricing and critical peak pricing[167]. Smart grids and smart metering systems create the technical basis for more sophisticated pricing mechanisms. There are several smart grid pilot projects[168] in Japan as well, including in Yokohama City, Kitakyushu City, and Kyoto.

UTILISE DECENTRALISED RENEWABLES THAT CAN REDUCE THE NEED FOR PEAK PLANTS

- Support local solar PV investments that can be useful to **reduce high demand volatility**, and reduce the need for expensive peak shaving.
- Japan has relatively peaky demand with great load variations, particularly in summer – peak demand reached 157GW in summer 2011. Given the summer mid-day peaks in the utility load-curves, it makes sense for utilities to allow and even support local rooftop PV and other solar developments in their area, as these may help smoothen their peak demand curves. In 2012 – before the new FiT system – PV contributed 1.2GW to meet the yearly peak demand[169].
- In Germany in May 2012, PV alone was able to meet around half of electricity demand for several days.
- The IEA 2011 World Energy Outlook sees the highest share in wind, solar and CSP within total new capacity additions thanks to the "higher correspondence between the peaks in demand – which are driven in part by air conditioning requirements on sunny afternoons – and the output of solar PV, which make up about 60% of the variable renewables capacity in operation in Japan by 2035."[170]
- Supporting small-scale solar PV can also help improve the utilities' eroded image with the dominantly anti-nuclear population.

REDUCE COSTS OF RE EQUIPMENT INTO JAPAN, AND IMPROVE POSITION OF JAPANESE MANUFACTURING

- Japan once was the leader in solar technology, but today renewable equipment is substantially more expensive in Japan than in the EU or in the US.
- Utilities could play a substantial role to increase competition among RE technology suppliers
- Current global over-capacity in solar PV and wind turbine manufacturing would help utilities to access equipment at the lowest prices ever (even at negative margins).
- Japan now has a chance to build up global leading positions in equipment manufacturing areas such as in floating offshore wind or marine energy.
- Consolidation in wind and solar equipment manufacturing seems inevitable, which offers Japan the chance to rebuild its lost leadership. If Japanese manufacturers miss the opportunity to lead global consolidation in the solar/wind equipment industries, then European, US and Chinese giants, such as GE, Siemens, Alstom, ABB and others, will consolidate and dominate the wind and solar equipment manufacturing within years.

LONG-TERM RELATIONSHIPS WITH EQUIPMENT MANUFACTURERS

The Japanese utilities have been working for decades with Toshiba (TEPCO, Chubu Electric, Tohoku Electric), Hitachi (TEPCO, Hokuriku Electric, Chugoku Electric), Mitsubishi (KEPCO, HEPCO, Kyushu Electric, Shikoku Electric) to build nuclear and fossil power plants. Now is the time to broaden these alliances to worldwide renewable technology positions, as even the market circumstances are favourable. For example HEPCO could be a great partner to help Mitsubishi in its bid to try to save struggling Vestas, one of the largest wind equipment producers.

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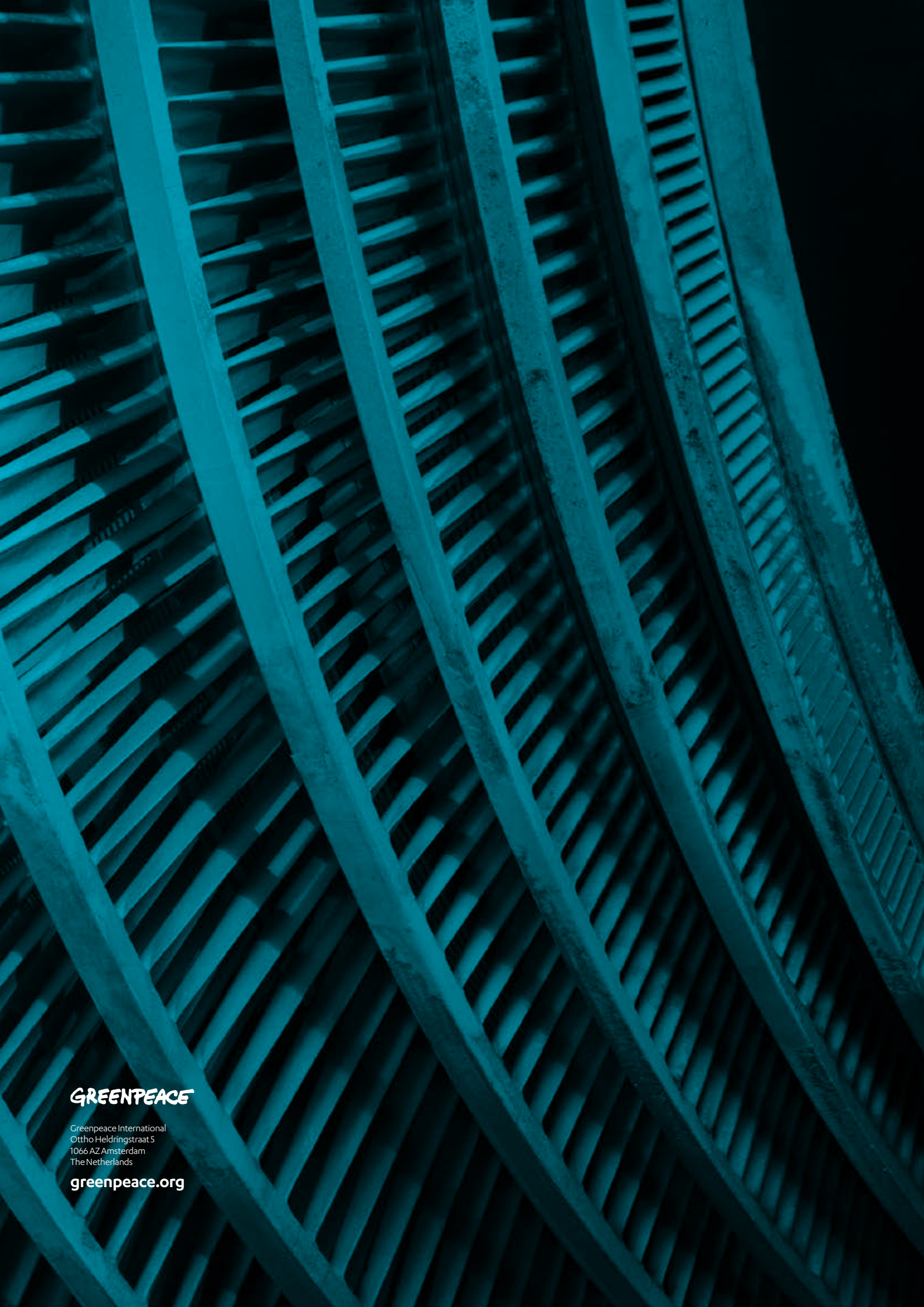

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