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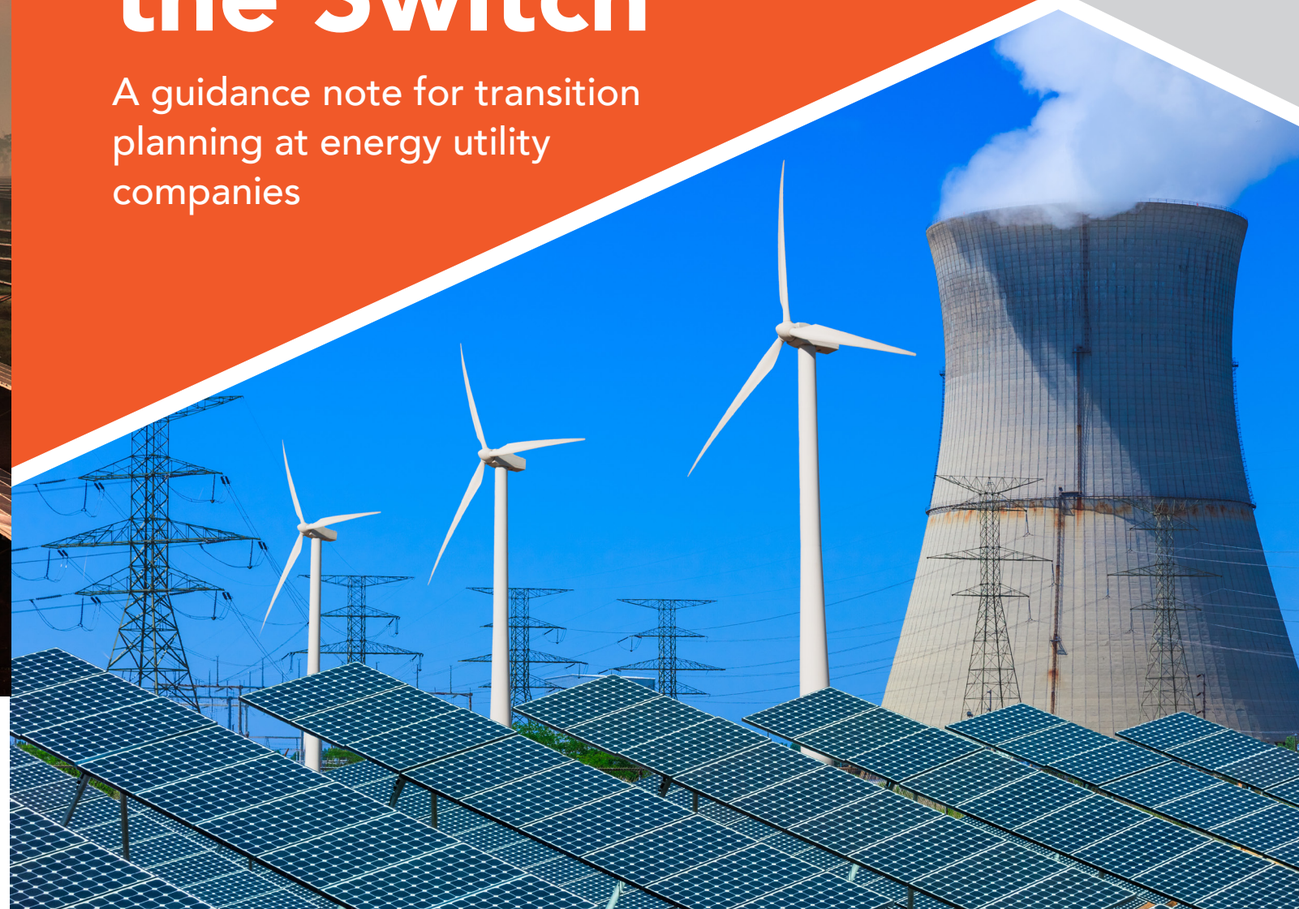
Flip the Switch

A guidance note for transition planning at energy utility companies



Contents

The need for utilities to rapidly develop and execute on transition plans is beyond dispute. Less clear is what an effective transition plan looks like. This guidance document provides a concrete framework for developing a transition plan that is fit for purpose in a world that must aggressively decarbonise. It is structured as follows:

Introduction

Purpose

This guidance note is designed to support dialogue between energy utility companies on the one hand, and asset owners, asset managers and other stakeholders on the other, on transition planning for a clean energy power system. The transition to a clean power system must be completed by 2050 at the latest; transition plans provide companies and their investors a shared basis of understanding how the utility company will chart its path through the coming energy transition, and the risks and opportunities along the way.

Context

> "When the rate of change on the outside is greater than the rate of change on the inside, the end is near."
>
> **Jack Welch, former CEO, GE**

Energy utility companies are facing huge disruption over the next twenty years through a combination of technological developments, new competitors, and regulation relating to climate change and air pollution. Many incumbents are not in a strong position, financially or in terms of leadership capacity, to meet these challenges. According to Credit Suisse HOLT data, in an analysis of 58 quoted US energy utility companies, only 16 had a consistently positive return on capital over the last five years, and only 15 have significant positive future value, with the median future value being 3.3% of enterprise value[1]. And utility companies' stock value is far more dependent on long term cash flows than any other sector[2]. There is a risk of loss of value right across the sector as has been seen in the case of coal, even before taking into account the IEA emissions targets.

In order to survive and prosper, incumbent utilities will need to take calculated risks and to pilot new technologies, generation, and grid systems. Investor support will be important, as returns on capital in the near term may need to be sacrificed for investments to drive business model transformation for long-term survival and growth. Hence, investors need to be "tough friends and stewards of assets". This point is made strongly in the recommendations of the Task Force on Climate Related Financial Disclosure (TCFD), which talks about the importance of 2°C scenarios as follows:

"The objective is to assist investors and other stakeholders in better understanding:

- the degree of robustness of the organization's strategy and financial plans under different plausible future states of the world;
- how the organization may be positioning itself to take advantage of opportunities and plans to mitigate or adapt to climate-related risks; and
- how the organization is challenging itself to think strategically about climate-related risks and opportunities".

[1] Enterprise Value – Current Value = Future Value (fade adjusted) where Current Value = (Net operating profit after tax / weighted average cost of capital) X Fade Rate on Return on Invested Capital and Enterprise Value = # Shares outstanding X Stock Price + Debt .(This calculation follow the same principles of business strategy, finance , valuation, future value and the corporate life-cycle of returns on capital used in the more robust Credit Suisse HOLT methodology.)

[2] See Figure 35 on page 31, All Swans are Black in the Dark. Available at: http://www.tragedyofthehorizon.com/All-Swans-Are-Black-in-the-Dark.pdf

TCFD recommendations, where relevant, have been included in the Commentary section as italicised boxed text. It will be apparent though, that a 2°C scenario is not a 2°C transition plan. It may be a precursor, and becomes a transition plan at the point where company and investors jointly agree that this is the one scenario among a number that will guide the company's forward path. Why should investors and companies take the step from scenario to transition plan?

For investors, the systemic risks arising from climate change are unpredictable, inter-related and pervasive. To fulfil their fiduciary responsibility to beneficiaries, particularly those who will still be dependent on their investments in the long term, they need to take action to avoid the worst consequences of climate change.

For energy utility companies, the profound changes that will be needed to survive and prosper in the rapidly changing marketplace are substantially the same ones that will result in reduced emissions. Climate change regulation, technology and new entrants all point in the same direction.

Hence this guidance note is intended to support an in depth discussion between companies and investors (on behalf of asset owners) on the long term path to profitability and growth in a rapidly changing world. The goal is to protect investors from climate-driven value destruction and to avert another 'preventable surprise'. It comprises eight questions, with linked background material, additional probing questions and metrics.

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About Preventable Surprises

Preventable Surprises (www.preventablesurprises.com) is a 'think/do' tank aiming to shift investors towards a more proactive role in anticipating crises in the global financial system. Our climate initiative focuses on the climate-related systemic risks that investors face across a diversified investment portfolio, which cannot be avoided by hedging or stock picking. We encourage investors to exercise forceful stewardship by voting for AGM resolutions requiring the companies they own to develop, disclose, and subsequently implement transition plans that reduce emissions in line with <2°C of global warming.

Acknowledgements

Many people have generously contributed insights and expertise to the writing of this guidance. The authors worked closely with staff at Ceres and CDP, as well as with Tom Murtha and Howard Covington, Senior Advisers to Preventable Surprises. We also received input from Colin Baines (Friends Provident Foundation), Penelope Curwen (Critical Resources), Mark Evans (Jupiter Asset Management), Mark Lewis (Barclays Investment Bank), Sanford Lewis (Attorney), Professors Catherine Mitchell and Anthony Froggatt (Exeter University), Sara Murphy (Sustainable Investments Institute), Hamish Stewart (ET Index), Carl Tishler, and Mark Van Clieaf (Organizational Capital Partners). None of them should be held responsible for, or deemed to agree with, this guidance note in its entirety. Organisations are listed for identification purposes only.

Setting parameters

Eight questions for the transition plan

1. **Are there clear short, medium and long term emissions goals that lead to the IEA targets of 184g/kWh by 2035 (or local targets, whichever is lower) and 40g/kWh equating to 95% clean electricity generation by 2050?**

The energy utility sector is the single biggest user of fossil fuels, and therefore achievement of the Paris target of keeping global warming to 2°C or less will depend critically on the sector rapidly reducing its consumption of fossil fuels. The IEA (International Energy Agency) has two relevant scenarios that yield a >50% chance that the increase in global temperatures will be kept to not more than 2°C. They are the World Energy Outlook 450 Scenario and the Energy Technology Perspectives 2DS scenario. (See Commentary 1A.)

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2. **Is there a long term business strategy (25+ years) to achieve 95%+ clean energy business model by 2050, including a long term power generation fuel strategy?**

Because of the long life of generation and transmission investments, decisions which will affect the achievement of a 95% clean electricity system in 2050 need to be considered over the next five to ten years. Investors and companies need to have a shared view of that trajectory. The business strategy needs to have key business model transformation milestones along the transition pathway to 2020, 2035 and beyond to 2050. The generation fuel strategy needs to take account of a) carbon dioxide emissions b) relative pricing of generation sources, including storage, at different scales c) demand side factors e.g. electric vehicles, space heating/cooling versus energy efficiency d) climate related stresses, e.g. water shortages, vulnerability to high winds e) likely business model transformation (see below). If the company is using a shadow carbon price, this should be revealed.

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3. **Is there a clear business plan, short medium and long term to adapt to a changed business environment and exploit new business opportunities in the face of new competitors and changing demand patterns?**

Given the level of uncertainty from so many factors, we suggest that investors ask companies to outline one or more scenarios for 2035 and 2050 under which they will be meeting the IEA targets, and then plan in detail on a rolling five-year basis as to how they will reach their 2035 and 2050 goals.

The business plan should incorporate at least the following aspects of the changing business model and core business process transformation:

- New clean energy end state (95% clean by 2050) and energy efficiency, as above
- New clean energy products and solutions and role in a new clean energy power ecosystem – distributed generation and transmission, storage, smart grid and grid reconfiguration, smart metering, electric vehicles
- Underpinning R&D strategy including direction and quantum of investment
- The timing of the phasing out of fossil fuel intensive plant, and implications for operations and the company balance sheet.

It should also display an understanding of who the leaders are in innovation worldwide.

4. Is there a short medium and long term capex plan showing relationship between ROIC and WACC and regulated ROE over the period of the transition? How will the expectation of growth, innovation and value creation based on the disclosed strategy affect the future valuation? Does the transition plan consider the impact on ROIC from potentially stranded fossil fuel assets, and the opportunities for increasing free cash flow from investment in renewable energy?

Taking the energy utility sector as a whole, future value is low compared with other sectors (median is 3.3% of enterprise value according to data from Credit Suisse HOLT 2016 compared with 40% in technology and 50% in consumer staples.) Hence the importance of the company making value-accretive investments that take into account the inherent risks of increased dependence on fossil fuels. The energy transition will demand investment from companies some of whom are already in a weak financial position (e.g borrowing to sustain dividend payments.)

5. Is there a clear view of the regulatory environment needed to support the transition and business model transformation strategy and a public policy plan to lobby for this? What are the company's working assumptions about how public policy affects its operating and investment decisions?

Future facing utility companies will be seeking to accelerate the transition and gain competitive advantage from early learning in the transforming market, not seeking regulatory cover to block it. This means companies leaving, or distancing themselves from, backward looking lobbying by established trade bodies.

6. Is there a corporate governance and succession plan to bring on board and deploy Directors who not only understand climate change and its impacts but also can conceptualize the new energy utility ecosystem and the company's place within it?

Companies will want a minimum of 2-3 Directors in key positions (audit, remuneration, risk) able to:

- Constructively engage with the CEO in assessing alternative paths short medium and long term to the clean energy transformation, including capital allocation between Business As Usual and strategically calculated bets on new business activities
- Set key metrics and incentive designs to align to the business transformation strategy
- Appraise CEO performance in executing a strategy that is likely to involve more innovation risk and uncertainty than in the past, and ensure that the CEO has the conceptual capacity and business model thinking to do this, or if not, determine the need for a new CEO.

7. Is there an organisation structure, succession planning, recruitment, retention, and development strategy (and supporting IT systems) for the CEO and senior leadership that recognises the imperative to recruit strategic thinkers able to conceptualise the new utility ecosystem, the changing value creation economics and the company's place within it? Is there a succession plan for the next generation of leaders up to 2050?

The CEO and senior leadership will need to be able to pay attention simultaneously to the day to day value creation through energy efficiency and innovation and the long term goal of 95% clean energy by 2050. They will need to be alert to competitive pressures from a wide range of new entrants, and enhance the organisation's skills base with skills in, among other things, product and process innovation and consumer marketing. Forward looking companies will show a new approach to managing the talent pipeline, in terms of remuneration, promotion, mentoring and recognition, to fast track innovative and visionary thinkers from within the company and encourage all employees to develop and implement innovative approaches to meeting transition plan goals.

8. Does the organisation demonstrate a good understanding of the risks from climate change – physical, transition, and regulatory/legal – including clear timelines when risks are expected to present and anticipated responses to them? Does the organisation in addition have an enterprise risk management system that recognizes the structural risks and leadership risks of the business model transformation to a clean power system by 2050?

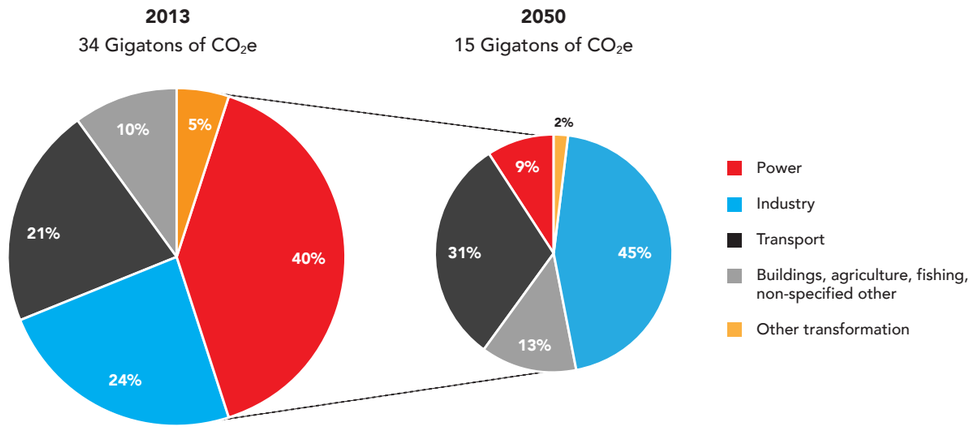
Today the sector is: stable; operations- and supply-driven; accustomed to long term capital projects; and monopolistic. Post transformation, it will be a highly distributed ecosystem with consumers acting as producers; with many different suppliers feeding into the grid; with storage capacity; and with demand shifting due to electric vehicles and electric heating/cooling in buildings that are increasingly efficient.

Systems level conceptual thinking in both board and senior management will be needed to integrate the risks arising from climate change, and from regulatory and legal implications of climate change, with the risks and opportunities arising from the transformation of the energy utility sector. There may be very few people within the utility sector with these business model transformation capabilities and recruitment from outside the sector will be needed.

A deeper dive

1 Emissions reduction target

Figure 1 - A climate compatible world looks different from today



International Energy Agency (IEA)'s "Energy Technology Perspectives 2016" model provides a roadmap for limiting global warming to 2°C

It is clear from this graphic from the IEA Energy Technology Perspective 2016 that the power utility sector (red) needs to do the largest share of the 'heavy lifting' in order to limit global temperature rise to 2°C. This requires that by 2050, 95% of electricity should be generated by non-fossil fuel sources, as illustrated in the IEA 450 scenario:[3]

"At the global level, the share of renewables in the generation mix increases from 22% in 2013 to 67% by 2050. Coal- and gas-fired power plants equipped with CCS reach 12% of generation in 2050, and the share of nuclear increases from 11% to 16%."[4]

With increasing scepticism about the technical and economic viability of carbon capture and storage (CCS) other technologies may need to be deployed on a larger scale. However Ontario shows what is possible, as the first jurisdiction of North America to go virtually fossil free. Its generation mix is 95.6% net zero GHG emissions (nuclear, hydro, wind, solar). Gas-fired power electricity is less than 4.2% of the fuel mix. A number of other countries with big hydro or nuclear installations are also at or above 65% non-fossil fuels.

The available fuel mix (not forgetting energy efficiency, the 'fifth fuel') will vary from place to place, but it will be helpful to have carbon emission targets along the way. The IEA suggests, for the US, not more than 184 g/kWh by 2035, coming down to 40 g/KwH by 2050. Decarbonisation pathways are extremely path-dependent, so for example a strategy to meet 2025-2030 carbon reduction targets through large scale investment in natural gas capacity may make it hard to get to zero by 2050 unless assets are retired before the end of their useful life. The Deep Decarbonisation Pathway Reports[5] show in detail bottom-up, country specific and sector specific examples of real decarbonisation pathways.

[3] For a useful comparison of different low carbon scenarios, see the Task Force on Climate Related Financial Disclosure Technical Supplemental The Use of Scenario Analysis in Disclosure of Climate Related Risks and Opportunities Table 2

[4] Energy Technology Perspectives 2016: Towards Sustainable Urban Energy Systems, OECD/IEA, Paris) p.37

[5] https://deepdecarbonization.org/ddpp-reports

Since utilities are generally regulated by a national or state/provincial regulator, the targets set locally are also relevant. Recent announcements include[6] :

United States	32% cut in electricity emissions by 2030 compared with 2005
Canada	30% cut in electricity emissions by 2030 compared with 2005
Germany	40% cut in emissions by 2020 compared with 1990
Japan	26% cut in emissions by 2030 compared with 2013
Australia	26-28% cut in emissions by 2030 compared with 2005

These targets do not necessarily meet the target of 2°C but are consistent with the commitment made by the countries in their NDC (Nationally Determined Contributions).

In the U.S., we can assume the new administration will dismantle the Clean Power Plan (CPP) and limit the powers of the EPA. However, even in the U.S., it is likely that regional renewable energy portfolio standards (RPS) will continue to be moved up. Depending on the jurisdiction, the RPS will range from 25% to 100% by 2020 to 2045 (California, Hawaii, Colorado, Maine, Nevada, New York, Vermont, Illinois, Minnesota, and most of the Canadian provinces as part of the North American power system). Other countries have more ambitious targets—for example the UK is aiming for a 57% reduction across the economy by 2030 compared with 1990. [7]

> *...even in the U.S., it is likely that regional renewable energy portfolio standards (RPS) will continue to be moved up*

Business and transition plans should assume that these goals will be met. PwC's latest Low Carbon Economy Index 2016 shows that across the world as a whole, at 2.8% the decarbonisation rate (i.e. the reduction in carbon use per unit of GDP growth) was only marginally below the NDC target for 2015 of 3.1%, though still well below the decarbonisation rate of 6.5% needed to limit the rise in temperature to 2°C. (The IEA has a more pessimistic view, estimating a reduction in 2015 of only 1.8%[8].) As all targets will be subject to a five-yearly upward-only ratchet in order to bring them into line, eventually, with the <2°C warming target, it is prudent to base strategies and long-term plans around the IEA 95% target—recognising that some will reach it more easily than others, depending on the utility's power plant legacy.

[6] Low Carbon High Stakes Accenture Strategy with CDP 2015

[7] https://www.theguardian.com/environment/2016/jun/30/uk-sets-ambitious-new-2030s-carbon-target

[8] IEA Energy Outlook 2016 p59

Supplementary questions

What assumptions about climate policy, including carbon pricing locally nationally and internationally, inform the transformation strategy?

Does the company have a mechanism to ensure it is well informed about the carbon reduction targets in the different territories in which it operates?

Metrics

Outline trajectory of reduction in carbon emissions.

Organizations should provide the following information:

- a description of what they consider to be the relevant short-, medium-, and long-term horizons, taking into consideration the useful life of the organization's assets or infrastructure and the fact that climate-related issues often manifest themselves over the medium and longer terms,
- specific climate-related issues for each time horizon (short, medium, and long term) that could have a material financial impact on the organization and distinguish whether the climate-related risks are physical or transition risks, and
- a description of the process(es) used to determine which risks and opportunities could have a material financial impact on the organization.

Organizations should consider providing a description of their risks and opportunities by sector and/or geography, as appropriate. In describing climate-related issues, organizations should refer to Tables A1 and A2 (pp. 100-101) TCFD Annex p 49.

2 Long term strategy – generation, fuel mix and demand for electricity

For the purposes of this guidance note, we recommend plans focus on two major waves of innovation and business model transformation. Up to 2035, the transition strategy should rely only on proven fuel strategies, technologies and system changes. From 2035 to 2050 it is appropriate to outline key business strategies, new technologies, and investment assumptions to further transform to clean energy power systems, given the long lead time for transformation. The long term strategy should take full account of the opportunities to grow the business by helping to switch as many energy end-uses to clean electricity as possible. This is not only good for the utility's business, but will help to protect investors against the systemic risks arising from climate change above 2°C.

Storage

The environment in which electric power utilities operate is undergoing rapid change, notwithstanding the recent U.S. election. The biggest single change that will 'flip the switch' is the imminent arrival of low cost and long term storage.

> *The biggest single change that will 'flip the switch' is the imminent arrival of low cost and long term storage.*

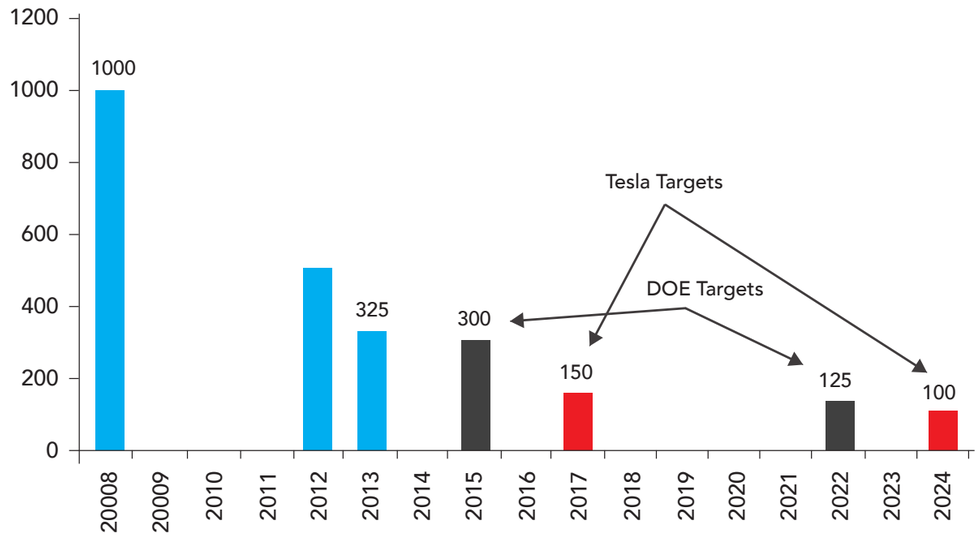
Together with the falling costs of renewable energy, smart grid management, and other low carbon power sources such as hydro and next-generation nuclear power, this will have a quadruple effect of enabling:

- More rapid growth of renewable power as the dominant part of fuel strategy, generation mix, and the smart grid.
- Increased independence of households, communities and businesses ('prosumers').
- Substitution of battery power for certain grid services.
- Faster market penetration of electric vehicles.

The effects of low cost storage are already being felt – for example in a December 2016 UK auction for capacity on the electricity grid, winning bids for new storage were roughly two thirds the price of competing new gas fired generation, and secured the majority of the contracts for new capacity.[9]

[9] https://www.ft.com/content/0f533cb6-bde6-11e6-8b45-b8b81dd5d080

Figure 2 - Historical Battery Prices, DOE/Tesla Targets ($/kWh)



Source: Deutsche Bank, DOE, Tesla

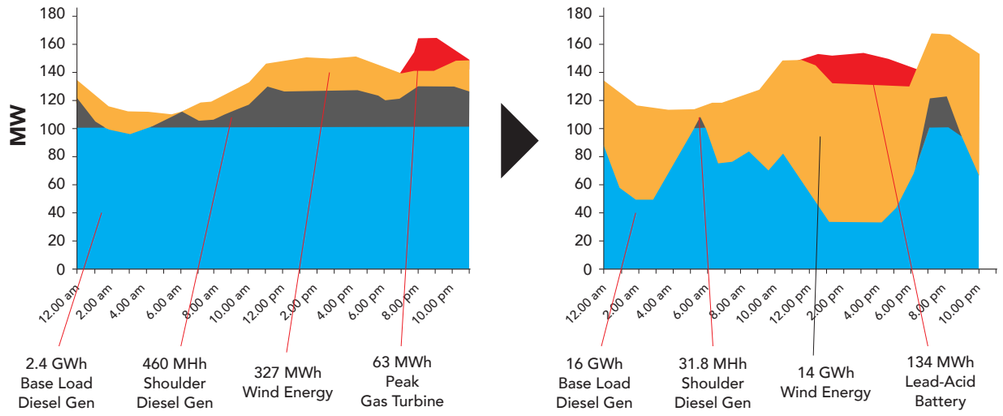
Without energy storage, there is a limit on the amount of variable renewable power that the grid can effectively manage. The availability of grid-level storage can remove this cap.

Particular applications of grid-level energy storage include:

- Smoothing of supply and demand, where batteries potentially offer both price and efficiency savings compared with peak-use-only fossil fuel plants;
- Compensating for sudden drops in renewable power, for example a cloud passing over a solar array;
- Complementing renewables for islands and off-grid scenarios, e.g. cellphone masts; [10]
- Providing more reliable power supply to businesses in areas with sub standard grid services, e.g. India and permitting more interconnections

[10] Battery storage for renewable: Market Status and Technology Outlook Irena 2015

Figure 3 - Impact of battery storage on fuel mix on an island [11]



The above graphic shows how the introduction of storage can reduce the use of fossil fuels, increase the use of renewables, and take out the need for a peak-load gas turbine. While the effects are particularly dramatic in a setting where inter-connection is not an option, similar principles will apply in many other situations. Battery power similarly offers a more efficient way to smooth supply and demand, while also providing voltage/reactive power support, frequency regulation, and black start capabilities. Overall, integration of additional renewables is forecast to be the most significant use for storage, followed by peak shaving.

Table 2 Grid-level battery use by application (% of total)

	2014	2023[12]
Integration of renewables	29	40
Peak shaving	20	15
Load shifting	18	37
Ancillary services	17	3
Other applications	16	5

[11] Balza, L. et al., Potential for Energy Storage in Combination with Renewable Energy in Latin America and the Caribbean, Inter-American Development Bank,Washington DC, USA. 2014 quoted in Irena 2015

[12] Battery storage for renewable: Market Status and Technology Outlook Irena 2015

Fuel mix

For the first time in 2015, additions of renewables-based generating capacity worldwide exceeded those from all other energy sources taken together, and total installed renewables capacity passed that of coal[13].

> *...it can be argued that wind and solar PV were cheaper in 2016 than coal and gas globally.*

Depending on the assumptions made about i) the cost of capital for renewables; ii) fossil fuel plant capacity factors; iii) financing costs of fossil fuels; and iv) carbon pricing for fossil plants, on average, it can be argued that wind and solar PV were cheaper in 2016 than coal and gas globally[14].

Alongside cost competitiveness, regulation will play a big part in determining which trajectory materialises. But concern about air pollution will also drive change. Around 6.5 million deaths are attributed each year to poor air quality, about half attributed to oil and coal consumption in power utilities, industry and vehicles. Governments are facing litigation from their failure to deal with air pollution, and health professionals are becoming actively involved, using the lessons learned from dealing with the tobacco lobby.

Demand for electricity

Demand for electricity is hard to predict, being the product of a number of variables. Roughly speaking, it can be seen as the growth in GDP in a particular territory, adjusted for the reduction in energy intensity of growth, plus new markets e.g. electric vehicles and electric space/water heating, minus energy efficiency measures in buildings and industrial processes. As temperatures rise, the energy demands of air conditioning are also likely to increase.

Energy efficiency

Improvements in energy efficiency, the 'fifth fuel', are reflected in the declining carbon intensity of economic activity. Most experts believe that considerably greater improvements in energy efficiency are both needed and possible. The ACEEE (American Council for an Energy-Efficient Economy) suggests that compound energy efficiency savings of 1.0–1.4% per year appear to be feasible, and savings of 2.0–2.6% per year might be possible, but have been infrequently demonstrated in practice.[15] European experience lines up with this assessment—the greatest gains in energy efficiency have been in private sector industries finalising a 17.6% cut in consumption over 14 years (in part through recession-related reductions in heavy emitting sectors). Over the same period, consumption fell by a little under 10% in the residential sector, while transport and services increased emissions by 2.2% and 16.5% respectively.[16]

To achieve higher rates of energy efficiency would require either more assertive government policies, including extending renewable subsidy schemes to energy efficiency projects[17], or more imaginative commercial offerings by organisations whose revenues are not solely drawn from supplying energy. With these conditions in place, ACEEE[18] reckons that energy efficiency opportunities could reduce electricity sales by 40-60% from current 2030 forecasts.

[13] IEA Energy Outlook 2016 p242

[14] End of the Load for Oil and Gas – Carbon Tracker 2016

[15] http://aceee.org/blog/2016/09/studies-suggest-past-rates-energy

[16] http://www.edie.net/news/6/UK-plays-leading-role-as-European-Union-hits-energy-efficiency-target-six-years-early/

[17] http://aceee.org/regulatory-filing/ceip-letter-091516

[18] http://aceee.org/research-report/e1502 quoted in Ceres 2015

An example of what can be achieved is the Japanese response to the Fukushima nuclear disaster[19]. In a short timeframe, demand in one of the affected regions was reduced by 18% (small businesses), 17% (households) and 15% (heavy industry). In another region, peak demand was cut by 20%.

Looking to the future, the City of Zurich set a goal of reducing by 2050 the per capita energy consumed by 50% and GHG emissions by 80%. After a positive citywide vote, the city developed a comprehensive strategy involving non-fossil fuel supplies, transport and building initiatives, and the assessment of projects and procurement against environmental impact. In a very different policy environment, one of the London districts, Haringey, has adopted the goal of a 40% reduction in primary energy use between 2005 and 2020, to be achieved by stitching together central government subsidy schemes with support for community mobilisation on reduction in use of fossil fuels. In the US, California enacted legislation that, among other measures, required the State Energy Resources and Conservation and Development Commission to establish annual energy efficiency standards that result in a 50 percent increase in statewide electrical and natural gas efficiency by 2030.

These are just three of thousands of place based initiatives in energy efficiency – over 7000 mayors of cities across the planet are putting in place measures to address climate change[20].

Less obviously, the IEA foresees an important role for greater efficiency in motors driving a whole range of production processes. A system wide energy efficiency approach, as assumed in the 450 Scenario, could reduce global electricity demand in electric motors by 8% in 2040, with additional cumulative investment in industry of around $300 billion outweighed by avoided investment in power generation of $450 billion[21].

Electric vehicles

There is no consensus on the speed of uptake of electric vehicles. At one extreme Exxon believes that as late as 2040, less than 10% of new registrations will be electric. Contrast this with VW's prediction that 25% of its sales will be electric vehicles by 2025. Adoption will vary by country, with high fuel prices encouraging the switch, and low prices, as in the U.S., inhibiting it. (UBS forecasts cost parity in Europe in 2021 and China in 2025, with the U.S. further out.) Although the largest installed bases are in China and the U.S., the most aggressive policies supporting adoption are in Norway (18% penetration already and the possibility of a ban on new sales of internal combustion engines as early as 2025), and the Netherlands (just under 10% penetration and considering a similar ban). California is on a similar track, aiming for electric vehicles to make up 30% of new sales by 2030.

Bloomberg New Energy Finance's New Energy Outlook 2016 shows light electric vehicles would add 8% to global electricity demand by 2040 if they reach 35% of new vehicles sales (c.40mm of 118mm). This is roughly consistent with Toyota's goal of an end to production of fossil fuel-driven cars by 2050.

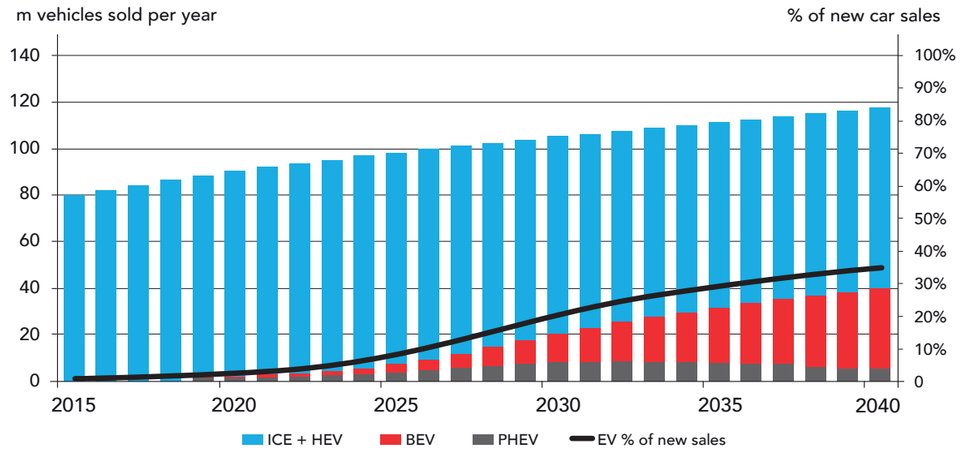
[19] Reset or Restart? The Impact of Fukushima on the Japanese and German Energy Sectors Chatham House 2012

[20] http://www.nationalobserver.com/2016/11/18/news/more-7000-cities-fighting-climate-change

[21] IEA Energy Outlook 2016 p283.

Figure 4 - The Rise of the Electric Vehicle

Battery electric vehicles and plug-in hybrids are predicted to gain on internal combustion engine and hybrids in coming years.



Note: Forecast uses gasoline and electricity prices from EIA's 2015 Annual Energy Outlook Low Oil Price scenario (ranging from $50pb to $65pb between 2015 and 2025).

Source: Bloomberg New Energy Finance

While this will require additional generation of electricity, and additional revenue if energy companies can capture a share of it, it may not however require commensurate additional generation capacity if cars are generally charged at night, when demand for power is low [22].

EVs will also contribute a growing share of the storage capacity in the system—an 8% penetration of electric vehicles could represent 25% of the total storage capacity in the grid. They will contribute to stabilising the grid and permitting a higher share of variable renewable power, but will potentially disrupt the order in which generation capacity is switched on, and could lead to the stranding of large high-variable generation capacity, depending on the regulatory regime at the time. In addition, the second life of EV batteries, once charging/discharging efficiency has reduced, as a resource for grid balancing, will contribute to driving down the costs of storage.

Demand from space heating/cooling

While over the next 20 years, demand from electric vehicles is likely to dominate growth in demand, in the long term, domestic heating needs to shift from fossil fuels to electricity, including CHP (combined heat and power) and ground-source heat pumps. For example, the UK's Carbon Plan states that by 2050, carbon emissions from heating and cooling buildings need to be near zero. Space heating represents a much bigger challenge than displacing the internal combustion engine. While there are some pioneering local initiatives[23] (Sweden already provides 20% of domestic space and water heating from heat pumps), it is unlikely to have significant impact on demand in the developed world until the 2030s[24]. However, the switch to use of electricity to heat water is more straightforward and could happen faster, particularly if half hourly tariffs are introduced on a wide scale, as the UK regulator is planning to do from 2017, so that water can be heated when demand is otherwise low.

[22] European Utilities: Fast Forward to the 21st Century Macquarie Research 2016

[23] http://www.greentoscale.net/en/green2scale-ratkaisut/residential-heat-pumps

[24] The Future of Heating: Meeting the Challenge DECC 2013 p 11.

Impact of climate related events and geosecurity

Long term strategies also need to take account of the potential impact of physical risk from climate change on capital plant in areas subject to storms, hurricanes, or rising water levels. Within the 20-year horizon of the transition plan, sea levels are expected to be 6-10 inches above 1992 levels. Combined with a doubling of the likelihood of severe storms[25], high winds and floods, this could put generation assets at risk, increasing the attractiveness of more distributed clean energy power systems, though these also have vulnerabilities.

Nuclear plants may suffer from shortage of water or increases in water temperature, and water shortages are already seriously affecting hydro power, e.g. in Brazil. Italy's increase in carbon intensity in 2015 was due in part to a forced substitution of gas for hydro power as a result of water shortages. Geo-political tensions may also make energy security a much bigger issue in some markets, in particular Western Europe.

Carbon pricing

Carbon pricing is becoming more widespread but it is not yet at a level that prompts significant movement towards renewables, although it can affect the location of carbon intensive businesses. A global carbon price now seems highly unlikely in the near future, but local carbon prices may begin to bite.

Supplementary questions

What generation mix is anticipated for 2025, 2035 and 2050? What contribution to meeting the emissions target will come from energy efficiency at plant level and what contribution from changing the generation mix?

Do calculations for investments in generation capacity take full account of empirical capacity and utilisation factors for different generation options, possible carbon pricing, and future price trajectories?

What assumptions are made about the price of fuel inputs and of storage over the transition period?

What is the timeline for phasing out coal-fired and oil and gas fired plants?

How is the company revaluing assets as projected closure dates approach to avoid large sudden write downs?

How will a smarter transmission system generate emissions savings, cost savings and increased margin medium and long term?

What plans are there to incorporate storage into the transmission system? How is this likely to affect operating costs?

How does the company track the factors affecting future demand e.g energy efficiency policies, growth of electric vehicle market, development of cost competitive options for space heating, impact of climate change on demand for air conditioning? How far out is demand modelled?

How is the possibility of future water scarcity factored into investment decisions?

[25] http://sealevel.climatecentral.org/ http://sealevel.climatecentral.org/

Metrics

A long term fuel strategy showing the fuel mix and associated carbon emissions in 2025, 2035 and 2050.

Guidance for All Sectors

Organizations should provide the key metrics used to measure and manage climate-related risks and opportunities, as described in Tables A1 and A2 (pp. 100-101) TCFD Annex, p49. Organizations should consider including metrics on climate-related risks associated with water, energy, land use, and waste management where relevant and applicable.

Where relevant, organizations should provide their internal carbon prices as well as climate-related opportunity metrics such as revenue from products and services designed for a low-carbon economy.

Metrics should be provided for historical periods to allow for trend analysis. In addition, where not apparent, organizations should provide a description of the methodologies used to calculate or estimate climate-related metrics.

Supplemental Guidance for the Energy Group

For all relevant metrics, Energy Group organizations should consider providing historical trends and forward-looking projections (by relevant country and/or jurisdiction, business line, or asset type). Organizations should also consider disclosing metrics that support their scenario analysis and strategic planning process and that are used to monitor the organization's business environment from a strategic and risk management perspective.

Energy Group organizations should consider providing key metrics related to GHG emissions, energy, water, land use and, if relevant, low-carbon alternatives that address potential financial aspects of shifting demand, cost of supply, reserves, and capital allocation. This could include examples such as:

Revenues

Investment in low-carbon alternatives (e.g., R&D, equipment, products, or services).

Expenditures

Indicative costs of supply for current and committed future projects (e.g., through a cost curve or indicative price range). This could be broken down by product, asset, or geography; by current internal carbon price or range of prices used in financial planning and analysis; by measurement of water used; by measurement of water used/withdrawn in regions with high or extremely high baseline water stress.

Assets/Liabilities

If relevant, a breakdown of reserves and/or long lived assets and an indication of associated emissions factors to provide insight into potential future emissions.

Capital

Relevant metrics to indicate flexibility of capital deployment, portfolio allocation and capital payback. This could include measures such as: proportion of capital allocation to long-lived assets versus short-term assets, capital payback periods or return on capital deployed, and/or investments in low-carbon alternatives (e.g., R&D, technology, products and/or services).

Suggested energy metrics from TCFD Annex p 57

(see Table 2 p 57 for more detail)

Percent of electrical generation capacity by source (e.g. coal, gas, solar, wind, uranium)

Total amount invested in renewable energy by type of technology and as a percentage of capital expenditure and acquisition

Total amount of renewable energy generated by source

Percent of electrical generation capacity based on hydroelectric generation in regions with high or extremely high baseline water stress

Percent water withdrawn (esp. in regions with high or extremely high baseline water stress)

GHG emissions intensity by asset

3 Short medium and long term business plan

The paradigm shift in the sector, with higher and more evenly spread value across the value chain, seems irreversible. The identified upside will be tough for incumbent utilities to capture, and it is rather unlikely that they will all be able to take part.

The transition to a 95% clean energy mix needs to take place at a time when the dynamics of the power utility sector are changing fast, driven by:

New technologies: smart meters, smart grids, storage, and possibly small modular nuclear reactors (SMRs technology), or next-generation nuclear power.

New practices: Time-based tariffs, time-zone shifting, greater use of demand response.

New entrants: 'prosumers', pure-play solar, wind, wave, and storage technology companies; other utility providers, e.g. telecoms, cooling services for data farms, and automotive and data companies.

The established utilities will need to make smart choices about where to situate themselves in the new value chain, while continuing to focus on maximising efficiency in existing operations in order to generate cash flow to invest in opportunities for future growth.

> *The established utilities will need to make smart choices about where to situate themselves in the new value chain.*

Key threats will come from the emergence of a whole range of new entrants, perhaps most significantly from the emergence of 'prosumers' i.e. consumers who are also producers.

Price competitive storage will accelerate the trend for individuals, communities and companies to generate their own electricity from renewable sources. At one level this could be seen as inefficient, compared with the economies of scale available at the utility level. However, there are other motivations driving this trend:

For individuals, the desire:

- to 'be green'
- to manage demand in line with when supply is greatest
- to enjoy cost advantages when renewables plus storage approach the wholesale, not the retail, price of electricity.

While there are limits to the proportion of households that can ever become 'prosumers', due to financial constraints, location, type of dwelling, etc., (possibly as low as 20% in the U.S.[26]), market research shows strong consumer interest in a number of countries, with South Africa and Brazil in the lead[27] with 88% and 81% interest respectively. The same may be generally true for countries that are facing rapid urbanisation.

[26] Pathway to a 21st Century Utility Ceres 2015

[27] Low Carbon, High Stakes Accenture Strategy with CDP 2015

For communities, including local government-led solutions:

- the opportunity to capture more value through the use of community assets (e.g. land and rooftops for wind and solar) and tapping community capital
- the potential for more flexibility on fees, e.g. subsidising low income households and time-slot charging
- funding projects for community benefit using the margin between retail and wholesale pricing.

For companies:

- to demonstrate green credentials to customers by buying green energy directly or generating it, as Google and others are doing
- to capture value from the electricity supply chain by using assets such as rooftops
- to invest in generation solutions that fit their particular pattern of demand.

In addition there will be new commercial entrants, including:

- Specialist renewable companies: In wind (DONG, Vestas, GE, Suzlon); solar (Sunpower, First Solar, Sharp Solar, Yingli Green Energy); and, possibly further out, wave energy.
- Storage companies: Not just batteries (e.g. Tesla) but pumped storage and other traditional solutions, driven by carbon regulation rather than technology.
- Smart grid solutions providers: Both utility scale and domestic (e.g. Active Network Management, Silver Springs Networks).
- Niche players, specializing for example in large data storage sites in cold climates (e.g. Hydro66); systems integration (e.g. IBM); telecommunications (e.g. Telstra).

Significant new generation capacity is being created by some unlikely competitors. In the US, Virint, a home security company, has installed 274 MW of solar power in Utah over the last five years, equivalent to a utility-sized plant. Waste Management has created 500MW of capacity using methane from its 130 landfill sites[28]. Apple invested $850m in a solar farm in California and, in 2016, was granted permission to sell that energy back to the grid[29].

While new entrants pose significant threats to both revenue and margins, there are also many opportunities:

- Offering a 'green only' energy option (major companies such as Ikea, Philips, BT and Unilever have pledged to use 100% renewable energy by 2020).
- Providing added value services, including sale, installation and maintenance of renewable and storage systems, and energy management services.
- Reducing the cost disadvantage of grid-based electricity by ironing out peaks and offering time-based charging (subject to regulation, system change, etc.).
- Providing energy efficiency audits for customers (residential and commercial).
- Offering innovative pricing/financing for both current usage and investments in generation and storage.
- Providing charging services for electric vehicles.

[28] A Strategist's Guide to Power Industry Transformation PwC 2015

[29] Carbon Tracker report

For suggestions on possible strategic directions, see *Low Carbon, High Stakes*[30] and *Beyond the Storm – value growth in the EU power sector*[31]. The former posits a potential value opportunity of €135 bb to €225 bb in saved and avoided costs, and €110 bb to €155 bb in new revenue per year worldwide in 2030.

As a Citi Research report concluded:

> *"We expect a new business model to emerge with (i) upstream focus on renewables and decentralized energy with conventional generation only as a back-up, (ii) midstream focus towards the creation of local distribution networks feeding into a smart and Pan-European transmission grid and (iii) downstream focus on services and facilities maintenance instead of supply. The pace of change will vary by country and plenty of stumbling blocks exist, the biggest of which is the lack of innovation track record in the utilities sector. However, the trajectory of change in our view is set and although the pace will be evolutionary (two plus decades), the outcome will be revolutionary".*[32]

Companies will need to reorient and probably increase their investment in R&D, with a clear strategy on whether to develop new products and services in house, or make acquisitions, and clear targets for the proportion of revenue to be derived from products and services which did not exist five years before. They will need to be alert to innovations worldwide that can be applied in their own market, and be aware of who the industry leaders are in making the transition and what can be learned from them.

Also, companies are unlikely to have in house the skills in consumer marketing needed to succeed in an increasingly competitive world, and will need to decide whether to acquire these through hiring or through acquisition of companies that have demonstrated strength in selling new products and services.

[30] 'Low Carbon, High Stakes' Accenture Strategy with CDP 2015

[31] Beyond the storm – value growth in the EU power sector McKinsey & Company 2015

[32] Pan European Utilities – The Lost Decade: Where Next? Citi Research 2013

Supplementary questions

What is the company's analysis of its competitive advantages?

Is there a clear long term business transformation strategy against which to assess investments in new business areas?

What is the vision for the relationship with customers in 2035? What changes do you expect in the size and makeup of the customer base?

What assumptions have you made about locally or nationally sponsored plans to increase energy efficiency over the period of the transition plan?

What value added services e.g. demand response, energy efficiency do you plan to offer customers over the next five years?

What will be the company's strategy in relation to domestic, community or business 'prosumers'? What products and services do you plan to offer to support 'prosumers'? How will value be captured from third party generators?

What is the vision for the relationship with customers in 2035? What changes do you expect in the size and makeup of the customer base?

How will customer satisfaction be monitored?

How will value be captured from third party generators?

Does the company have a good understanding of who the leaders are in energy utility transformation, and what can be learned from them?

What is the company's R&D strategy?

Metrics

% of revenue derived from products and services not in existence five years previously

Building on recommended disclosure, organizations should disclose how identified climate-related issues have affected their businesses, strategy, and financial planning.

Organizations should consider including the impact on their businesses and strategy in the following areas:

- Products and services
- Supply chain and/or value chain
- Adaptation and mitigation activities
- Investment in research and development
- Operations (including types of operations and location of facilities)

Organizations should describe how climate-related issues serve as an input to their financial planning process, the time period(s) used, and how these risks and opportunities are prioritized. Organizations' disclosures should reflect a holistic picture of the interdependencies among the factors that affect their ability to create value over time. TCFD Annex p 49

4 Capital expenditure

Nowhere is a long term perspective more necessary than in understanding the company's capital expenditure plans.

If, for any period of time longer than a couple of years, the return on capital does not exceed the weighted average cost of capital, the company is likely to lose the backing of investors, unless there is a clear strategic rationale.

It may be possible to lower the cost of capital through the use of green bonds, as Enel is planning to do.[33] Bonds that are framed in the context of an overall transition strategy should have greater credibility with investors.

Companies will face difficult decisions about the life expectancy of existing fossil fuel plant, if, as expected, their rate of utilization reduces as other cheaper and more flexible forms of load balancing emerge. New investments in fossil fuel generation capacity will need to be made against explicit assumptions about their longevity in relation to a 2°C trajectory.

Supplementary questions

In what circumstances, if any, would any item of generation plant be taken out of service before the end of its useful life?

How are decisions made on the allocation of capital between 'business as usual' and investment in new opportunities?

How far out has the company modeled cash flow to complement its investment plans?

[33] Environmental Finance 19.12.16

Organizations should also consider including in their disclosures the impact on financial planning in the following areas:

- Operating costs and revenues
- Capital expenditures and capital allocation
- Acquisitions or divestments
- Access to capital

If climate-related scenarios were used to inform the organization's strategy and financial planning, such scenarios should be described.

Supplemental Guidance for the Energy Group

Energy Group organizations should consider discussing how climate-related risks and opportunities are integrated into their strategy formulation and decision making as well as the key planning assumptions around:

Income Statement

Revenues — Energy Group organizations should consider providing carbon-pricing assumptions, including any internal carbon price applied, and how it is determined, and an assessment of the potential impacts on future operational revenues.

Expenditures — Energy Group organizations should consider describing the potential impacts of climate-related risks and opportunities on cost of supply and strategy for managing these impacts relative to market demand and competition. This may include discussions of research and development (R&D) expenditures, adoption of new technology, and costs of key inputs.

Balance Sheet

Assets/Liabilities — Energy Group organizations should focus on existing and committed future activities, noting any, if applicable, expected changes to the balance sheet or reserves (e.g., additional investments, restructuring, write-downs, or impairment). Energy Group organizations should consider describing their critical planning assumptions around legacy assets, for example, strategies to lower carbon-, energy-, and/or water-intensive operations.

Capital — Energy Group organizations should consider discussing whether applicable, and, if so, how GHG emissions, energy, and water issues are taken into account in capital planning and allocation. This could include a discussion of major acquisitions and divestments, joint-venture requirements, and investments in technology, innovation, and new business areas in light of changing climate-related risks and opportunities. Energy Group organizations should also consider providing an assessment of flexibility in positioning/repositioning capital to address emerging climate-related risks and opportunities. TCFD Annex p 49

5 Regulation and public policy

In all jurisdictions, this transformation will have profound implications for regulation, including but not limited to the following:

- As consumers continue to rely on the grid, but for a smaller proportion of their electricity consumption and in some cases for feeding in, how can the costs of maintaining the grid be covered? Will a fixed charge, similar to a broadband charge, be the preferred way forward?
- How can the role of storage be recognised in legislation?
- What is the equitable way for third-party generation organisations to connect to the grid?
- How will the carrying capacity of the grid for variable power be assessed and policed?
- How is responsibility for resilience and service levels shared between different generation providers?
- Will grid operators make consumers liable for any damage their battery storage systems cause to the grid?

Regulation will be just as much a driver/constraint on company strategy as before.

Hence in shaping a transition strategy and plans to 2035 and 2050 utility companies cannot avoid conclusions about what form regulation should take in order to support the transition.

> *...utility companies cannot avoid conclusions about what form regulation should take in order to support the transition.*

Different utility companies will inevitably choose different paths, putting different pressures on regulators. So although the big binary bets on which low carbon technologies get subsidies will fade away, the regulatory environment is likely to continue to be dynamic. Creating and managing constructive stakeholder relationships with regulators (regional and national) and helping regulators to recognize the risks in transition will be a key success factor for utility executive teams.

Attempting to block or slow change through regulatory capture will not succeed because increasingly customers will have a range of alternative power supply opportunities.

Companies need to work with regulators to advance the energy transition, not block it. The interests of incumbents and new entrants will often diverge – incumbents need to make a strong case for protection of their revenue base as they go through the transition, and support regulators' efforts to satisfy the trilemma of energy that is affordable, secure and meets climate change goals, without blocking innovation.

Similarly with public policy, companies should clearly set out their public policy positions – which organizations they support, what those organizations are doing to promote or block action on climate change, and what is the board's involvement in decisions on public policy and lobbying. A company that is serious about making the clean energy transition will—at the very minimum—be transparent about its public policy positions and trade association memberships, and both will be selected to support governments and regulators adapting to the transformation of markets and technologies.

Supplementary questions

Public policy[34]

What is the company's position on specific matters of climate and energy policy (e.g. capacity payments, renewables subsidies, energy-efficiency targets, carbon price, carbon tax, reform to local carbon markets)?

How are these policies made public?

Is the company playing a leadership role to help ensure policy makers determine sustainable policies that will serve the long-term interests of investors?

How much is spent on lobbying activity, and how is this divided between lobbying related to the traditional business model and lobbying for the clean energy transition?

What industry associations does the company have links with?

What is the governance process for managing these relationships?

How does the company ensure consistency between the policies needed to support the company's transition strategy and those articulated by your trade associations?

[34] With acknowledgement to 'IIGCC Investor Expectations of Electric Utility Companies 2016'

6 Corporate governance

In order to survive and prosper through the transition, companies will need radical transformation of their strategic planning processes, accountability and managerial structure, performance metrics, and executive succession planning processes. This needs to begin with the board of directors.

Boards need to assess their competence in relation to the very different business environment they will face in the future, compared with the past.

> *Boards need to assess their competence in relation to the very different business environment they will face in the future, compared with the past.*

Outside assistance may be useful, and involvement of unions/employees will be important to ensure a just transition that safeguards their interests, as far as possible.

Boards will need to include at least two or three directors with a good understanding of climate change. These should not be 'single issue' climate specialists, but rather members who can contribute to board discussions in the round and have a good appreciation of sources of information on climate change drivers, risks and time frames.

The board as a whole should have a demonstrated level of conceptual capacity and systems thinking in relation to the transformation of both the industry eco-system and the company's own strategy. The board must support management in the transition while sharing risks and opportunities with lead investors. In particular the chairs of audit/risk and remuneration committees should be fully up to speed with transition objectives and targets so these can be fully integrated into the work of these committees (see risk section below). Designing executive succession planning, selection and development for the next four generations of management will be critical to leading transformation of the utility business model and the industry eco-system.

Supplementary questions

Has the board undertaken a formal review of its competence in relation to the emerging business transformation strategy? What were the conclusions?

How have the remits of the audit and risk committee been amended to reflect the business transformation strategy?

Board

How is the board ensuring that climate competency is central to new appointments?

What are the processes and frequency whereby board and/or board committees are informed about climate-related risks?

How does the board monitor and oversee progress against goals and targets for addressing climate-related issues in both the near and the transition term plans?

How is the board addressing the needs to enhance the organisational structure and talent development of senior management to encompass additional skills needed for a successful transition?

How are performance measures, remuneration and long-term incentives adjusted to reward long-term progress towards the end state of the transition plan, as well as meeting short-term operational and financial goals?

Is there a broad-based CEO and executive succession plan to 2050, including tools to assess the cognitive capacity of C-suite staff?

Metric

Change in average length of term of board members

In describing the board's oversight of climate-related issues, organizations should consider including a discussion of the following:

- processes and frequency by which the board and/or board committees (e.g., audit, risk, or other committees) are informed about climate-related issues,
- whether the board and/or board committees consider climate-related issues when reviewing and guiding strategy, major plans of action, risk management policies, annual budgets, and business plans as well as setting the organization's performance objectives, monitoring implementation and performance, and overseeing major capital expenditures, acquisitions, and divestitures, and
- how the board monitors and oversees progress against goals and targets for addressing climate-related issues.

Supplemental Guidance for the Energy Group

Energy Group organizations should consider describing whether and how performance metrics for board and management, including links to remuneration policies, take into consideration climate-related risks and opportunities. TCFD Annex p 48

7 Senior leadership team

In addition to new skills at board level, new skills and knowledge will be needed among employees, particularly:

- C-suite leaders (direct accountability for strategy for the energy utility eco-system transformation and utility business model transformation)
- Other staff complement (development and marketing of new clean energy products and solutions, energy efficiency and GHG reduction process innovations)

In the past, senior executives were selected for their ability to manage a complex, integrated, stable, capital-intensive business in an environment that was heavily regulated, with high barriers to entry. Key skills needed were in-depth knowledge of the energy utility sector, operational experience, financial management and capital planning, and safety assurance. These skills will continue to be relevant for the continued operational oversight of existing generation and T&D assets, focusing on the need for positive returns and cash flows to internally fund the transition to a clean energy system, as well as emissions reductions through increased efficiency.

But a completely different and arguably higher order skill set will be needed to plan and execute the transition, focusing on strategic thinking, intellectual curiosity, risk taking, and rapid decision making, as well as a sound understanding of drivers of change in technology and climate regulation.

The CEO and senior executives must be able to conceptualise and assess different pathways to the end goal of a clean energy power system, including drivers of change and ways in which new and undiscovered technologies may play a role.

> *The CEO and senior executives must be able to conceptualise and assess different pathways to the end goal of a clean energy power system, including drivers of change and ways in which new and undiscovered technologies may play a role.*

They will need to understand how new business models for generation, transmission and distribution interact and be explicit about the strategic milestones, and timescales for key decisions to be made. There is a limited pool of people with the capacity to plan at the level of complexity required and the search will probably need to go wider than the energy utility sector.

Below senior management, new skills will be needed in R&D, strategic planning, technology forecasting and consumer marketing, including market research. Critical roles will include innovation for new clean energy products and solutions across the company's entire value chain, and the translation of the innovations associated with the long-term transition strategy into operational processes. Performance metrics and decision making structures will need to be redesigned to reflect the new business environment. Remuneration policies will need to reflect the demands of simultaneously generating returns from existing assets while making well-timed and considered moves into new territories and being on course to achieve the target reduction in emissions. Remuneration must be competitive to promote the recruitment and retention of skilled people with the conceptual thinking capacity to operate at the level of business and ecosystem transformation.

Supplementary questions

What is the organisational model and staffing strategy to identify and attract staff with the competencies and experience to support the transition, including the five-year business plan, and ensure successful integration of staff bringing new skills with the rest of the organisation?

How is responsibility for climate-related issues assigned to senior staff? How do the relevant staff ensure they are informed about climate-related issues and the impact on business strategies and risk management?

How do staff and board interact on climate related issues?

What arrangements are in place to monitor staff satisfaction as the business transformation progresses?

How far ahead is the company looking in C-Suite succession planning?

Guidance for All Sectors

In describing management's role related to the assessment and management of climate-related issues, organizations should consider including the following information:

- whether the organization has assigned climate-related responsibilities to management-level positions or committees; and, if so, whether such management positions or committees report to the board or a committee of the board and whether those responsibilities include assessing and/or managing climate-related issues,
- a description of the associated organizational structure(s), processes by which management is informed about climate-related issues, and how management (through specific positions and/or management committees) monitors climate-related issues. TCFD Annex p 48

8 Risk management

The performance of the company in managing risks and identifying and exploiting new opportunities through the transition will be critical to its survival and growth. Risk management will need to encompass both physical adaptation risks associated with climate change (for example rising sea levels, water scarcity, increased storms) and transition risks arising from changes in technology, markets, and regulation that will affect the achievement of its business and transition strategies. Litigation risk may also emerge as an issue.

Supplementary questions

What are the arrangements for monitoring, and shaping responses to, the following risks?

- Acute physical risks from increased extreme weather, such as cyclones, floods and droughts
- Chronic risks, such as secular changes in rainfall, temperature, sea levels, and extreme variability in weather patterns
- Increased pricing of GHG emissions
- Enhanced emissions-reporting requirements
- Mandates on and regulation of existing products and services
- Exposure to litigation
- Substitution of existing products and services with lower emissions options
- Unsuccessful investments in new technologies/products/services
- Upfront costs to transition to lower emissions technology
- Changing consumer behaviour
- Uncertainty in market signals/regulatory environment
- Increased fuel and other input costs
- Shifts in consumer preferences
- Stigmatisation of sector
- Increased activism

Guidance for All Sectors

Organizations should describe their risk management processes for identifying and assessing climate-related risks. An important aspect of this description is how organizations determine the relative significance of climate-related risks in relation to other risks.

Organizations should describe whether they consider existing and emerging regulatory requirements related to climate change (e.g., limits on emissions) as well as other relevant factors considered.

Organizations should also consider disclosing the following:

- processes for assessing the potential size and scope of identified climate-related risks and
- definitions of risk terminology used or references to existing risk classification frameworks used.

Organizations should describe their processes for managing climate-related risks, including how they make decisions to mitigate, transfer, accept, or control those risks. In addition, organizations should describe their processes for prioritizing climate-related risks, including how materiality determinations are made within their organizations.

In describing their processes for managing climate-related risks, organizations should address the risks included in Tables A1 and A2 (pp. 100-101), as appropriate.

Supplemental Guidance for the Energy Group

With specific consideration of the income statement and balance sheet implications described earlier and any significant climate-related risks identified, Energy Group organizations should consider describing actions taken to prevent and mitigate any relevant climate-related risks or take advantage of opportunities (e.g., procurement of low-carbon substitutes as inputs, development of lower-carbon products and services, investment in low-emissions technologies, and other activities to reduce emissions and increase resilience to climate-related impacts).

Guidance for All Sectors

Organizations should describe how their processes for identifying, assessing, and managing climate-related risks are integrated into their overall risk management. TCDF Annex p51