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The road ahead
Gaining momentum from energy transformation

Megatrends and disruptions are having profound implications for the strategies and future role of companies all along the power utility value chain.

We map the impact on the power sector and look ahead at what it might mean for future market and business models.

Making the right moves now will be vital if companies are to be a successful part of energy transformation.

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Introduction

The impact on the power sector from the convergent forces of changes in customer behaviour, new forms of competition, renewable and distributed energy and regulation is creating new opportunities and challenges. The root causes for these developments are global megatrends that are affecting all markets and are having particular impacts on power.

Norbert Schwieters
Global Power & Utilities Leader

This report looks at the overall trends that are shaping tomorrow's market environment and the market designs and business models that might ensue. It looks at the disruptions affecting companies and introduces PwC's Energy Transformation framework. The framework helps companies map the effect on them all the way from the root causes through to impacts on future market designs and business models, addressing questions such as:

- *What will the future market design look like?*
- *Who will be your competitors?*
- *What will customers want?*
- *How might regulation be responding?*
- *What are the implications for the company's purpose, role and positioning?*
- *What will be the winning business models?*

The changes affecting the power utilities sector have provoked some apocalyptic phrases from headline writers. We're much more optimistic. True, if companies don't stay ahead of change, the dangers they face will intensify. But if they make the right moves to address the challenges they face and embrace the opportunities, they can be a successful part of energy transformation.

The forces of transformation

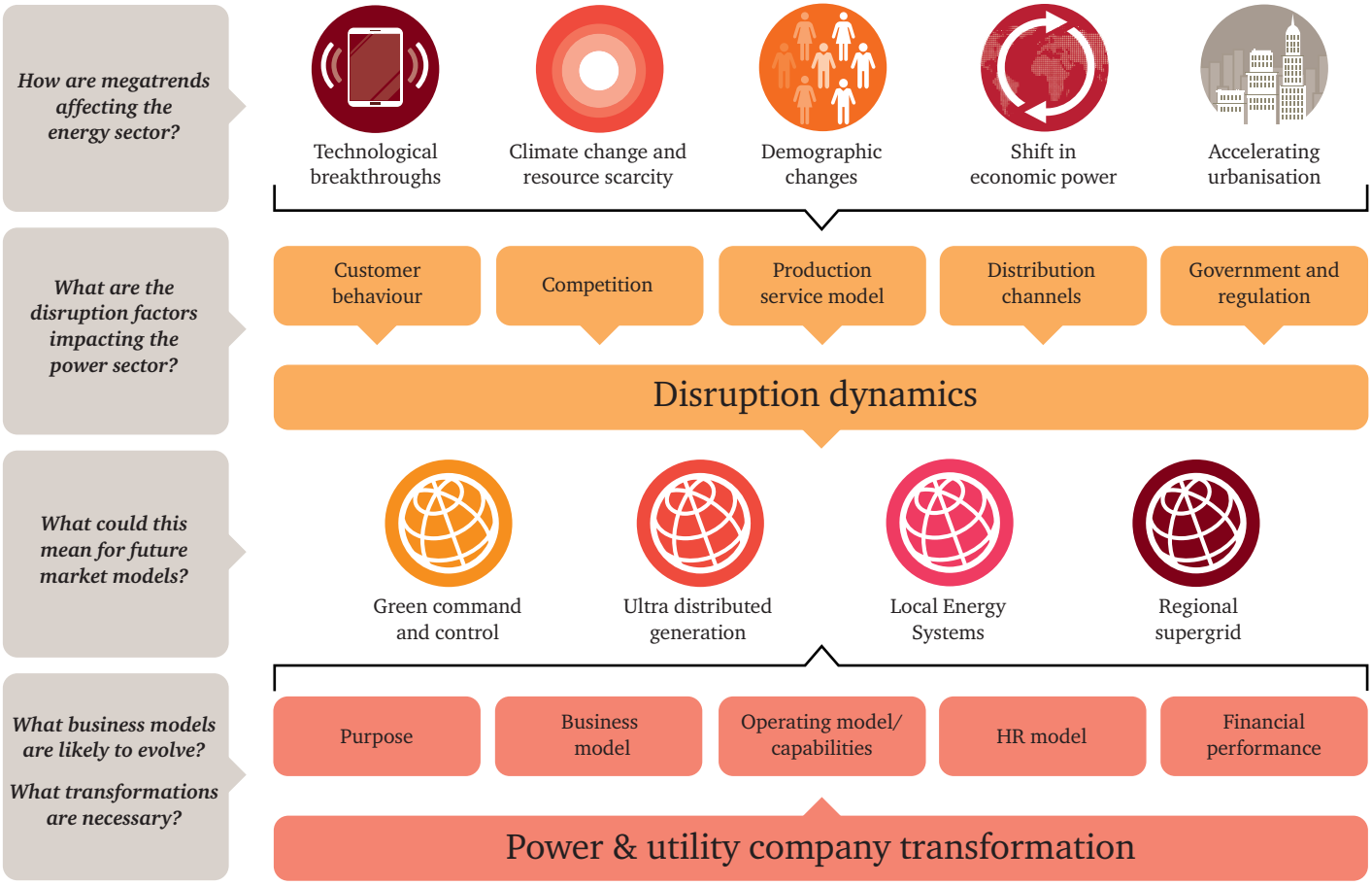
Energy transformation is being driven by five global megatrends interacting with and amplified by a set of shifts taking place within the power sector. The five megatrends – technological breakthroughs; climate change and resource scarcity; demographic and social change; a shift in global economic power and rapid urbanisation – are challenges for all businesses.

But in the power sector their impact is made all the greater by a number of simultaneous disruptions, involving customer behaviour, competition, the production service model, distribution channels, government policy and regulation. The extent and nature of these disruptions vary from market to market. But in many markets, their intensity is making their impact transformational rather than incremental.

Some of the changes arise from the megatrends – for example the regulatory encouragement of renewables in response to climate change concerns – while others heighten the impact of particular megatrends – for example the potential for rapid urbanisation to accelerate the roll-out of distributed energy and micro-grids.

Together these megatrends and the changes taking place in and around the sector have profound implications for the strategies and future role of companies all along the power utility value chain. They are combining to have a disruptive impact which will lead to the development of new market models and require companies to pursue new business models (see figure 1).

Figure 1: PwC energy transformation framework



Global forces – five megatrends impact power

Technological breakthroughs

Technological innovation is at the heart of the shifts that are occurring in the power sector. Advances are happening in many parts of the sector – for example, in large-scale technologies such as offshore wind and high-voltage DC transmission, in distributed and smaller-scale customer-based energy systems and on the load side. Power is being transformed from a top-down centralised system to one that is much more interactive but also decentralised and fragmented. Elements of the old centralised system are becoming stranded and there's a need to find an alternative investment model that recognises technological advances.

In many jurisdictions, renewable power is replacing or has the potential to replace fossil fuel generation. Smart grids are delivering the potential for greater interactivity with customers. And the scope for even more transformative technological breakthroughs is being taken more and more seriously all the time. A breakthrough in the cost and practicality of battery storage technology could be a quantum leap enabler, opening up the possibility of off-grid customer self-sufficiency when used in combination with 'own generation'. 'Power to gas' is also a potential transformative technology. All bring opportunities for incumbent power companies but many also have the effect of eating away at a utility company's traditional revenues and undermining the traditional utility business model.

Other technologies, notably the combination of the internet, mobile devices, data analytics and cloud computing with smart grids and smart metering, present opportunities for utility companies to get closer to the customer, play an enhanced 'energy partner' role and exploit data opportunities. Analytics capabilities, which today are generally of a low to moderate standard within utilities, will need to be a core strength in the future if companies are to fend off competition from new entrants who already have these capabilities at the heart of their business.

Climate change and resource scarcity

The energy sector is on the frontline of concerns about climate change. The sector as a whole accounts for more than two-thirds of global greenhouse-gas emissions[1] with just over 40% of this stemming from power generation. Resource scarcity or availability, and the associated geopolitics and economics of gas, oil and coal supply, are key factors shaping power market policy.

A growing emphasis on renewables is a response to both climate change and security of supply concerns. In the US alone, over 30% of new electricity generation capacity added in 2010–2013 involved solar and wind power, up from less than 2% in 2000–2003.[2] Solar photovoltaic (PV) is now present on more than 1.2 million Australian homes and producing over 3.3GW per annum.[3] In Germany, renewables accounted for 24% of gross electricity consumption in 2013[4], placing the country slightly above the growth trajectory needed to reach its 2025 target of 40 to 45%.

Energy efficiency has also risen up the policy and customer agenda. Together, renewable technologies, energy saving and a different customer outlook are leading to a transformation of the electricity environment. They are causing the value chain to shift, away from large conventional power plants towards local power generation, and a greater focus on distributed energy and demand management.

Transformation is also very relevant to developing countries, many of which face the triple challenge of being unable to meet existing demand for electricity while also facing huge demand growth and the need to extend access to those who don't have electricity. The need for good demand management is already very familiar in countries such as South Africa where managed outages and demand restrictions are commonplace. Technological advances will enhance this response as well as present the opportunity for expansion of power in ways that may leapfrog the traditional grid evolution route.

Demographic changes

Within the next minute the global population will rise by 145. By 2025, we'll have added another billion people to reach about eight billion. Explosive population growth in some areas set against declines in others makes for very different power market growth potential in different parts of the world. Africa's population is projected to double by 2050 while Europe's is expected to shrink.

The growth prize for power companies of serving expanding populations is a big one. For example, Nigeria's population is expected to exceed America's by 2045. But the infrastructure challenge in many countries is immense and not all growth markets are readily open to international expansion. Companies seeking to reposition their geographic footprints towards faster-growth countries will also need to have a clear view on the impact of energy transformation on these countries. The prospect of bypassing the grid and leapfrogging to new local distributed technologies and market models is not unrealistic if the pace of technological advances and cost reductions continues.

Shift in economic power

The focus of global growth has shifted. Looked at historically, we come to realise that western economic strength is a relatively recent phenomenon and the current developments we see are essentially a rebalancing of the global economies.

As fast-growth economies become exporters of capital, talent and innovation, the direction of capital flows is being adjusted in a way that is quite different from the traditional routes from developed-to-emerging and developed-to-developed countries.

We are already seeing significant east-west and east-south investment flows in power markets, involving both financial investors and power sector corporate investors. For example, Chinese state-owned power and utilities companies have been active in their search for suitable international power utility and grid investment opportunities. Europe, South America, Australia and other parts of Asia have all been targets for expansion. Sovereign wealth funds and pension fund investments in the sector have also become multi-directional. The challenge for many power companies is access to scarce capital from this global flow of capital, minimising the risk of stranded investments and seeking innovative ways of securing investment in replacement assets.

Accelerating urbanisation

Over the next two decades, nearly all of the world's net population growth is expected to occur in urban areas, with about 1.4 million people – close to the population of Stockholm – added each week.[5]

By 2050, the urban population will increase by at least 2.5 billion, reaching two-thirds of the global population.[6] Fast urban expansion presents a major challenge and an opportunity for power utility companies. The speed of urban growth puts a big strain on infrastructure development. In Africa, already large cities such as Lagos, Kinshasa and Cairo are going to become megacities, with more than 15 million people. The population in Nairobi is set to more than double between now and 2025.

Power companies can play a pivotal role in ensuring future cities become 'urban smart' rather than 'urban sprawl'. They have the potential to be lead players at the heart of future city infrastructure but it will require a new mindset and the development of new partnerships. And, of course, the pace and nature of urbanisation in fast-growth and developing economies takes a different form than in the west. In the former, the challenge is very fast growth on top of already stretched or absent infrastructure. In the west, rural urbanisation is a trend alongside big city growth.

Snapshot: Faster technology development, falling costs

The time it takes to go from breakthrough technology to mass-market application is collapsing. In the US, it took the telephone 76 years to reach half the population. The smartphone did it in under ten years.

The price of new technologies is falling equally rapidly. An analysis by UBS predicts shrinking battery and solar costs will make the combination of electric vehicles, solar panels and stationary batteries for excess power a compelling proposition in many markets within the next ten years. It estimates the combination of an electric vehicle + solar + battery should have a payback of 7–11 years, depending on the country-specific economics.[7] After that, the electricity generated is truly 'free electricity' for the remainder of the lifetime of the equipment.

Falling costs have the potential to introduce a new challenge to the power utility business model. If they translate into actual falls in the price of electricity itself, the industry will have to move away from the default assumption of ever-rising prices, on which many of its deals and investment are based.

Disruption dynamics

The disruption taking hold in the power sector is just the start of an energy transformation. It's not a question of whether the business models pursued in the sector will change but rather what new forms they will take and how rapidly companies will have to alter course. Companies need to be sure they have fully factored into their strategic planning the megatrends and changes discussed in the previous chapter.

The pace of change will be different in each market and each specific situation. The important thing for companies is that they assess their strategy and implement the changes they need to make in time or, even better, ahead of time. Already, of course, many have reset their compasses with a switch in priorities and emphasis. But will this be enough and what more needs to be done?

We see five areas in which disruption is having an impact and where it will be important for companies to assess their strategies:

- customer behaviour
- competition
- the production service model
- distribution channels
- government and regulation.

Together they form the context in which future market and business models will be framed. For each one it is possible to identify developments that are happening now and which, if they accelerate or impact in combination, could intensify disruption dynamics.

Snapshot: Google eyes power opportunity

Addressing a recent PwC roundtable on customer transformation,[8] Google's Chief Technology Advocate Michael T. Jones described the internet as "machines talking to machines. It can develop in all sorts of ways whether it is components on a 747 or your roof tile sending an SMS saying 'replace me, I'm starting to leak'." Moving on to the world of power, he observed: "All electronic devices will talk about their power needs to an aggregator and you can have an auction for the power for each one. All you need is someone to identify what the rates are."

Google already holds a wholesale power licence in the US. Its January 2014 acquisition of Nest Labs for US$3.2bn also gives it a position in home automation with ownership of a company that has built a position selling thermostats and smoke alarms for the home. At the time of the acquisition, Tony Fadell, CEO of Nest, said: "Nest will be even better placed to build simple, thoughtful devices that make life easier at home."

Customer behaviour

We're already seeing a gradual erosion of power utility company revenues as distributed energy gains an increasing foothold. Some commentators go so far as to predict that customers will be saying "goodbye to the grid" in the future. In some places, it's already happening. Significant changes in the economics and practicalities of self-generation and storage are needed for such a scenario to occur on any kind of scale.

But even if customers don't literally say goodbye to the grid, power utility companies face the prospect of playing the role of being providers of secondary or back-up power to customers. Instead, they could become part of the change by being more active participants in the self-generation market, providing advice on equipment, metering and using the opportunity to secure more of the home and business services space.

The growth in self-generation can create a reinforcing dynamic. As well as the decline in revenues to decentralised sources, there is the impact of cost pressures on the centralised system which, in turn, reinforces the movement to decentralisation. The reaction of some in the industry has been to press for new regulatory policies to allow for some form of cost recovery in recognition of utilities being left with the fixed cost of the grid but a shrinking revenue base. But as one academic study points out: "In the short run, these steps very well could insulate the utility from solar PV competition but at the same time create substantial medium- and long-term risks, including those of customer backlash, deferral of adaption, and stimulation of enhanced competition."[9]

Both in terms of regulatory relations and customer relations, utility companies need to align their ambitions with those of their customers in a new energy future, ensuring their services are relevant to and cost-effective for as many customer situations as possible.

Competition

Energy transformation is shifting the opportunity for good margins into new parts of the value chain. But lower barriers to entry in these areas of the value chain and the need for new capabilities mean there is the prospect of existing companies being outflanked and outpaced as more nimble and able competitors seize key revenue segments.

New roles for companies come into view. In a distributed energy community with its own micro-grid, players other than power utilities can play an energy management role. This could be for local systems such as transport networks, residential communities or industrial communities.

For example, distributed energy is a key focus both for incumbent power utility companies and for new entrants. It's a big market space, worth tens of billions. It covers a wide spectrum of opportunities, from energy controls and demand management activities that save energy, to local generation, both small-scale and larger-scale, embedded in own use or local networks, through to distributed storage that can shift loads or, ultimately, end grid dependency.

Engineering and technology companies such as GE, Siemens and Schneider Electric have long been important players as equipment providers in larger-scale segments of the distributed energy market. The growth and extension of distributed energy is likely to blur the boundaries between such companies and the power utility sector, both at the individual customer and community levels.

Demand management services are another key area and, already, we see companies such as Kiwi Power in the UK providing services to industrial and commercial clients, offering demand reduction strategies that they claim might typically see larger businesses reduce their electricity bills by around £100,000.[10]

In addition, there is considerable interest from companies seeking to explore the opportunities that come from existing home and online services as well as future smart grid and distributed energy provision. "The battleground over the next five years in electricity will be at the house," David Crane, CEO of NRG Energy, told Bloomberg Businessweek. "When we think of who our competitors or partners will be, it will be the Googles, Comcasts, AT&Ts who are already inside the meter. We aren't worried about the utilities, because they have no clue how to get beyond the meter, to be inside the house."[11]

"Utility companies need to align their ambitions with those of their customers in a new energy future, ensuring their services are relevant and cost-effective."

"Do power utility companies risk losing out to new entrants from the world of online data and digital technology?"

The production service model

The production service model of centralised generation and grids is being joined by a much more disintermediated and distributed model. New supply sources requiring centralised infrastructure, such as offshore wind, are coming onstream but the danger for utilities is that other assets and infrastructure are left stranded. The centralised infrastructure that has long been a source of strength of the industry can be a source of weakness vulnerable to market, policy or disaster risk. And we're seeing all three of these risks currently playing out in Europe, the US and Japan.

In Europe, the changing economics of generation brought about by a combination of the rise of renewables, the collapse in the carbon market and cheaper international coal prices has left much gas generation out of the market. Even modern plants, completed as recently as 2013, have had to be temporarily mothballed and many others have been taken out of the market more permanently. In total, over the course of 2012–13 ten major EU utilities announced the mothballing or closure of over 22GW of combined cycle gas turbine (CCGT) capacity in response to persistently low or negative clean spark spreads, of which 8.8GW was either built or acquired within the last ten years.[12]

Disaster risk led to all of Japan's nuclear reactors being gradually taken offline after the 2011 Fukushima disaster and they remained offline three years later. Across the world in Germany, the reaction to Fukushima was to begin to phase out nuclear power altogether. Official policy in Japan is to bring plants back into operation, with the first restart expected to be announced in late 2014, as and when the atomic regulator deems new stricter safety standards are being complied with. But opinion polls have consistently shown that a majority of Japanese are opposed to restarting reactors and nuclear assets are unlikely to regain the same role in Japan's energy system as they had before Fukushima.

In the US, one can draw a direct line from environmental policy to the stranded asset risk faced by many of the country's coal generation plants. Coal-fired power plants are subject to the Mercury and Air Toxics Standards (MATS), which require significant reductions in emissions of mercury, acid gases, and toxic metals. The standards are scheduled to take effect in 2015 and 2016, with generators needing to install costly pollution-control equipment if they want to keep their coal plants running. The US Energy Information Administration expects about 60GW of coal generation to shut down between 2012 and 2018 – a reduction of about a fifth.[13] A further threat to coal comes in the form of the proposed Clean Power Plan, which will require carbon emission from the power sector to be cut by 30% nationwide below 2005 levels by 2030.

These developments highlight the risk of over-reliance on a concentrated centralised power generation asset mix. The wrong type of asset mix can leave companies vulnerable to rapid transformation, arising from market or policy forces or the forces of events, in the case of nuclear. Such forces provide a wake-up call which is likely to accelerate the move to alternative power systems.

Distribution channels

In a digital-based smart energy era, the expectation is that the main distribution channel will be online and the energy retailing prize will hinge on innovative digital platforms to secure the energy automation, own generation and energy efficiency customer space.

Already, many companies are shifting their positioning to cluster energy management offerings around a central energy efficiency and energy saving proposition and using new channels such as social media to engage with customers. But do power utility companies risk losing out to new entrants from the world of online data and digital technology?

A risk for energy companies is that their distribution channel to end customers becomes disintermediated in ways that are not dissimilar to what has happened to incumbent publishers and booksellers with the advent of Amazon. Not only is the channel to market for incumbents dominated by the new platform but the actual demand for product is eroded as the platform acts as an aggregator for self-publishing and second-hand sales. And, of course, the offering is now much wider than just books, with the combination of a trusted brand and sheer presence providing a marketplace joining consumers to a wide range of product providers.

Smart grids, micro-grids, local generation and local storage all create opportunities to engage customers in new ways. Increasingly, we are seeing interest in the power sector from companies in the online, digital and data management world who are looking at media and entertainment, home automation, energy saving and data aggregation opportunities. In a grid-connected but distributed power system there are roles for intermediaries who can match supply and demand rather than meet demand itself.

A key consideration for incumbent power utilities is if their brands are perceived as being part of the past that is being broken away from rather than the future for customers. An energy saving or demand management proposition may be perceived as more credible coming from a new entrant rather than an incumbent, so use of the brand needs to be carefully considered.

Another important challenge for companies arises from the need to be expert at managing data in a smart home, smart city and smart company environment. As well as data from smart devices and the grid, additional layers of information about demographics, behaviour, customer characteristics and other factors will often be required to best exploit the data opportunity. Many power utility companies already use sophisticated data analytics for customer segmentation purposes which can be built on and supplemented by enhanced analytics, big data from social media and learning from other industries.

Government and regulation

Energy is by its nature a key economic and political issue. More than in many other sectors, firms in the power sector depend on the political context for their licence to operate and public trust in their activities is a big factor.

The cost of power is an important element in household budgets as well as business and industrial competitiveness. The availability of power is a 'make or break' matter for everyone. And its infrastructure is the centre of often controversial planning debates.

So it's inevitable that the activities of power utility companies are never far from the centre of the public and political spotlight. Recent and current events in different countries discussed in the earlier section on the production service model highlight the potential for the public and political will to alter the nature of the business.

The political context shapes the utility business model. Changes in that context can dramatically impact utilities. This has always been the case but, in a more dynamic energy transformation context, political and regulatory decisions become even more significant. The different political approaches to energy transformation in different countries are key to explaining why the impact on fossil and nuclear generation has been faster and more dramatic in Europe compared to elsewhere.

A more dynamic environment also elevates the importance of public trust and perception. Energy transformation is extending the scope for the public to vote with their feet, not just by switching suppliers but by reducing dependence on utility companies altogether.

Snapshot: A weakened capital base

In Europe, the erosion of utility company earnings has had an inevitable impact on investment attractiveness. The Economist reported that "in 2008 the top ten European utilities all had credit ratings of A or better. Now (in 2013) only five do."[14] Share prices were similarly hit over the same period.

In the US, the power utility share price story has been much healthier but the association representing US shareholder-owned electric utilities has sounded a warning note about the capital implications of energy transformation: "When customers have the opportunity to reduce their use of a product or find another provider of such service, utility earnings growth is threatened. As this threat to growth becomes more evident, investors will become less attracted to investments in the utility sector. This will be manifested via a higher cost of capital and less capital available to be allocated to the sector."[15]

"Sector transformation could shrink the role of some power utility companies to providers of back-up power."

The need for innovation

Incumbent companies that don't innovate could risk seeing themselves succumbing to the pressure points and being eclipsed in the same way that incumbents like Kodak, Blockbuster video stores and high street booksellers were in other sectors. Certainly, sector transformation could shrink the role of some power utility companies to providers of back-up power.

In our most recent Global Power and Utilities survey, only a minority of our survey participants expect centralised generation and transmission to play the lead role in meeting future demand growth across the main markets of Asia, Europe and North America.[16] Instead, energy transformation will gather pace and we expect that growth will become more innovation-dependent, with success coming to those companies that use innovative technologies, products, services, processes, and business models to gain competitive advantage, to stay ahead of change and create new markets for their products and services. In Africa innovation will be driven in part by the fact that power utilities will not be able to support the increasing demand for electricity supply and businesses will evaluate other solutions, such as looking at different means of co-generation.

Business model innovation is just one element of the innovation required but is likely to be a key part. The difficulty is that business history tells us that the majority of business model innovations are introduced by newcomers and incumbents often find it hard to respond successfully. Incumbent companies sometimes try to hold on to the existing model for too long or fall between two stools as they try to manage two competing business models at the same time – the original business model and the new model.

One way to avoid this trap is to separate out responsibility for developing new business models and value propositions. For example in banking, this is what HSBC did in the UK when it developed its highly successful First Direct telephone, and now internet, banking service in the 1990s. Not only was branding separate from its then 'Midland/HSBC' traditional branch banking brand but the service operated largely independently of the parent company. Another route for separation is by outsourcing to a community of new entrants and smaller firms. The incumbent utility can then nurture these innovations and help scale up the emerging dominant products or services.

Avoiding a capital crunch

As well as innovating, utilities need to make sure that a weakened investment case doesn't close off growth routes. Energy transformation is eroding the capacity of utilities as investors. Some have suffered rating downgrades. Others have had to deleverage, reducing debt relative to cashflow, to maintain credit ratings. These developments, primarily affecting companies in Europe and some in Africa, come at a time when they also face major capital investment challenges to replace ageing infrastructure as well as make energy transformation investments such as smart grids. In parallel, many such utilities need to deploy capital to pursue diversification away from mature, low or flat-growth markets towards fast-growth regions.

Global competition for capital is intense, and all the more so because the capital constraints faced in some markets stand in contrast to other markets. In the US, the challenge for power companies has been to convince investors that peak stock valuations can be maintained, a key part of which will be to demonstrate that they can negotiate the challenges of energy transformation without facing the kind of conditions that have engulfed their European peers. Innovative and alternative approaches to financing are becoming more commonplace in the sector. Partnerships and strategic tie-ups with sovereign wealth funds, insurance and pension funds, already becoming more numerous, are likely to increase in importance.

"We expect that growth will become more innovation-dependent, with success coming to those companies that use innovative technologies, products, services, processes, and business models to gain competitive advantage."

Looking ahead: future market and business models

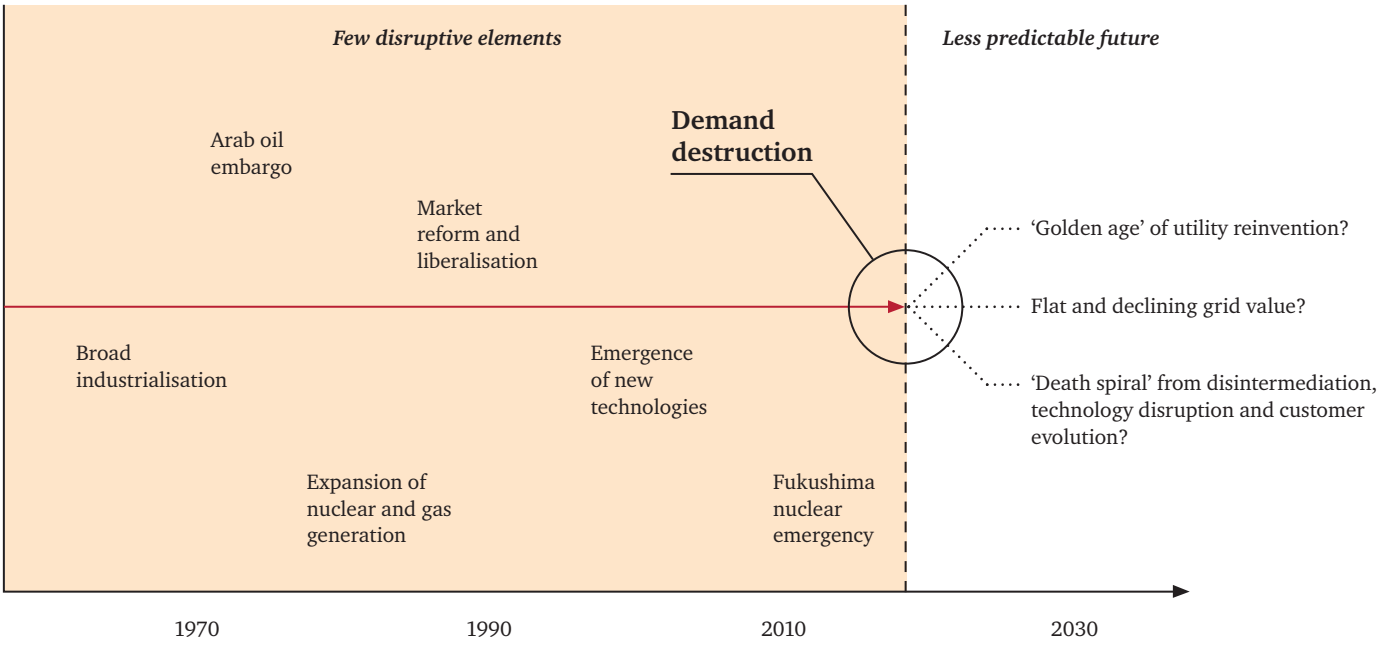
No-one can predict the future but it is important that companies take a clear view on the ways in which their marketplace is likely to evolve and their company's place in the various different possible scenarios.

PwC's energy transformation programme includes joint activities with companies to support their future strategies and map out the risks and opportunities involved.

At its heart, this means addressing key questions such as:

- What will future market design look like?
- What are the implications for my company's purpose, role and positioning?
- What are the business models that I need to pursue?
- What are the implications for people and operational change?
- What will existing and new competitors be doing?
- How best to continue to deliver shareholder value throughout the transformation process?

Figure 2: The power sector has reached an inflection point where its future direction is much less predictable



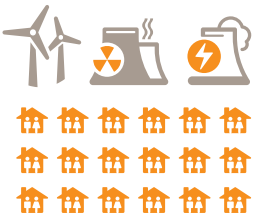
Future market designs

We foresee a number of market models emerging. Unlike markets for many other products and services, the role of governments is significant given the importance of power to everyday life and economic activity. So the exact market shape for individual countries will depend on policy direction as well as on other local factors such as the extent of competition and customer choice, access to fuel, the nature of existing infrastructure, the degree of electrification and degrees of interconnectedness or isolation from neighbouring territories. And, of course, a crucial factor will be the pace of global technological change.

'Business as usual' with the maintenance of a classic centralised 'command and control' energy system may continue to be an option for some countries, although we expect to see an increased focus on technology and innovation as this model develops. But already over the last two decades or so, many countries have moved away from this 'classic model' and, through a combination of regulator-led and market-led innovation, have created markets characterised by different ownership structures with varying degrees of market liberalisation, customer choice and technology adoption.

Current change has so far, on the whole, been incremental and stopped short of 'transformative change', although many would see aspects of current developments in Europe as transformative. But we believe that, if the pace of innovation leads to widespread adoption of renewable and smart energy technologies, we are likely to see the emergence of a number of new market models. Each market scenario can be described by a unique set of characteristics and illustrates different points along a series of transformation curves. We have considered a wide range of characteristics in developing the scenarios, including ownership structures, the level of adoption of renewable technology, level of deregulation, level of engagement in the wholesale market by customers, regulatory and policy involvement in market structure and operations, use of digital media and the mix of large-scale and small-scale generation.

We outline below four new market scenarios which represent transformative change – a significant shift from where we are today. Power utility companies are unlikely to be in only one of these scenarios but, instead, experience a blend of them with perhaps one being dominant. The most appropriate path for any given company will depend on local, as well as global, factors.



Green command and control

The Green Command and Control market scenario represents a market in which government owns and operates the energy sector and mandates the adoption of renewable generation and digital technology.

In this scenario, we see vertical integration as the norm (particularly between generation and retail), and investment decisions made as a response to regulatory direction. It is a market in which renewables may be cost-competitive or supported under renewable policy initiatives, whilst stranded thermal assets may remain operational even when private sector owners would have taken closure decisions. Ongoing capital investment would be subject to policy approval and would feed into regulated tariffs.

The market may combine a central grid with distributed networks where the latter support social policy initiatives such as rural electrification or reducing the level of capital investment in major transmission infrastructure. There is likely to be an increased level of investment in distribution networks to support back-up capacity in localised areas of the grid. Consumer tariffs will reflect policy decisions and recovery of stranded costs, and may be smeared across central and distributed networks.

There may be some limited opportunities for new market entrants – potentially as outsource partners supporting state-owned companies with operations of distributed networks, or as compliance advisors to the regulator supporting tariff determinations and investment case business approvals. Outsourcing support opportunities might offer local small-scale as well as large project opportunities. For example, in South Africa the Department of Energy has mandated the roll-out of a national solar water heater programme with the goal of one million installations on households and commercial buildings over a period of five years, providing significant potential for local capacity-building.

How might this market arise?

We see two routes. In the first, it might develop directly from a traditional, centralised "classic model" where the government takes policy decisions to invest in renewable generation, smart technology and local energy hubs. In the second, the market may have undergone some degree of liberalisation and/or new entrants in generation or retail, but policy decisions result in control reverting to the public sector. This might be the case, for example, in the event of a political decision to renationalise or when a company fails and private sector entities are not prepared to step in.

We would see private sector players exiting the market and may see mergers of generators and/or retailers to support government policy preferences (for example, a state-owned generator operating stranded assets as back-up for renewable generation, another state-owned company operating small-scale renewable generation and supplying customers within distributed networks).

Which countries might adopt this market scenario?

In our view, a green command and control market scenario is most likely to evolve in markets where there remains significant public ownership, single-buyer models or limited interest from the private sector in investment, e.g. in China, selected South American, Middle Eastern and African markets. Further, in some countries, renewable energy dominates the energy mix, such as hydropower in Bhutan or Norway. In such situations, it makes sense for governments to encourage green power for own use, thereby reducing any import of fossil fuels, and for earning extra revenue from export of green power.

Ultra distributed generation

The Ultra Distributed Generation (DG) market scenario represents a market in which generators have invested in distributed renewable generation, with investment decisions based on policy incentives and/or economic business cases. It is a market with full unbundling and strong customer engagement, both in retail and as micro-generators.

Market operation becomes more complex for both transmission and distribution operators, given the increased volume of distributed and renewable generation and the continued operation of large-scale thermal generation, but remains centrally operated and does not fragment. Regulatory oversight and revenue price controls are likely to address efficiency of system operation and equitable treatment of generation in dispatch and system support. In particular, determining which market participants pay for the central transmission grid becomes a critical regulatory question.

We expect to see stranded thermal assets as distributed resources become cost-competitive and, in part, due to the lower flexibility of some distributed generation and the ensuing volatility of wholesale prices. Risks to security of supply increase and we are likely to see continued policy and regulatory intervention to maintain an appropriate level of thermal capacity on the system. Generators with distributed capacity will have increased volumes of operational data to manage as they match their physical and trading positions. Retailers will need to continually review their trading and hedging strategies to manage price volatility and to determine the tariffs that can be offered to different categories of consumers – particularly prosumers who offset their demand through micro-generation.

This scenario presents considerable challenges for system operators with complexities such as reverse flows, voltage management, fault maintenance etc., placing even greater importance on data management capabilities. Generators, transmission system operators (TSOs) and distribution system operators (DSOs) will need to revisit the capability and skills required from their staff and we expect to see an increased emphasis on technology specialists over time.

There are significant opportunities for new entrants in addition to investment in renewable and distributed generation. We expect to see growth in participants providing aggregation services, both for small-scale distributed generation and for load management. Offshore TSOs or private sector, localised DSOs linked to a portfolio of distributed generation will become more prevalent. There may be new roles for managing the interconnection between local networks or for managing and interpreting generation data.

How might this market arise?

We see the main driver of this model being policy decisions which result in a significant increase in small-scale distributed capacity over a relatively short period of time. This might be led by retailers encouraging their consumers to reduce demand through becoming a prosumer owning micro-generation, by proactive consumers or by generators sizing investments to meet local community needs at a distribution grid level.

Integrated investments in new communities that include distributed generation and a back-up connection to the grid also support an Ultra DG market scenario. The Ultra DG model could also arise through an evolving spiral of developments, where there has been no conscious policy decision but investments over time have led to the closure of uneconomic thermal plant, prosumers reducing local demand requirements and rebalancing the system operations roles of the TSO and DSOs.

Which countries might adopt this market scenario?

In our view, an Ultra DG model is most likely to arise in markets where there is already significant investment in distributed generation but where there is a strong national infrastructure supported by policy objectives, e.g. Germany or California. It could also arise in markets where the opportunity for significant investment in small-scale renewables or larger-scale distributed generation could support local networks or isolated developments which would only require periodic back-up generation from the transmission grid, e.g. Middle Eastern markets or Australia.

Local energy systems

The Local Energy Systems market scenario represents a market in which we see significant fragmentation of the existing transmission and distribution grids and local communities demand greater control over their energy supply, or a market in which a local approach is adopted for serving remote communities.

The market is likely to have undergone full unbundling and experienced strong customer engagement, both as consumers and micro-generators, but recognises the benefits of vertical integration for off-grid solutions. Financial viability of distributed generation and distributed grids is a prerequisite. Strong policy support for fragmentation is required, either to allow local initiatives or to encourage and incentivise local communities and businesses to take control and build and operate their own local energy systems.

In its purest form, there would be a limited role for large-scale generation connected to a central transmission grid. It would continue to support industrial customers with large, secure, long-term loads and would be able to provide back-up for security of supply reasons. We would expect significant levels of stranded capacity, which may close without policy support.

We see generators focusing on developing and operating small, distributed generation assets, sized to support domestic communities or commercial customers and most likely connected to distribution networks. Tariffs may well vary across the country as the costs of supply would be based on the local generation assets. Customers may be able to invest in the generation assets so that they have an incentive to manage their demand at times when the local capacity margin is tight.

We see a need for new approaches to security of supply, which we would expect to be provided by DSOs in the main, providing interconnections between localised grids. The role for the TSO would be greatly reduced and would result in significant overcapacity in transmission.

The market provides a new set of challenges for the regulator, particularly in relation to a customer protection obligation. Regulators will need to address interconnections between local energy systems, review the risk of disconnection and put in place reporting oversight mechanisms to check that customers are not being overcharged. Where a territory has existing transmission capacity, the regulator might also need to determine appropriate charging mechanisms for the transmission grid, both in terms of which customers should pay and what proportion of the stranded capacity should be included.

There are a number of new roles that could arise within a Local Energy Systems market. Generators may wish to become local energy operators providing a full range of generation, network and retail services across a range of technologies. Technology companies are also likely to look at the option of becoming local energy system operators. Market participants may look at the opportunities to link the power and gas markets. Grid companies may decide to provide O&M services to micro-grids to maintain the capability and skill base required to support their stranded assets.

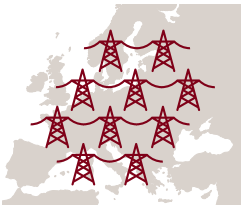
How might this market arise?

We see the main driver for Local Energy Systems to be policy decisions, based on an objective to increase rural electrification, reduce the emissions caused by using diesel generation in isolated communities or to deal with currently unreliable/intermittent supply. Coupled with technology improvements in electricity storage and reductions in the capital investment costs of solar and wind generation (for example), tariffs become affordable and Local Energy Systems become practical.

Which countries might adopt this market scenario?

We see Local Energy Systems as having most relevance in developing countries without a strong national transmission infrastructure. The fall in costs of renewable generation and the improved technology to support distributed grids means that isolated communities could be electrified without the need for major capital investment in transmission or fuel infrastructure. We would expect to see combinations of solar, wind, biomass and storage technologies used in these markets, for example in Africa, where a number of such systems have already been put into place. But in a country like India, where almost all generation capacity is grid-connected, local energy systems based on renewable energy are likely to be limited to island systems such as in the Sundarbans or Lakshadweep.

We see Local Energy Systems as being particularly suitable for isolated island systems, such as are found in Indonesia and the Philippines. The prerequisite is likely to be cost-competitive storage technology to support distributed renewable technology, CHP generation and limited thermal generation.
The benefits would be in replacing carbon-intensive diesel generation, for example in Alaska or the Philippines.
In India, a new local approach to energy is taking root in some states in the form of retail supply outsourcing, whereby the DSO contracts out part of its licence area to franchisees.



Regional supergrid

The Regional Supergrid market scenario represents a market which is pan-national and designed to transmit renewable energy over long distances. It is likely to embrace some degree of unbundling and customer choice. It requires large-scale renewable generation, interconnectors, large-scale storage and significant levels of transmission capacity.

The main challenge that will need to be overcome is regional regulation that applies across borders. National regulators will have limited responsibilities and will be required to oversee national markets within the regional context. In some situations, geopolitical risk will also be a major factor, for example if supply relies on generation located in neighbouring but politically sensitive regions.

We will see a new approach to generation investment decisions, where generators or governments will consider a regional merit order and interconnector access requirements as part of their business case assessment (for example, South Africa and the Democratic Republic of the Congo in the case of the Inga hydro dam project). The emphasis on large-scale renewable generation means that we are likely to see stranded thermal assets, which would require regulatory support to remain available for national or local grid support for security of supply reasons.

We will see a shift in approach from retailers, who will either become regional retailers or will enter into partnerships to access customers in other countries. Brand management and customer segmentation will become more complex as retailers embed their products and services in multiple countries.

Both generators and retailers will place an increased emphasis on trading and risk management. The presence of constraints, for example through limited interconnector capacity, means that locational pricing is the most likely outcome, so market participants will need to manage both national market prices and market prices in neighbouring countries.

The intermittent nature of some renewable generation is likely to mean volatility in market prices, particularly with long-distance transmission, and managing the pricing differentials between different countries will be crucial. Skilled regional traders will be vital, particularly for merchant generators.

National TSOs will enter into agreements with other TSOs in the region or, if agreement can be reached between countries, a regional TSO will manage the overall system. Decisions on where new transmission capacity is required to improve the efficiency of the system will be taken on a regional basis, and will require a new charter to be developed to lay out the objectives, rules and operational processes of the regional market. Distribution businesses will remain national or local but are likely to require restructuring so that their focus shifts to management of small-scale local renewables and of the interface with the transmission grid.

How might this market arise?

The main driver for a Regional Supergrid is policy, jointly created and pursued by neighbouring governments who recognise the benefits of harnessing renewable generation sources and linking them to distant demand centres. It could arise from market coupling initiatives, where the governments and regulators determine that each market would become more efficient and pricing signals would become more appropriate if the two markets became one.

Which countries might adopt this market scenario?

We see forms of a Regional Supergrid, but without common regulation in the USA, so there is the potential for further aggregation and adoption of common approaches. Looking at where a Regional Supergrid could arise through investment, we think that the Middle East has the potential to adopt this model. The EU has an objective of a single European electricity market which would effectively become a Regional Supergrid, but the complexities of implementing common regulation across multiple countries with different legal structures makes the pure model less likely to be achievable. A hybrid market adopting certain aspects would be a more realistic option.

India has proposed the development of a renewable energy grid, the 'Green Energy Corridor', with support from the German government. It aims to handle growth in renewable energy from the current 30GW to 72GW by 2022. In southern Africa, with the support of the Southern Africa Power Pool (SAPP) and the different utilities in the region, a supergrid called Zizabona is being established between Zimbabwe, Zambia, Botswana and Namibia, providing for the import/export of electricity via either PPAs or day-ahead trading through the SAPP.

Combined models

Each of the four potential market scenarios outlined above represents a transformative move away from current markets. There are common themes across the models and we can see how, in practice, countries might adopt certain components from more than one model.

The seeds are in place for transformative change but there is still a lot of inertia in the system. The pace of change will vary from territory to territory. Some will see a gradual evolution while others will see parts of the sector undergoing faster transformative change. Such transformative change might be defined by locality or by the part of the value chain.

We believe that these transformative energy market scenarios provide a future in which market participants and new entrants can thrive and the role of policy makers and regulators is clear. The most appropriate market scenario will come out of an assessment of the impact of the major disruptors and the local factors that apply in each individual situation.

Future utility business models

Companies need to determine the future direction of their own markets, how these markets are affected by technological advancement and what this means for their business strategies. While the urgency of their responses may vary by location and value chain presence, we believe companies can't afford to wait as the next decade is crucial.

Within the next decade we anticipate that step-change milestones will be reached in at least some of the key disruptive technologies – grid parity of solar distributed generation, lower cost and mass-scale storage solutions, vibrant and secure micro-grids, attractive electric vehicle options and ubiquitous behind-the-meter devices. In this new technology-enabled, customer-engaged marketplace, companies need to define their desired purpose (see figure 3). We foresee a distinction between energy suppliers, integrators, enablers and optimisers with different points of focus along the value chain.

Incumbents and new entrants need to ask themselves how they intend to position themselves as market participants, i.e. the 'role' they will play in market development, customer engagement and business execution. Companies have distinct options on this spectrum ranging from 'passive and market-following' to 'innovative and market-making'. Defining the future role of the entity is fundamental to shaping the business model to deliver on aspirations.

In defining future business models, companies need to first understand and challenge their company purpose and positioning in the markets of the future. We call this 'blueprinting the future' and it consists of several fundamental steps, starting with defining *'where to play'* in terms of business segments, markets, products and, services (see figure 4). Core, adjacent and growth market participation areas are assessed based on attractiveness, capability to compete and potential for profitable success. Next comes assessing *'how to play'* in these selected areas, which defines the go-to-market strategies to be adopted by participants in pursuing their market aspirations, e.g. new products, innovative unbundled pricing.

We then focus on the most important dimension of the blueprint, *'how to win'*. This element defines the particular tailored approach that is most appropriate for a company to achieve competitive market success, e.g. partnering or channel expansion.

Figure 3: Future role evolution

Emergent roles	Energy Supplier	Integrator	Enabler	Optimiser
	'Asset-focused'	'System-focused'	'Value-focused'	'Insight-focused'
Primary segment focus	Generation	Transmission/ distribution	Distribution/ customer	Customer
	• 'Have to do' if asset heavy or short in supply	• 'Will do' regardless of new area participation	• 'Should' migrate into depending on role	• 'Could' evolve into as new business models mature
Key focus areas	• Ensuring *assets are optimised* in the market to match price signals • *Achieving the right balance* of asset-based and notional transactions within risk parameters	• Facilitating *grid interconnection* with other transmission developers • Extending the *deployment of technologies* or equipment into the distribution network	• Enhancing the *value of the grid* to all stakeholders • Addressing how to *leverage technology* to enhance system performance and customer engagement	• Enabling customers to better leverage *behind-the-meter* technology • *Broader engagement* with the customer by providing value through advanced data analytics

To fully evaluate the above choices, companies need to examine their current core capabilities against the type and level necessary to effectively compete and prosper in a more decentralised and disaggregated marketplace. In particular, incumbents and new entrants need to take stock of which capabilities are distinctive and differentiable, e.g. asset management or regulatory prowess, and which may need to be developed or strengthened, e.g. innovation or commerciality.

The energy value chain of the future will be more interconnected than ever before. This value chain forms an integrated ecosystem of unique elements that are highly interrelated, notwithstanding the specific focus of these individual elements (see figure 5). Incumbents will need to focus on extending beyond independent views of each value chain element into a more integrated view of how these elements can interact with each other in the future, e.g. how the benefits of increased knowledge about system performance can bridge the gap to enhance the customer experience. Non-traditional entrants will need to determine how they interact between incumbents and customers in a manner that does not 'island' assets or 'diminish' customer relationships. Just as we are now entering the era of the 'connected customer', we are also seeing the broader emergence of the integrated grid.

Figure 4: 'Blueprinting the future'

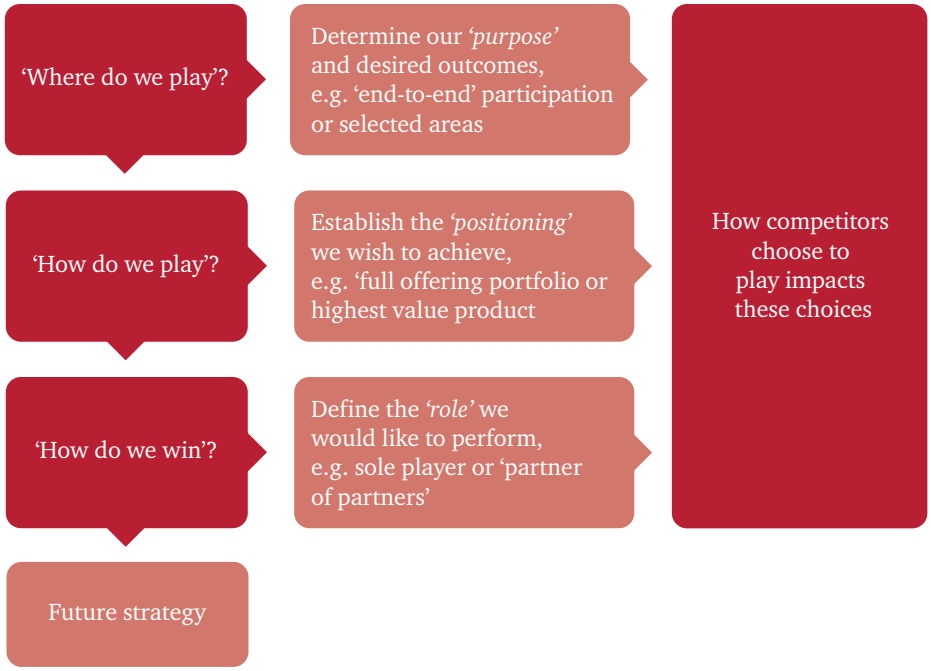
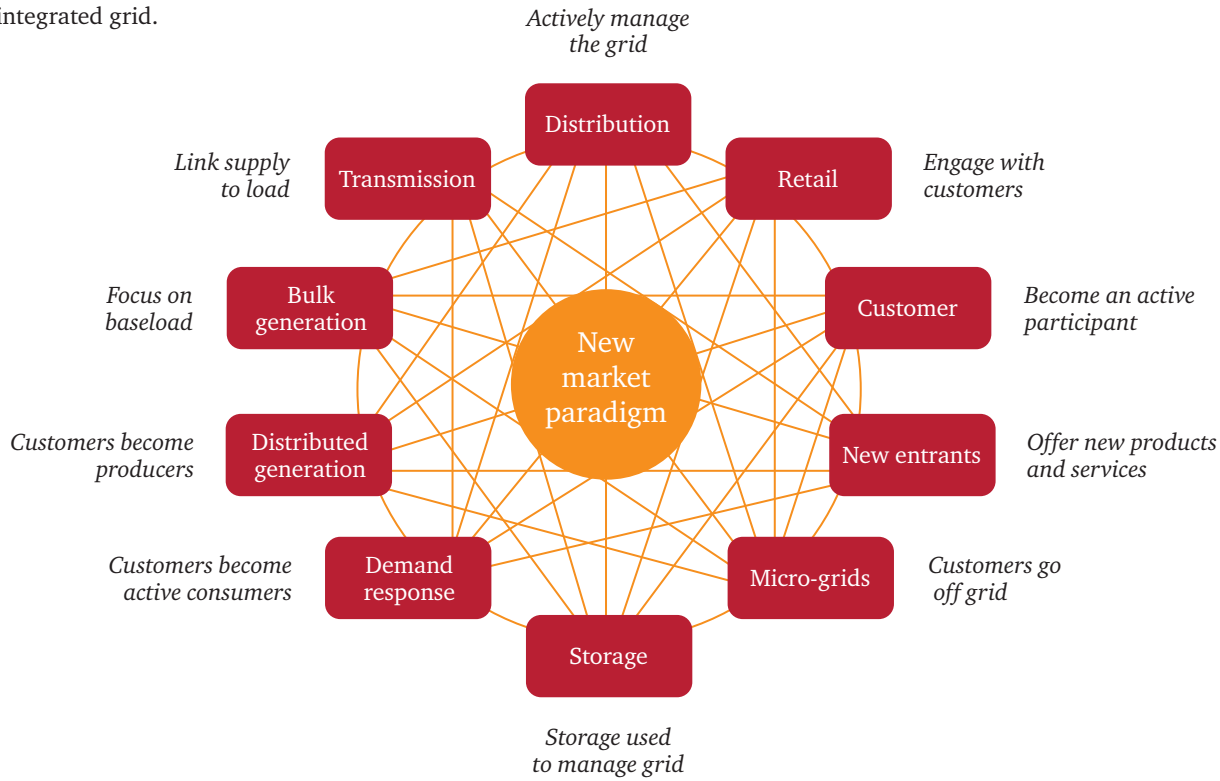


Figure 5: A networked model



The range of future business models

Much comment has been directed at the business model of the future. We do not believe there will be a single winning business model but rather that there will be a range of business models that will deliver success in the new market environments. Just as we see a number of transformational market models, we see a range of business models that build on existing models or fill new service or product needs. We outline eight business models which we believe will emerge individually or in combination (see figure 6). These individual business models cover the full power sector value chain; each has individual characteristics and several are based on integration and/or collaboration with non-traditional partners.

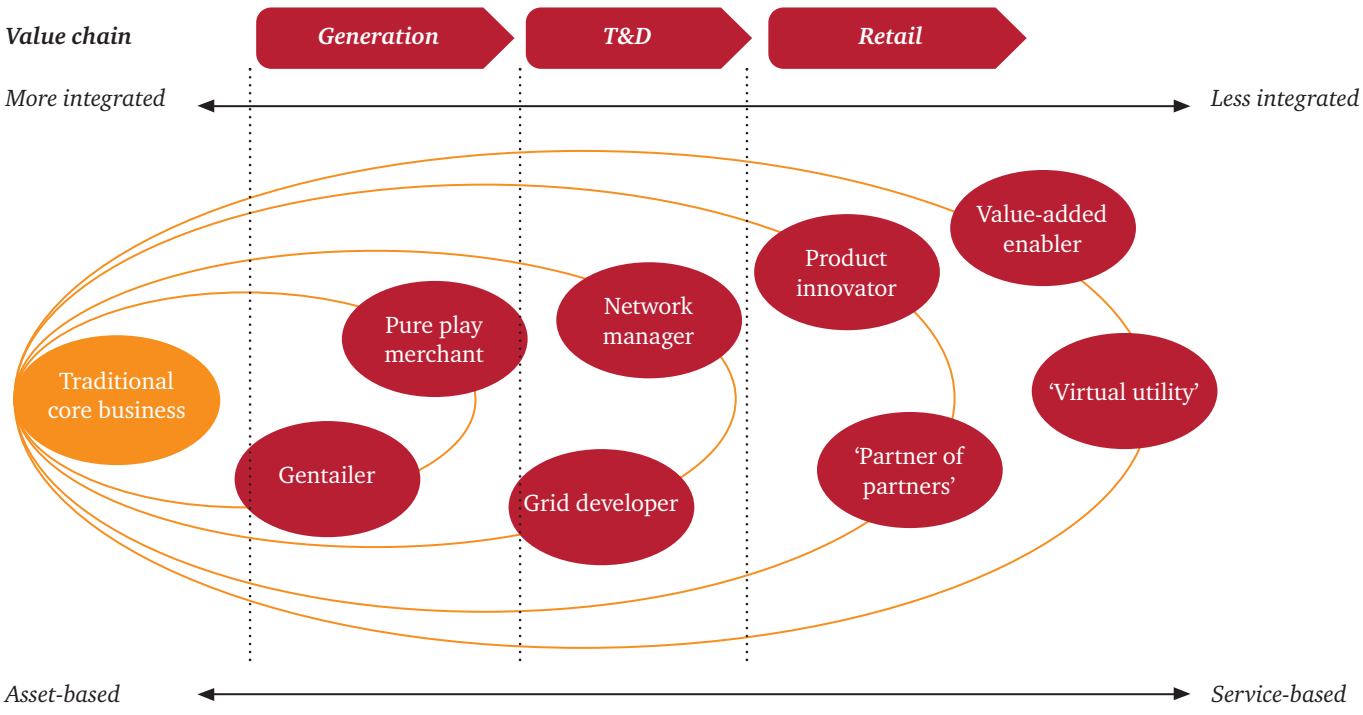
Some market participants – incumbents or new entrants – may be prevented from playing in all segments, while others may seek to specialise in selected segments or integrate into broader market areas. Whatever the case, the adopted business model(s) need(s) to be tailored to enable companies to succeed in three key ways – strategically, financially and competitively.

Traditional core model

Alternative business models of the future may be very different from the traditional model that dominated power and gas delivery for decades. In the past, operating an integrated utility from generation through to customer supply was well understood because the utility controlled the entire value chain. However, this model has been supplanted in many countries through market restructuring and may be rendered further obsolete through the convergence of distributed technology and customer engagement.

In this traditional model, both tangible assets and franchise customers were considered important to preserve the benefits of physical integration, economies of scale and access simplicity. As policies encouraging competition emerge, to take advantage of market options or regulatory mandates, specific segments of the value chain became available for specialisation and for new entry. Now, unbundling opportunities are starting to extend deeper into the value chain and enable more specialist participation.

Figure 6: Business model choices



In the traditional model, making money was easy to understand – invest and earn a return on invested capital. In emerging business models, although we consider that this feature may still apply in selected segments, we believe a greater emphasis will be placed on obtaining higher margin from prices/revenues rather than cost reduction to get higher earnings and profit growth.

Depending on how a traditional utility thinks the electricity industry may evolve in its country/region and what market models may emerge, it needs to evaluate where to play across the value chain. Should a traditional utility leverage multiple business models? And if so, which ones and how should they transform their business to be successful?

We have identified eight alternative business models, which we describe below with respect to their scope, rationale, basis for competition, and source of earnings (see figure 7). This should help utilities think through which business model options might be right for them and the key decisions required to enable them to develop their new market position in sufficient time.

"Beyond the traditional model, we foresee eight different future business models that could emerge either individually or in combination."

Figure 7: Business model elements

Business models	*Business focus*	*Business alignment*	*Profitability basis*
Traditional core business	Assets – customers	Generation – T&D – retail	ROIC
Gentailer	Assets – customers	Generation – retail	Competitive margin
Pure play merchant	Assets	Generation	Competitive margin
Grid developer	Assets	Transmission	Regulated ROIC
Network manager	Assets	Transmission – distribution	Regulated ROIC
Product innovator	Customers	Retail	Competitive margin
'Partner of partners'	Customers	Retail	Competitive margin
Value-added enabler	Customers	Retail	Competitive margin
'Virtual' utility	Customers	Distribution – retail	Competitive margin

1
Gentailer model

Relevance for transformative market scenarios

Green command and control	*Low*
Regional supergrid	*Medium*
Ultra distributed generation	*High*
Local energy systems	*Low*

Description

A gentailer utility operates at both ends of the value chain by owning generation assets and selling retail energy to customers in a competitive market. Gentailers pay a charge to transmission and distribution system operators to deliver this power and also buy and sell energy on the futures and spot markets to manage any forecast or real-time differences between load and supply. This business model is a by-product of the design of the local market and not relevant to all markets. Advantages of the gentailer model are that it provides a natural hedge for the business, i.e. a 'sink' for capacity when the generator is 'long' and a 'source' for the retail business when it is 'short'. A key risk to the gentailer model is that retail consumers may gradually switch to competitors or invest in behind-the-meter distributed energy resources, which could potentially strand part of the gentailer's generation assets over time.

Market/model examples

The gentailer model is typically applicable in markets where the generation and retail portions of the value chain are competitive and the transmission and distribution companies operate as a regulated monopoly. Australia, the UK and New Zealand are countries that have successfully deployed this model. In New Zealand, the five major generators are also the top five retailers. This type of market development often has regulatory implications which are likely to influence future development of this business model.

This model has also developed in areas where traditional IPPs have moved into retail energy sales as energy markets have deregulated. NRG Energy and NextEra Energy are two examples of utilities operating in this model in the United States that developed or acquired retail capabilities to complement their generation positions.

Capabilities

On the generation side, a successful gentailer has strong capabilities in demand and market insights, project development, project finance and asset management. When planning to add new capacity, a gentailer applies its strong market knowledge to determine cost-competitive generation technology choices based on fuel markets, operating constraints and consumer preferences. On the retail side, a successful gentailer has strong capabilities in energy trading and hedging, origination and product development, pricing, customer acquisition and customer management. Strengths in these areas enable a gentailer to cost-effectively acquire and maintain customers while delivering higher margin services.

What utilities should do now

Monitor and understand the way different customer segments use smart technology and assess how to harness these preferences into mobile and/or tariff solutions. Identify potential partners to help develop behind-the-meter distributed energy resource business plans. Review make/buy decisions to support their asset position and investment requirements under alternative market scenarios to determine what generation products to offer in the future. Invest in understanding customer segmentation and what that means for switching rates and retaining the most profitable customers.

Maximising competitive position against potential competitive threats

Gentailer actions	*Competitor threats addressed*	*Future gentailer profitability drivers*
• Develop a behind-the-meter distributed energy resource business, organically or through networks partnerships or acquisitions • Increase customer engagement via new energy management solution offerings and intelligent tools • Develop alternative pricing packages and approaches that provide greater optionality or risk/reward tariffs to customers	• High penetration of customer or third-party owned behind-the-meter distributed energy resources • Regulatory change enabling transmission and distribution operators to develop, own, and operate distributed energy resources • New entrants offering products/services that increase customer engagement in managing their energy needs through mobile tools or social media	• Offer, bundle, price, and cost-effectively deliver a wide range of energy products (low cost, high renewables, local premise-based generation etc.) with selected value-enhancing partners • Energy trading approaches to hedge business risk • Cost-effectively plan, develop, finance, construct, and operate the right asset mix

2
Pure play merchant model

Relevance for transformative market scenarios

Green command and control	*Medium*
Regional supergrid	*Medium*
Ultra distributed generation	*Medium*
Local energy systems	*Low*

Description

A pure play merchant utility owns and operates generation assets and sells power into competitive wholesale markets at market clearing prices, or through negotiated bilateral contracts with other generators or large industrial consumers. This entity occupies a very narrow portion of the value chain and competes within the riskiest part of the business when markets are volatile and positions are uncovered. Assets are built and financed by investors on a speculative basis, pre-contracted in part or in full or acquired from another generator. Pure play merchants have traditionally developed baseload or peaking plants with mature generation technologies from gas, which also enables participation in ancillary grid services markets. However, wind merchant plants have increased in popularity over the last decade and solar merchant plants are starting to emerge.

Market/model examples

Merchant players prefer liquid markets with rising and/or high peak wholesale energy prices and high price volatility. Examples include deregulated regions like Texas, California and New England in the US and countries in emerging markets like Chile. Areas with low natural gas and coal prices are typically not well suited for merchant players because these low-cost inputs often depress wholesale energy prices and do not provide significant 'spread' for merchants to leverage.

Capabilities

Similar to a gentailer, a successful pure play merchant utility has strong capabilities in demand and market insights, project development, project finance and asset management. Additionally, a successful player has strong market origination, trading, hedging and risk management capabilities, including the ability to execute a variety of complicated purchase and sales agreements (e.g. using derivatives) that effectively lock in the price of fuel and electricity to eliminate as much market risk as possible. As more low-carbon energy enters a market, mitigating market risk becomes more challenging because market prices become more volatile, so a merchant's strategy needs to be flexible and adaptive.

What utilities should do now

Implement world-class operational procedures to minimise costs of operations, manage price and volume risk exposure. Develop robust investment plans to create a balanced generation portfolio, either across technologies or markets. Investigate alternative products to offer from the generation portfolio to mitigate against market change or merit order structure.

Maximising competitive position against potential competitive threats

Merchant actions	*Competitor threats addressed*	*Future merchant profitability drivers*
• Assess feasibility of expanding capacity of traditional fossil fuel plants with solar or energy storage to expand ability to play using same grid interconnection • Explore options for developing distribution level or behind-the-meter projects (e.g. solar, charging infrastructure). • Evaluate investment to enhance plant operational capabilities to capture value of flexible thermal capacity	• High penetration of behind-the-meter distributed energy resources and solutions like demand response that reduce peak demand • Development of disruptive grid-level solutions such as energy storage that compete with merchant generators • Development of ultra-efficient generation and excellence in operations	• Identification of profitable regions for future merchant potential and key early investments (e.g. land) • Ability to cost-effectively plan, develop, finance, construct, and operate the right asset mix • Strong analytics and energy trading capabilities to hedge business risk

3
Grid developer model

Relevance for transformative market scenarios

Green command and control	*High*
Regional supergrid	*High*
Ultra distributed generation	*Low*
Local energy systems	*Low*

Description

This utility acquires, develops/constructs, owns and maintains transmission assets that connect generators to distribution system operators. In most cases, it operates as a natural monopoly, although there may be multiple grid developers within a single market. Some grid developers seek to build new transmission lines to connect remote renewable generation to load centres, while others will also maintain lines and infrastructure that have been in operation for years. If a grid developer operates in a wholesale electricity market, it must manage the stability of the power system in real time and coordinate electricity supply and demand to avoid imbalances and supply interruptions.

Grid developers must constantly assess the ability of their systems to adequately meet current and future needs and plan cost-effective system upgrades to meet those needs, usually governed by regulation which may incorporate incentive mechanisms. Where these transmission developers construct or maintain assets with an organised regional transmission operator present, close coordination with that operator is necessary to achieve grid coordination and support the regional market model.

Market/model examples

Grid developers are typically established by regulation in areas with existing infrastructure. Examples of this model include transmission system operators (TSOs) in Europe and independent system operators (ISOs) in the US. Additionally, new grid developers may be formed in areas that lack sufficient transmission infrastructure between generation and load centres.

For example, a grid developer may be created to build and operate transmission lines between remote generation assets like a hydropower facility or wind farm and a distant urban area, or to provide new transmission infrastructure where there are transmission constraints. Examples of the newer grid developers in the US include Electric Transmission Texas (ETT) and Clean Line Energy Partners.

Capabilities

A successful grid developer has a very strong operating track record and excellent capabilities in designing, operating and maintaining high-voltage transmission lines and supporting infrastructure.

In wholesale markets, they have very strong capabilities for managing electricity demand and supply in real time and in ensuring reliability standards are fulfilled. Grid developers are also very good at engaging with key stakeholders, including landowners, communities, local and state officials, customers and equipment suppliers to facilitate siting and permitting. Newer grid developers typically have strong relationships with investors and joint venture partners to enable access to low-cost capital and to leverage creative financing and ownership arrangements. As remote generation capacity increases and a larger proportion of connections are made at distribution network levels, the number of interfaces a grid developer needs to manage will increase and the obligations and responsibilities will become more complex to oversee.

What utilities should do now

Identify new locations (within their own market or in new markets) for large-scale renewable generation, flexible thermal generation and associated transmission build. Work with alternative owner classes, e.g. financial sponsors, to shape market bidding processes where competitive transmission protocols will exist in the future. Review existing contracting and procurement procedures to assess whether they are maximising value for money, risk allocation and whether they reflect regulatory settlements. Streamline grid connection processes to improve resource productivity and lower operating costs. Consider whether alliances with DSOs may provide economics of scale and increased scope for new investment.

Maximising competitive position against potential competitive threats

Grid developer actions	*Competitor threats addressed*	*Future grid developer profitability drivers*
• Develop close relationships with distribution system operators and regulators to support large-scale generation growth plans • Convince investment partners to invest in large scale, low-cost renewable project developments that require new transmission to urban areas • Implement world-class operational procedures to improve cost-effectiveness and develop new forms of contracts with generators, load managers and the supply chain that incentivise strong performance and cost management	• High penetration of distributed energy resources in urban areas combined with strong distribution system operators and micro-grids, reducing the need for transmission support • Other grid developers obtaining first-mover advantages in new markets • Regulatory imposed incentives where risks cannot be managed by the grid developer alone	• Access to low-cost capital • Partnering with generation developers to expand project access • Robust operations to cost effectively manage transmission and infrastructure upgrades • Identification of profitable regions for future expansion • Innovative contracting with the supply chain to manage risks

4 Network manager model

Relevance for transformative market scenarios

Green command and control	*Low*
Regional supergrid	*Medium*
Ultra distributed generation	*High*
Local energy systems	*Medium*

Description

A network manager operates transmission and distribution assets and provides access to their networks to generators and retail service providers. Similar to some incumbent grid developers, they typically operate as natural monopolies. Network managers also manage power stability in the network in real time and coordinate electricity supply and demand to avoid imbalances and supply interruptions.
A new role for network managers is emerging in the area of an ISO-like entity that will assume responsibilities as a 'distribution system operator' and have specific, expanded responsibilities for network integration of incumbent systems and distributed energy resources. As distributed generation increases, the opportunity for an entity to manage all interfaces between local energy systems and traditional distribution grids increases.

Market/model examples

The network manager models typically exist in regions where the generation and retail portions of the value chain are competitive and the transmission and distribution companies operate as a regulated monopoly. Australia, the UK and New Zealand are countries that have successfully deployed this model, though with the expansion of distributed generation and micro-grids, we expect this role to expand and become more relevant in many global regions.

Capabilities

Similar to grid developers, network managers have strong capabilities in designing, constructing, operating and maintaining transmission and distribution lines and supporting infrastructure. They also have strong capabilities for managing electricity demand and supply in real time and integrating power from different central and distributed generation resources. These network managers also have deep skills in system operations data analytics that can enable insight into asset and network performance and optimisation. These capabilities are provided through the deployment of 'smart grid technologies' that utilise multiple sensors to monitor and collect system performance data to enable enhanced analysis of power flows, equipment failure risks and asset deterioration.

What utilities should do now

Invest in the evolution of the network and the deployment of 'smart grid technologies' throughout the system. Move toward the next stage of 'big data' management and the analytical evaluation of power quality, equipment failure, circuit risks and investment priorities. Anticipate the deployment of distributed energy resources, i.e. storage, micro-grids, distributed generation, electric vehicles, etc., and prepare for integration into the network and management of all deployed resource impacts. In some markets, instigate discussions with the regulator to develop and implement appropriate mechanisms to facilitate the new services. Implement world-class operational procedures to manage costs.

Maximising competitive position against potential competitive threats

Network manager actions	*Competitor threats addressed*	*Future network manager profitability drivers*
• Work with regulators to approve investments focused on advancing system capabilities (smart grid) • Harden the infrastructure through targeted investment • Advance reliability standards and awareness • Develop partnerships with distributed generation developers to install, operate and manage network connections	• High penetration of behind-the-meter distributed energy resources and micro-grids, reducing the need for a network manager to deliver power • Regulatory mandates that create an independent entity that assumes traditional DSO roles	• Access to low-cost capital • Investment recovery mechanisms • Data analytics systems • Predictive failure software • Distributed energy resource integration

5
Product innovator model

Relevance for transformative market scenarios

Green command and control	*Low*
Regional supergrid	*Low*
Ultra distributed generation	*High*
Local energy systems	*High*

Description

A product innovator is a company that offers electricity as well as behind-the-meter products to customers. This model focuses on expanding the role of the energy retailer and changing the level of customer expectations. We expect behind-the-meter products to evolve into a mix of retail supply packages, e.g. the provision of 'green energy' options, the development of service and pricing 'packages' that offer more flexibility to customers and the provision of behind-the-meter smart devices, e.g. power monitors, smart thermostats. The products offered will empower the connected customer to manage its energy control and provide a link to the network to advance insights into consumption patterns and impacts on network stability. We anticipate that many product innovators will seek to be active players in electric vehicle charging, the provision of premises-based infrastructure and the management of roof-top solar and fuel cell markets.

Market/model examples

The product innovator model will be most relevant in markets where the regulatory framework allows choice and the level of customer acceptance of new technologies and products is high. A market with a high penetration of distributed energy will be attractive for a product innovator who can help provide products that enable or complement distributed energy. Examples of product innovators that have moved beyond pure energy supply include Direct Energy and TXU Energy in the US and Powershop in New Zealand.

Capabilities

A successful product innovator will be highly effective at customer acquisition and retention as well as cross-selling products. Keeping operating costs competitive will be essential to preserving an acceptable margin. To this end, the product innovator needs competitive contracts with energy suppliers and other operational efficiencies, and contracts with technical asset providers for customer support and management of faults. A key question is whether the product innovator can succeed in offering a compelling set of products at the right price. Companies participating in this space will need exceptional skills in customer knowledge, product development, channel management, pricing and product bundling. Product innovators will also need robust customer data analytics and buying propensity insights to shape the right offerings to the market.

What utilities should do now

Focus on knowing their customers' needs, their customers' willingness to pay for solutions, and the value of their own brand. Assess whether a new brand would be more successful, perhaps through partnering with a product provider or creating a separate business unit (or corporate structure). Market research will provide views of what product expansions have been successful or failed in different markets in the past, and the potential products that could be offered in smart homes or through mobile devices. We expect that companies will enter into discussions with providers from other markets, e.g. Google Nest, to discuss how to partner around customer product development and provisioning, rather than default to automatic competition.

Maximising competitive position against potential competitive threats

Product innovator actions	*Competitor threats addressed*	*Future product innovator profitability drivers*
• Develop a compelling product suite including everything from the commodity to the home device • Develop opportunities for superior products that integrate with other needs, such as home or building security or automation • Invest in data analytics tools to develop excellence in customer acquisition and retention • Enhance brand reputation to support product expansion	• Multiple new entrants offering a range of new energy products to customers • Incumbents and new entrants innovating on specific customer offers • Regulatory change enabling retail energy sales • Bundling of offerings to enhance product attractiveness • New tariffs offering risk/reward opportunities for customers	• Keep customer acquisition costs low and operating costs overall low (e.g. attractive energy supply contracts or own energy supply) • Diversify the product portfolio beyond commodity products to preserve margin • Establish partnerships to enhance product range • Focus on retention of profitable and high-volume customers and minimise switching

6
'Partner of partners' model

Relevance for transformative market scenarios

Green command and control	*Low*
Regional supergrid	*Low*
Ultra distributed generation	*High*
Local energy systems	*High*

Description

Incumbent utilities will need to assess whether they have the requisite experience and portfolio breadth to address future customer needs for products and services. A 'partner of partners' utility is a company that offers not only standard power and gas products and associated services, but also a range of other energy-related services, from life-cycle EV battery change-out, to home-related convenience services like new service set-up coordination, to management of net metering-driven grid sell-back. These services can be provided solely by the utility but are more likely to gain customer acceptance when they can be bundled through an expanded relationship with high quality branded providers, like Vivint, OPower, Honeywell, GE, Tesla or Solar City.

Market/model examples

The 'partner of partners' model is most relevant in markets where there is a high proliferation of energy technology and choice and customers are seeking ways to simplify their lifestyle while lowering upfront costs. A market with a high penetration of distributed energy is attractive for a 'partner of partners' who can help provide simple and innovative service-based solutions. One example of a 'partner of partners' model is NRG Energy in the US, with its eVgo and Sunora offerings. Few utilities have embraced this model as it involves non-traditional partnership arrangements.

Capabilities

A successful 'partner of partners' will be highly effective not only at customer acquisition, but also provide superb service delivery. A distinguishing characteristic of these companies will be their ability to innovate in a manner that customers would not expect from their traditional power retailer. These companies will also possess deep customer insights and a commitment to satisfy customers across all touchpoints. A 'partner of partners' may find that many customers want a simple, low upfront cost approach, enabling these utilities to not only install but also continue to own certain assets, for example installing and then servicing a solar system, or installing and continuing to manage energy management equipment. One challenge will be for companies to determine the most appropriate brand with which to go to market, overcoming customers' perceptions of the constraints on services that can be successfully offered by a utility company.

What utilities should do now

Evaluate brand strength to understand constraints and the need for innovative partnerships. Invest in data analytics products to understand customer needs and demand elasticities. Identify potential partners with complementary technology or customer management products and services and engage in introductory conversations. Understand the impact of new products and services on customer switching, margins and long-term growth objectives.

Maximising competitive position against potential competitive threats

'Partner of partners' actions	*Competitor threats addressed*	*Future 'partner of partners' profitability drivers*
• Develop a compelling suite of services and identify the right solution provider partners • Create a range of relationships with solution partners • Expand the range of channels to market that can be leveraged • Develop bundles of offerings targeted at the connected customer • Enhance brand value	• Increasing choice and complexity in the market in terms of technologies and providers • Multiple new entrants offering range of new energy and associated services to customers • Incumbents and new entrants innovating on service delivery models • Regulatory change enabling retail energy sales	• Keep cost of service low, e.g. cross-selling multiple products to a single customer • Keep customer satisfaction high by establishing clear customer service standards, pinpointing and quickly addressing customer pain points, and offering a wide range of innovative yet convenient services

7 Value-added enabler model

Relevance for transformative market scenarios

Green command and control	*Low*
Regional supergrid	*Medium*
Ultra distributed generation	*High*
Local energy systems	*High*

Description

A value-added enabler leverages its fundamental capacities for information management to expand the role that a utility can provide on behalf of its customers. While many customers seek to gain more control over energy consumption or more choice with respect to energy supply, these customers do not share a uniform desire to always be 'hands-on' in making decisions regarding their energy use patterns. Many customers are 'inert', i.e. they do not easily adapt to the existence of choice or accept the role of 'high touch' in energy management. This is where an incumbent can play a new and valuable role that is difficult for other providers to fulfil. Utilities collect and manage massive amounts of data from two primary sources – system operations and customer load. These data provide insights into energy usage patterns that are valuable to the customer and from sources that a customer cannot access. Thus, the utility has the ability to become a value-added energy manager for customers given the 'customer knowledge' it possesses and the customers' lack of desire to perform these same activities themselves.

Market/model examples

Most utilities have performed value-added roles that are knowledge-based in the past, specifically around energy efficiency programmes or energy management in industrial processes. The level of knowledge-based energy management anticipated in this model, however, dramatically extends the scope and scale of these activities into the mass market to a much deeper level.

Manufacturers such as Honeywell and Mitsubishi are focused on addressing certain control elements, like power monitors and smart thermostats. Others, such as Google Nest, are playing in a similar vein with the objective of providing customers a 'set and forget' experience, leveraging their massive data centres to provide real-time and predictive energy consumption data. This space is relatively wide open to utilities, particularly if they understand how to leverage system and customer data to provide premise and action-based insights and solutions. Utilities may also benefit from constraints on third party data usage under data privacy laws, enabling them to offer solutions or to become a partner of choice for solution providers.

Capabilities

Managing large amounts of data in a manner where insights can be rapidly gleaned to guide customer energy decisions and behaviours will be fundamental to success in this business model. In addition, skills in customer education and decision guidance will be key to delivery of value to the customer. Beyond these analytical and interface capabilities, utilities will need to provide a customer experience where value is readily demonstrated so that customers feel comfortable sourcing their energy decision-making to a utility rather than a non-traditional entrant. Utilities will need to demonstrate to customers that they can keep personal data secure and risks of data leakage are remote.

What utilities should do now

Utilities looking to become a value-added enabler need to harness the data that they already possess and determine how to extract value from this information. These companies will need to invest in additional information technology capacity to support, leverage and protect this data. Customer acceptance of the utility in a non-traditional role will require both a campaign to expand customer awareness and appropriate dialogue with regulators to establish the parameters of the value-added services to be provided.

Maximising competitive position against potential competitive threats

Value-added enabler actions	*Competitor threats addressed*	*Future value-added enabler profitability drivers*
• Build-out 'big data' platforms • Educate customers on energy management options • Design innovative methods for sharing customer benefit • Deploy data synthesis methods and tools • Develop data security protocols • Enter into partnerships with data managers to improve competitive position	• Low-priced/free behind-the-meter devices • Regulatory change preventing utilisation of customer data • Leverage of third-party brand for market entry	• Robust data analytics systems • Pricing mechanisms for performance • Decision tools for customer adoption • High quality data security management systems and protocols

8
Virtual utility model

Relevance for transformative market scenarios

Green command and control	*Low*
Regional supergrid	*Low*
Ultra distributed generation	*High*
Local energy systems	*High*

Description

A virtual utility can aggregate the generation from various distributed systems and act as the intermediary between and with energy markets. A virtual utility can also act as an integrator of non-traditional services provided to customers by third parties, e.g. distributed energy resources outside its traditional service territory. In this model, the utility does not own assets but merely provides integration services on behalf of the supplier, provider or performer. A primary focus of companies in this space is to optimise the sourcing of energy, with respect to costs, sustainability and customer needs, and to manage the distribution system. The virtual utility can also undertake demand-side management functions for commercial and industrial loads and smart residential appliances, to help balance demand and supply, either in the wholesale market or contracting with the TSO or DSOs.

Market/model examples

Markets with high penetration of generation connected at distribution level (Germany, US states of Hawaii and California) or a regulatory setting that offers a high degree of freedom for customer choice (US states of New York or Texas, the UK and Australia) are ideal for the virtual utility model. Island systems and remote systems are also ideal markets for this business model. Utilities may combine distributed generation with their own generation, providing a route to market for independent generators and expanding their own asset portfolios.

Capabilities

A successful virtual utility will be highly efficient at energy sourcing, managing or interfacing with local distribution networks, real-time balancing of demand and supply, and providing intelligent tools for managing customer engagement. Sustainability and increased reliability (back-up power) may be offered as additional products, beyond the traditional reliable and affordable grid power. To develop the additional capabilities, the virtual utility will need to build partnerships with developers, system integrators, energy service/energy savings companies (ESCOs), software/technology vendors and online energy marketplaces.

What utilities should do now

Companies wishing to become virtual utilities should develop an aggregation service offering to small, distributed generators, merchant generators and load reducers. Build capabilities to monitor development of innovative technologies and potential partners to leverage to expand solution offerings for the wholesale market and for balancing services. Additionally, they should determine pricing structures that provide appropriate incentives for the energy providers and a sufficient margin for their own operations. In some markets, utilities should instigate discussions with the regulator to develop and implement appropriate mechanisms to facilitate the new services.

Maximising competitive position against potential competitive threats

Virtual utility actions	*Competitor threats addressed*	*Future virtual utility profitability drivers*
• Participate in distributed generation and storage projects • Develop partnerships with technology-based providers • Increase customer engagement via intelligent tools • Define future roles for incumbents in concert with regulators	• High penetration of non-utility-owned distributed generation and storage systems • Regulatory change enabling retail energy sales • New entrants offering products/services that increase customer engagement in managing their energy needs	• Offer structure and pricing of a wide range of energy products (low cost, high renewables, local generation etc.) • Ability to trade energy (sourcing and consumption) • Partnering with key players across the energy value chain

Where do we go from here?

Utilities may choose from a range of paths to move forward from where they are today. But frankly, business model clarity may be difficult to achieve as a lot of uncertainty exists on how future markets may develop and mature. And multiple models may need to be deployed to meet diverse market needs or specific regulatory structures in various countries, or even jurisdictions. Companies will need to be agile in designing their future business model and recognise that an imperfect view of the future will likely lead to an unfinished product that evolves through time.

Regardless of the business model chosen, utilities need to understand how they can leverage their current business position and the external market to enhance their future competitive positioning. While not always obvious, companies have several levers that can be used to advance their readiness for the future and position themselves for success (see figure 8).

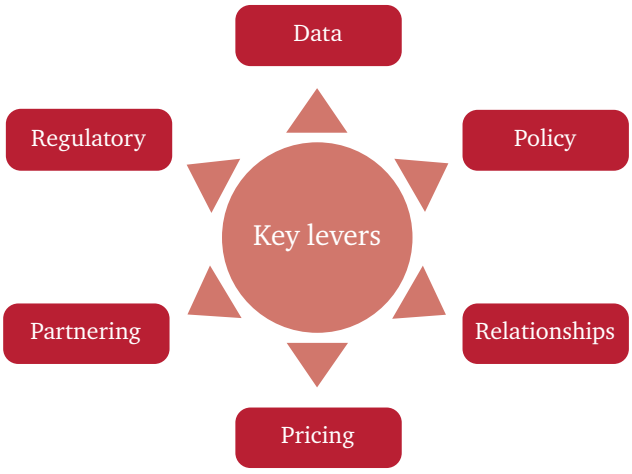
Incumbent companies may not be as nimble or focused as some new entrants. But they have a number of potential advantages with regard to data, policy, relationships, pricing, partnering and regulatory decisions. These can help leverage the successful development of their future business models. At the same time, it's important for companies to recognise that future markets are likely to create networks of participants in new partnerships and collaborations that become a norm of the go-to-market models.

Companies can take advantage of these levers to strengthen their starting point for defining their future roles and for subsequent market participation. For example, utilities already hold large quantities of data that have not been effectively utilised, giving them the opportunity to add value through better utilisation and communication of this data.

Similarly, utilities are a natural collaborator with regulators in the shaping of responsive policies to accomplish public interest objectives, including how to enable customers to achieve greater control and choice. Utilities are also attractive partners to new entrants that wish to offer high-value products but do not wish to support them in the manner customers are used to from their utility.

Utilities will need to determine 'where' it makes sense for them to participate in the future energy market and 'how' they can best position themselves for success. No single business model will be the panacea for utilities. Rather, they will have to be adaptive to the development of the marketplace and the evolution of the connected customer. Just as utilities are unsure of market direction, customers are equally uncertain of what really matters to them in energy decision-making. These gaps between foresight and expectations provide the 'open seas' where utilities can forge new business models that fundamentally reshape the historical relationship with customers and position incumbents for a broader and more value-creating future.

Figure 8: Future business model levers



Data
Ownership of grid and customer information can provide a knowledge platform that enhances the value proposition.

Policy
Mandates and legislation can shape the playing field and enhance the incumbent's ability to compete.

Relationships
The natural interfaces of the incumbent with customers, suppliers, stakeholders and other providers create a natural platform.

Pricing
Shifts in traditional cost-recognition models can provide greater certainty to cost recovery and additional flexibility to rate design.

Partnering
Enhanced creative and delivery capabilities can extend the incumbent's existing platforms and market reach.

Regulatory
Decisions can provide both offensive (exploit) and defensive (preserve) mechanisms to enhance market competitiveness.

Discover more

Contact us to learn more about PwC's energy transformation programme and give your viewpoint on the themes and scenarios discussed in this report.

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