

# *A different energy future*

## Where energy transformation is leading us



**97%**

expect to see a medium to very high level of market disruption by 2020.

**73%**

anticipate major or very major business model transformation by 2030.

**60%**

say their main home market will be more than '50% transformed' by 2030.

# Introduction

*We are witnessing considerable disruption in the power sector arising from a combination of policy, technological and customer change. It's creating a transformation in how we think about, produce and use electricity. In some parts of the world, disruption is already taking a strong hold. In other parts of the world, it is just beginning. It comes on top of the already considerable existing challenges companies face in providing energy security, affordability and sustainability.*

In response, the business models and the operational focus of many companies in the sector are changing. We focus on these changes in much of this year's survey. We look at what is driving the change and where it is leading. We include an analysis of some of the principal disruptive factors at work and, based on the survey data, have constructed a Power & Utility Market Disruption Index that shows the extent to which disruption is expected to intensify in the next five years to 2020.

Looking further ahead, we find that a clear majority in our survey expect significant or very significant market model change by 2030 in response to energy transformation and that current business models won't be sustainable for long. For some the need for change is pressing and, indeed, well over a third of those in North America and Europe say that current power sector company business models are already broken and the need for change is urgent. But elsewhere in the world, the imperative to change is felt to be less immediate.

We examine what all this means for the operational focus of companies. As well as a switch away from thermal to renewable generation, we find a big step-up in activity is expected in areas that are of limited or only emerging importance to the sector at the moment, such as smart city, smart home and smart community infrastructure, local energy systems, electric vehicles and off-grid solutions. We conclude with a look at the capabilities that will be needed and get the industry's opinion on whether we can expect a new 'golden age' for the sector or whether the future is less promising.

**70**

companies

**52**

different  
countries

We look at these big issues through the viewpoint of a survey that is extensive in scope as well as intensive in its depth. We have talked to senior power and utility company executives in 70 companies and 52 different countries around the world. The survey is supplemented by the ‘on the record’ perspectives of a number of CEOs that are also included in the report. We report survey responses to a range of questions and also, in a series of future scenarios, views on how particular aspects of the world of electricity will look in the future.



**Norbert Schwieters**  
Global Power & Utilities Leader

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### Terminology used in the report

By the term ‘**energy transformation**’ we refer to the convergent effects of technological advances, the growth of distributed generation, new forms of competition, changes in customer behaviour, regulatory direction and their combined impact on the nature of the power system and power companies.

The term ‘**disruption**’ is used to mean a change in the established way of doing business. It could arise from a single factor, such as technological change, regulatory change, competitive forces, changes in customer behaviour, or from the accumulated impact of a host of factors. The result is a challenge and a shift in existing business viability or ways of working.

We use the term ‘**market models**’ to refer to the way a market is structured and designed, whether it is policy/regulator-led, market-led or a mixture of both, the extent of competition, separation or integration of roles and the ‘policy goals’ that are promoted.

By the term ‘**business model**’ we mean the means by which a power and utility company makes a profit or creates revenue – what it does, how it addresses its marketplace, and the business relationships it deploys to do so.

# Executive summary

*The PwC Global Power & Utilities Survey goes to the heart of boardroom thinking in utility companies across the globe. In this, our 14th edition, we look at the major changes facing the sector as it gets to grips with the prospect of a very different energy world ahead. We look at the way companies expect their markets and business models to change in the period to 2030 and get their viewpoint on the outlook for the energy trilemma and risks facing them in the short term. For many, the current way of doing business is at stake and survey participants give their insight on what operational changes lie ahead and whether the future will bring success or failure.*

## ***A changing emphasis in the energy trilemma***

Survey respondents appear to be anticipating a more robust climate deal at the December 2015 inter-governmental climate change summit in Paris than has been achieved before. Evaluating the classic energy trilemma between security, affordability and sustainability, they expect significant change in the next five years. Currently they give sustainability/cleaner energy only 61 per cent of the emphasis given to security of supply (with affordability receiving 92 per cent). By 2020 they expect sustainability/clean energy to move up to 81 per cent, largely at the expense of affordability.

## ***A mixed record on the megatrends***

Five megatrends – technological breakthroughs; climate change and resource scarcity; demographic and social change; a shift in global economic power; and rapid urbanisation – are having a significant impact on the power sector. Many of our survey respondents recognise their importance for their companies but the sector has a mixed record at best in responding to them. In the case of technology breakthroughs and the shift in global economic power, more participants report little or no success than report high or very high success. And nearly as many companies in the sector say they are unsuccessful in addressing climate change and demographic trends as say they are successful. Rapid urbanisation was the only example of a megatrend where many more reported success than those who said they are having little or no success.

## ***Rising risk levels***

Concern about nearly all of the major risks facing the power sector is rising. Regulatory uncertainty and the difficulties of attracting investment top the list of concerns. The challenge of managing these two leading risks looks set to be all the greater as a result of rising risk concern levels for the five other risks that we asked survey respondents to assess – blackouts, market dislocation, emissions/air pollution, fuel availability/supply risk, and cyberattack. Concern about all of these risks is heightening. Around three-quarters of survey participants think these will be medium to high-level concerns in 2020. Many more companies expect to have them on their high alert radar than is the case today.




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# 97%

expect a medium or high amount of disruption in their main home market by 2020.

## *Energy transformation sights set mainly on the next decade*

The convergent effects of technological advances, policy measures, the growth of distributed generation, new forms of competition and changes in customer behaviour are having a transformative impact on power markets. We asked the survey participants about the extent and pace of energy transformation in their main home markets. Some expect it to intensify in the next five years but most anticipate transformation will take real hold in the 2020s. Only a few (14%) expect that their main home market will be more than '50% transformed' by 2020. But by 2030, three-fifths anticipate transformation of this magnitude.

## *Customer pull gains ground on regulatory push*

All regions except North America report that regulatory direction is the biggest driving force behind energy transformation. But in North America, it is changes in customer behaviour that are cited by most respondents. The contrast is evident when comparing Europe and North America. In Europe, 87 per cent of survey participants say regulatory change is having a high or very high impact compared to just 43 per cent saying the same about customer behaviour. But in North America it is the reverse – more (71%) point to customer behaviour as the factor having the high or very high impact than choose regulatory direction (57%). As energy transformation takes hold, we would expect customer pull to increasingly take over from regulatory push.

## *The rise of distributed generation*

In some territories, distributed generation is already taking a large chunk out of the market for centralised generation, undermining the classic power utility business model and adding complexity into the task of balancing supply and demand. Globally, survey respondents anticipate distributed generation will take a 10–20% share of total generation by 2020, rising to a 20–30% share by 2030. But a significant minority think the distributed generation share could be higher. Over a fifth (22%) anticipate a '30% plus' share for distributed sources by 2030. Nearly half of survey respondents (47%) say there is a medium to high probability that distributed generation could shrink the role of some power utility companies to providers of back-up power.

## *Market disruption intensifies*

Disruption and market change are gathering pace in power markets around the world. Over half of survey participants (55%) report that their market is undergoing a medium degree of disruption now and a further 16 per cent report high levels of disruption. Less than one in three said their market is relatively undisrupted now and hardly any expect that situation to continue to be the case in the next five years. Looking ahead to 2020, nearly half (47%) expect a high or very high amount of disruption, with a further 51 per cent anticipating medium levels of disruption.

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# 60%

expect their main home market will be more than '50% transformed' by 2030.

**Executive summary**

## The Power & Utilities Market Disruption Index

The Power & Utilities Market Disruption Index is based on survey respondents' assessment of disruption in five key areas – policy and regulation, customer behaviour, competition, the production service model (the infrastructure, products and services provided by the sector), and distribution channels (how the sector reaches and delivers to customers). 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. The Market Disruption Index is a composite measure of a basket of these five disruption factors.

On a global level, the market disruption index rises by 42 per cent between 2015 and 2020. Europe remains the most disrupted region in 2020 but, because it is already experiencing a relatively high degree of disruption, the 2015–2020 rise is one of the smallest. Survey participants in North America anticipate the biggest market disruption index increase, up 64 per cent from 3.9 to 6.3 to take the region to disruption levels comparable with Europe by 2020. All regions record significant increases in the market disruption index. North America moves above the Asia Pacific region to second place in the ranking by 2020.

2020 ranking	2020 Index score	2015–2020 % increase
1. Europe	6.7	+33%
2. North America	6.3	+64%
3. Asia Pacific	5.5	+33%
4. Middle East & Africa	5.5	+50%
5. South America	4.9	+44%
<b>Global</b>	<b>6.0</b>	<b>+42%</b>

Scored on a scale of 1–10 where 1 = no disruption; 10 = very disrupted. The index comprises the mean scores recorded for a basket of five disruption factors (policy & regulation; technology change; production service model; distribution channels; customer behaviour; and competition). Each disruption factor is given an equal weighting.

Source: 14th PwC Global Power & Utilities Survey

## Widespread market model change anticipated

Across all regions, 70 per cent expect significant or very significant market model change by 2030. A further 22 per cent anticipate medium change. Less than one in twelve think there will be little or no change in market models. The global figures mask significant regional differences, with the expectation of change most intense in Europe and North America, where 91 per cent and 86 per cent predict major change. There is less consensus about the extent of market change elsewhere although a clear majority (59%) in the Asia Pacific region and nearly half (46%) in the Middle East and Africa share the viewpoint of their peers in Europe and North America.

## A more open, competitive and different type of power market

An expectation of a more open and competitive power market is shared by many of the survey participants. Nearly four fifths (78%) anticipate greater competition and competition from outside the sector is being taken very seriously. Three-quarters see a medium to high level of competitive threat coming from companies with a technology or engineering focus and nearly as many (71%) from companies from the IT/telecoms sector. Powerful brands from the retailing or online sectors are also seen as a threat. 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.

# 78%

anticipate greater competition.

## Future power sector business models

What's the future for the current power utility business model? Much will be determined by the future direction of each country's market and regulatory situation. This location-specific shaping of business models is reflected in the wide variety of answers we got from different regions of the world on the outlook for existing power sector business models. In North America, only seven per cent of survey participants feel that current business models will 'serve us well into the future' but nearly half (47%) of those in the Asia Pacific region think that current business models will remain durable. However, globally, only a quarter (26%) agreed with this optimistic outlook, with just over half (52%) disagreeing. In part, these different regional outlooks reflect the different patterns of state ownership and market opening of the sector across the world, with developing countries, in particular, having a higher number of state-owned utilities and finding it less imperative to consider business model change.

### A changed operational focus

There is a big step-up in activity in areas that are of limited or only emerging importance to the sector at the moment. The number saying involvement in smart city, smart home and smart community infrastructure will be of major importance rises from 14 per cent now to 62 per cent in 2030. Similar big increases are evident across a range of areas:

- Local energy systems and infrastructure – up from 11 per cent now to 55 per cent in 2030;
- Electric vehicles and transportation – 11 per cent now versus 51 per cent in 2030;
- Own distributed generation – 8 per cent now versus 48 per cent in 2030;
- Support for customer or third-party distributed generation – 5 per cent now versus 41 per cent in 2030;
- Off-grid energy solutions – 3 per cent now versus 37 per cent in 2030.

### The end game – rise or fall?

New market models and new business models will become established as a result of energy transformation and could quickly eclipse current company strategies. We presented a trio of future scenarios to survey participants – an optimistic 'golden age' one in which power utilities flourish and grow, a pessimistic 'death spiral' scenario in which the sector declines rapidly, and a middle ground of flatter growth and a slow transition away from the current central grid model.

Opinion is evidently undecided on exactly where transformation and disruption is taking us:

- 89 per cent say there is a medium to high probability of a 'flat and declining role for power utility companies and current central grid-based energy systems';
- But 70 per cent also attach a medium/high probability to a 'golden age' of utility reinvention in which power utilities enjoy significant success and growth;
- Yet 58 per cent don't rule out a 'downward' or even 'death spiral' from disintermediation, technology disruption and customer behaviour, with power utility companies and current energy systems undergoing a major decline.'

Looking ahead, we think predictions of a 'death spiral' for companies in the power and utilities sector are overdone. But if companies in the power sector don't stay ahead of change, the challenges they face will intensify. The challenge will be to make timely moves to gain the most of the market opportunity of 'old energy' systems and business models while, at the same time, transitioning to the new business models required as energy transformation takes hold.



# 66%

say business model change is becoming urgent.

*If companies in the power sector don't stay ahead of change, the challenges they face will intensify.*

**Executive summary**

## Mapping a successful energy transformation path

Many of the issues discussed in this survey are the focus of PwC and Strategy&S's Energy Transformation framework. The framework helps companies map the effect on them of the disruption and transformation taking place in the sector all the way from the root causes through to impacts on future market designs and business models.

This programme of work with companies helps them address a series of crucial questions. What will the future market design look like? Who will be our 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 challenge for many companies in the sector will be to make timely moves to gain the most of the market opportunity of 'old energy' systems and business models while, at the same time, transitioning to the new business models required as energy transformation takes hold.

In parallel, companies will need to judge carefully what capabilities they can successfully add themselves and what will need to come from partnerships, joint ventures or M&A strategies.

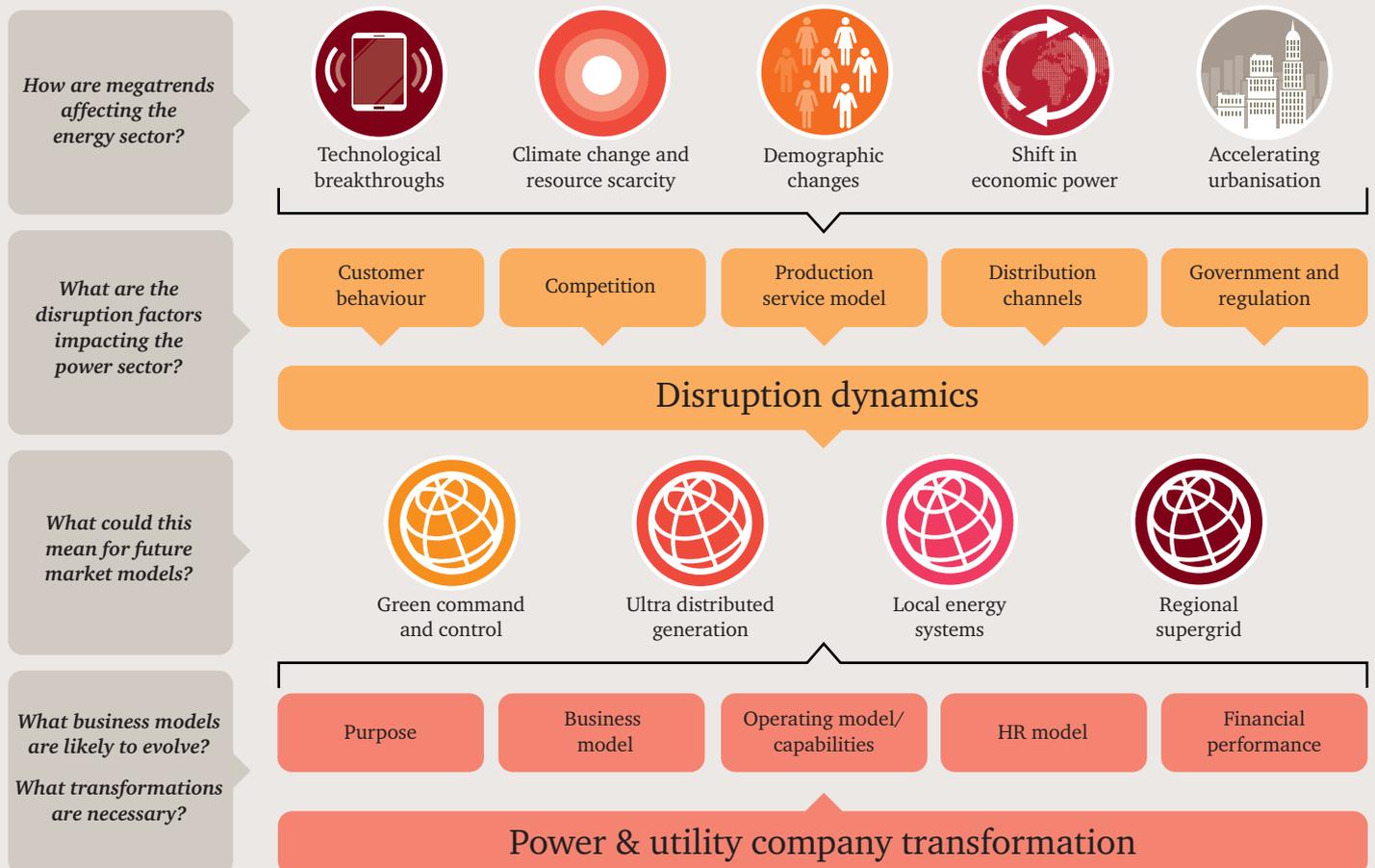
*'Where do we play?'*

*'How do we play?'*

*'How do we win?'*

*What should our future business models look like?*

### PwC energy transformation framework



# A trickier balancing act

*The balancing act facing power utility companies is multiplying in complexity. As well as the classic trilemma of security, affordability and sustainability, a range of new issues has to be weighed up. Foremost among them are decisions that flow from a series of megatrends at work in the world.*

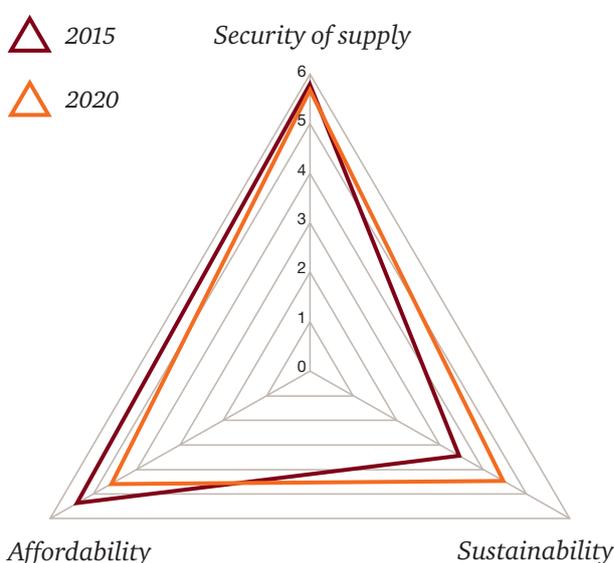
How best to respond to technological change and energy transformation which is altering the way in which we use and think about electricity? What parts of the value chain to focus on in an era of energy transformation? How to manage an increasing level of risk on a number of fronts, including a more precarious balancing of supply and demand and new concerns such as cyberattack? In this chapter we look at how survey participants view the energy trilemma, global megatrends and the risks facing the sector. In the following chapter, we look more closely at energy transformation and where it is taking companies in the future.

## The shifting energy trilemma

The trade-off between the three classic energy objectives of security of supply, affordability and sustainability has long been recognised as a central dilemma, or 'trilemma', for energy policy. The energy supply that might be the most secure may not be the most affordable and/or the most sustainable and vice versa. As the World Energy Council points out, "delivering policies which simultaneously address energy security, universal access to affordable energy services, and environmentally sensitive production and use of energy is one of the most formidable challenges facing government and industry."<sup>1</sup>

**Figure 1: Energy trilemma**

Where is your 'home country' energy market positioned in the 'trilemma' between security of supply, affordability and sustainability now and where do you expect your 'home country' energy market to be positioned in 2020?\*



2015	Average score	Index
Security of supply	5.9	100
Affordability	5.5	92
Sustainability	3.6	61

2020	Average score	Index
Security of supply	5.7	100
Affordability	4.7	83
Sustainability	4.6	81

\* Respondents were given a total sum of 15 points to allocate between the three trilemma goals. All 15 points had to be used. The lead goal is then indexed to 100.

Source: 14th PwC Global Power & Utilities Survey

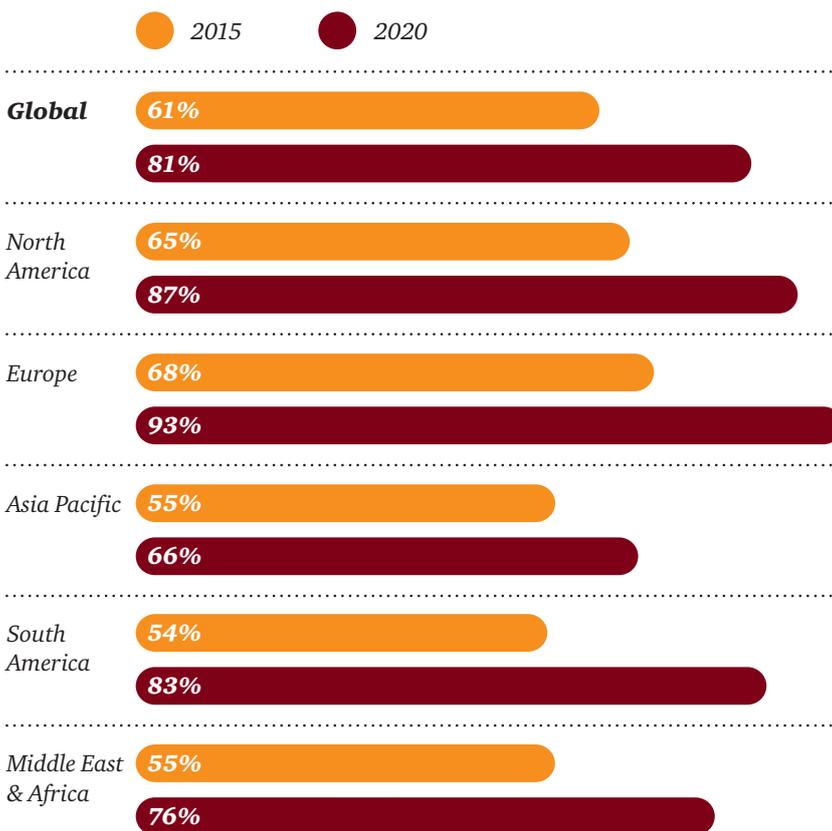
**A trickier balancing act**

We put the question of this ‘energy trilemma’ to our survey participants. We asked them to assess how well they feel their ‘home country’ market rates on each dimension of the trilemma but also forced them to make trade-offs between the different elements, in a reflection of the real-life trade-offs that exist. The responses confirm security of supply as the foremost priority, with affordability not far behind (figure 1). Both receive an ‘above par’ score. But survey participants expect significant change in the next five years. Currently they give sustainability only 61 per cent of the emphasis given to security of supply. By 2020 they expect this to even out somewhat with sustainability moving up to 81 per cent, largely at the expense of affordability (figure 1).

The trend towards a more elevated priority for sustainability is one that’s expected by survey participants in every main region of the world. As we see in figure 2, sustainability currently gets about two-thirds of the attention given to the lead goal of security of supply according to survey participants in North America and Europe, and even less in Asia Pacific, South America and the Middle East and Africa.

But respondents anticipate that will change quite significantly in the next five years and that, by 2020, it will be gaining around a 90 per cent focus in North America and Europe and around 75 per cent elsewhere. In December 2015, in the biggest climate change meeting since the 2009 Copenhagen summit, representatives from more than 190 countries are due to meet in Paris to sign an international agreement to cut CO2 emissions. The shift in the energy trilemma emphasis placed on sustainability and clean power suggest that our survey respondents expect a more robust deal than was achieved in 2009.

**Figure 2: Sustainability – moving up the agenda**  
Sustainability indexed against security of supply – 2015 and 2020\*



\* Point share allocated to sustainability/clean energy as a proportion of those allocated to the lead goal of security of supply. Indexed against security of supply = 100.  
Source: 14th PwC Global Power & Utilities Survey

**81%**

The relative priority expected to be given to sustainability in the energy trilemma in 2020 compared to security of supply, up from 61% in 2015.

## Responding to megatrends

### A trickier balancing act

We've identified five megatrends – technological breakthroughs; climate change and resource scarcity; demographic and social change; a shift in global economic power; and rapid urbanisation – that are presenting important challenges for all businesses. And many aspects of them are having a profound impact on the power sector. For example, the regulatory encouragement of renewable power comes partly in direct response to climate change concerns. Other trends are interacting, for example the potential for rapid urbanisation to accelerate the roll-out of distributed energy and micro-grids. And, of course, the shift in the focus of global economic growth is amplified by population growth in many of the same high-growth markets.

All of these megatrends are rated as being of medium to high importance by a majority of the companies in our global survey (figure 3). Technology breakthroughs and climate change/resource scarcity head the list with over 80 per cent saying they are important and the vast majority of these saying there are of high or very high importance. Urbanisation is also high on the agenda for many companies, with 77 per cent of respondents ranking it of medium to major importance.

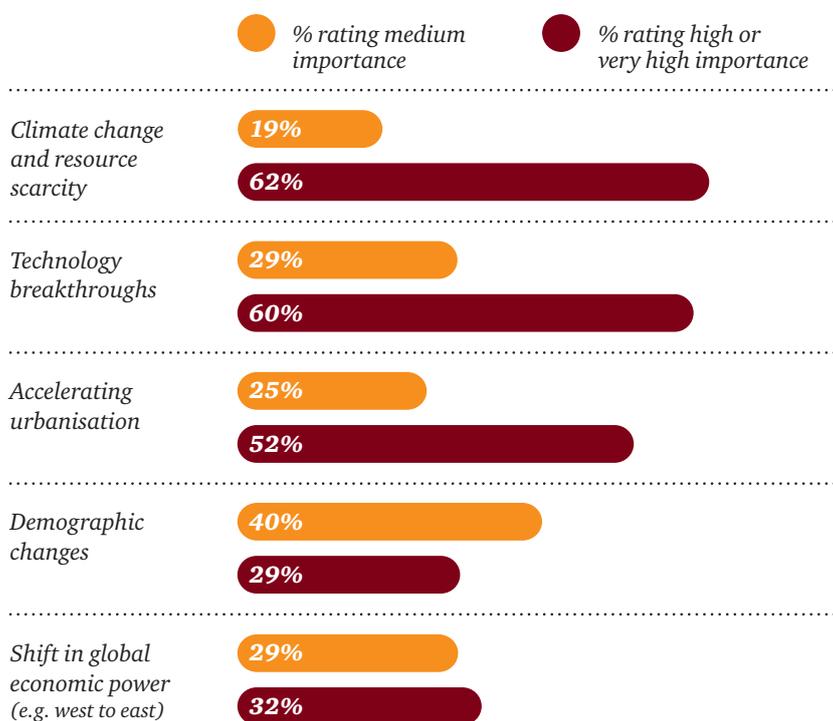
Technology breakthroughs and climate change are rated as being of fairly uniform importance by power utility companies in all regions. But the other megatrends impact different power utilities in different ways depending on their geographic and market circumstances. The shift in global economic growth, for example, has led a number of European power companies to try to gain market share in fast-growth Latin American and other overseas markets to offset dwindling growth in Europe. But the same need to switch focus is not of such importance for companies who judge that their current markets offer sufficient potential for future growth. Reflecting this, over half (52%) of survey participants in Europe said the shift in global economic growth was of major importance for their company compared with a third (32%) of all respondents globally.

# 62%

Expect climate change and resource scarcity will be of major importance in 2020 compared to just 19% in 2015.

Similarly, the impact of demographic trends is felt more in some regions than others, with around 54 per cent of respondents in the Middle East and Africa and Asia Pacific saying it is of major importance to their company compared to only 29 per cent of all respondents. And accelerating urbanisation is also more of a concern for survey participants in the Middle East and Africa and Asia Pacific than those in North America and Europe. Indeed, 77 per cent of those in the Middle East and Africa say it is of major importance to their companies. Africa already has at least 120 cities of over half a million residents and 47 of over a million, spread out among 54 countries<sup>2</sup>. It is home to seven of the world's megacities and more than half of global population growth between now and 2050 is expected to occur in Africa.<sup>3</sup>

Figure 3: Global megatrends – level of importance\*



\* Score 1 to 5 where 1 = not important; 5 = very important. Scores 3 (medium) and 4/5 reported.  
Source: 14th PwC Global Power & Utilities Survey

2 For cities of over half a million inhabitants, see Demographia World Urban Areas: 11th Annual Edition: 2015:01, Table 5: Summary: Urban Areas 500,000 & Over, p. 132, Demographia, January 2015, at <http://www.demographia.com/db-worldua.pdf>; for cities of over a million, see the infographic by Future Cape Town on its website at <http://futurecapetown.com/2013/07/infographic-fastest-growing-african-cities/#.VMqShqlv3dl>.

3 World Population Prospects: The 2012 Revision, Population Division, UN Department of Economic and Social Affairs.

**A trickier balancing act**

But while there is a considerable recognition of the importance of the megatrends for power and utility companies, many are having difficulties responding to them. We asked survey participants to rate how successful they feel their company is at addressing each megatrend. We then filtered the results to exclude any respondents who thought a trend wasn't important for their company. The results are in figure 4.

In the case of technology breakthroughs and the shift in global economic power, more participants report little or no success than report high or very high success. And nearly as many companies in the sector say they are unsuccessful in addressing climate change and demographic trends as say they are successful. Rapid urbanisation was the only example of a megatrend where many more reported success as said they are having little or no success.

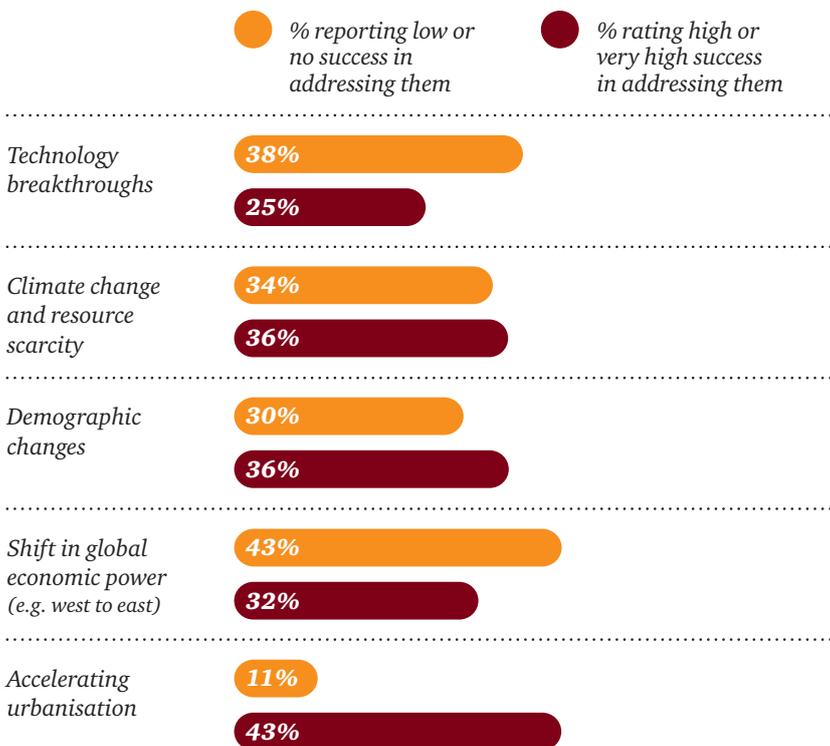
To some extent, these results are a reflection of a moment in time. Success takes some time to come to fruition and some companies may feel their strategies are at too early a stage to justify reporting successful outcomes. On the other hand, they also reflect some of the things we know about the sector. Historically, the pace of technology adoption in the power utilities sector has been slow. Key technological developments, such as the use of system operation computers for grid energy management, have taken a decade or longer to become established.

Responding to megatrends

**38%**  
vs  
**25%**

More survey participants say they are having difficulty responding to technological change than report success.

**Figure 4: Global megatrends – level of success in addressing them**  
Results for those saying the particular megatrend is of medium to high importance for their company.\*



\* Rated success of company on a score of 1 to 5 where 1 = not successful to 5 = very successful. Scores 1/2 and 4/5 reported.  
Source: 14th PwC Global Power & Utilities Survey

The traditional centralised generation and grid model is relatively unchanged and companies are used to medium to long capital programme cycles for renewal and innovation rather than the months and few years that have come to characterise fast-moving technology adoption in the digital communications world. It's no surprise that power and utility companies report that they are struggling to respond to technology breakthroughs, especially when some of these technologies are at the consumer end of the value chain.

When it comes to global repositioning moves to respond to the shift in global economic power, again we would expect many survey participants to report difficulties in executing strategy successfully. Moving away from mature markets into fast-growing but often more volatile and less familiar environments, is challenging. Brazil is a case in point. A market downturn has put pressure on Brazilian power utility companies and financial troubles, including bankruptcy filings, have been a setback to European expansion ambitions there.

## Rising risk levels

Regulatory risk and the difficulty of attracting the investment required in the sector are the highest-rated concerns among the risks we asked survey respondents to assess (figure 5). They were rated as medium to high-level concerns by well over 80 per cent of participants. Few anticipate any improvement between now and 2020. Indeed, the proportion with high or very high-level concerns about attracting investment rises from 56 per cent in 2015 to 68 per cent in 2020.

Both these risks are concerns across all regions with very little regional variation. The exception is 'difficulties in attracting investment' where the proportion of respondents in Asia Pacific and South America rating this as a medium to high-level 2015 concern was rather less than in other regions – 59 per cent and 67 per cent respectively versus 84 per cent globally. However, greater optimism in both these regions is not maintained in their 2020 outlook, with concern levels for both risks rising back up.

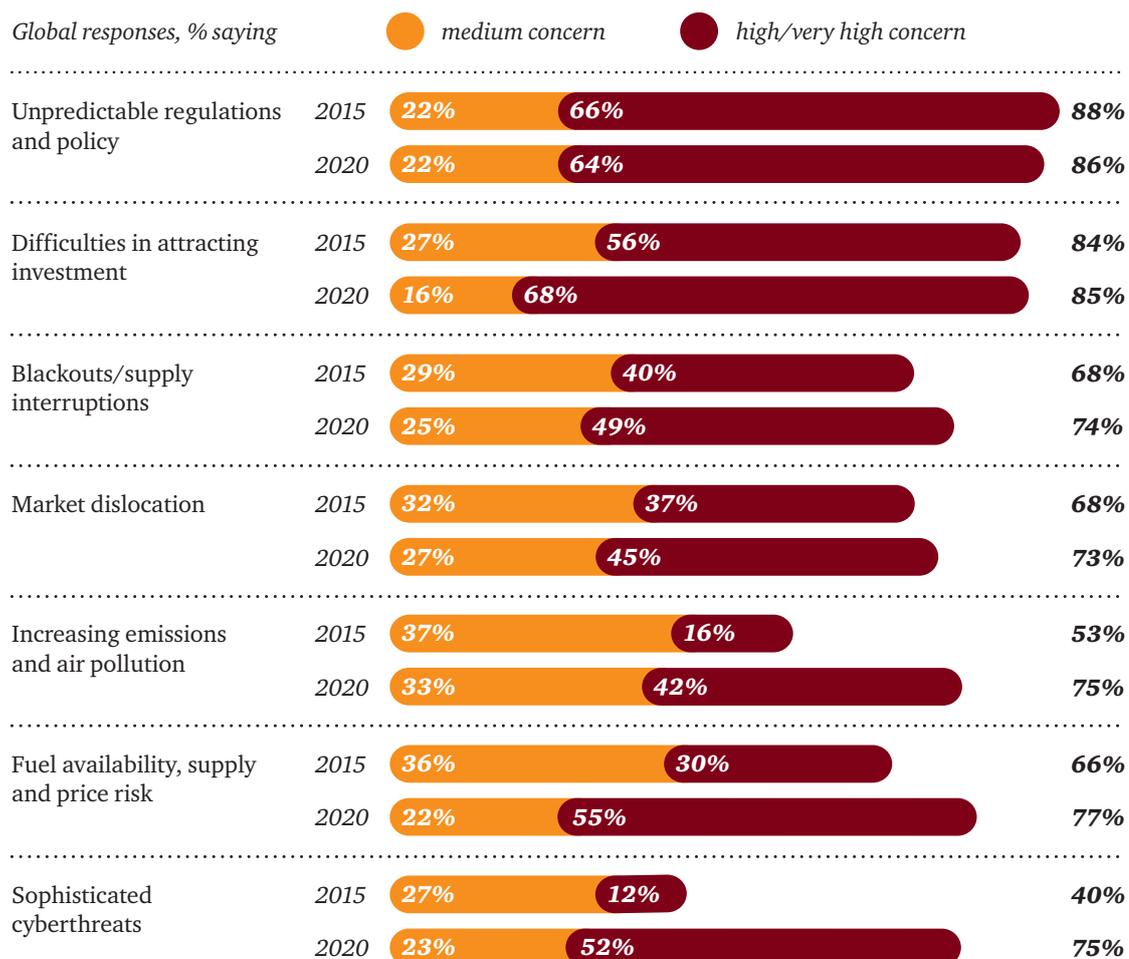
Responding to megatrends

**43%**  
vs  
**32%**

More are struggling to respond effectively to the shift in global economic power than are dealing with it successfully.

**Figure 5: Power sector risks – now and in 2020**

What is your assessment of the following power sector risks in your 'home country' market?\*



Note: Numbers are rounded to a single whole number. Rounding accuracy means totals may not exactly match the sum.

\* Scale of 1-5 where 1 = no concern; 5 = very high concern. Medium = 3. High/very high = 4/5.

Source: 14th PwC Global Power & Utilities Survey

***A trickier balancing act***

The challenge of managing these two leading risks looks set to be all the greater as a result of rising risk concern levels for the five other risks that we asked survey respondents to assess – blackouts, market dislocation, emissions/air pollution, fuel availability/supply risk, and cyberattack.

Concern about all of these risks is heightening. Around three-quarters of survey participants think these will be medium to high-level concerns in 2020. More companies expect to have them on their high alert radar than is the case today.

In the case of cybersecurity, for example, only 40 per cent report it as a concern in 2015 but this rises to 75 per cent when asked about 2020. It should be noted that we conducted this survey before the major power failure that affected much of Turkey in April 2015 and which led to an initial move by the energy minister to monitor whether a cyberattack could have been a cause, although sabotage was later ruled out. The critical national infrastructure of the power sector is a particular target for cyberattack, as are the online systems for the commercial relationships the sector has with millions of customers.

A similar rise in risk concern is seen in the case of emissions and air pollution – up from just over half (53%) being concerned today to 75 per cent in 2020. As we noted earlier, UN negotiations are under way to develop a new international climate change agreement that will cover all countries from 2020. But irrespective of whatever is decided on the international stage, national governments are moving to tighten national air pollution and emissions rules. In China the risks arising from air pollution are the subject of increasing discussion and, recently, the government announced that the last of the coal-fired generation plants around Beijing are to be closed. This is a noteworthy move although China's power generation is heavily dependent on coal and longer-term moves to limit emissions remain unclear.

In the US, coal-fired power plants are subject to the Mercury and Air Toxics Standards (MATS), which require significant reductions in the 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. A further tightening of rules could come in the form of the proposed Clean Power Plan, which will require carbon emission from the power sector to be cut by 30 per cent nationwide below 2005 levels by 2030. These measures are very significant for many power companies in the US. Reflecting this, in our regional results, it is North American survey respondents who rate air pollution risk highest – 79 per cent expect it to be a medium to high-level concern by 2020, with the proportion expecting it to be a high or very high-level concern rising from 21 per cent in 2015 to 57 per cent in 2020.

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**40%**  
rising to  
**75%**

Proportion of survey participants expressing concern about cyberthreat risk.

## CEO perspective

### In step with the pace of change



*Pacific Gas and Electric Company (PG&E) is one of the largest natural gas and electric utilities in the United States. Tony Earley, Chairman, CEO and President of PG&E Corporation, gives his viewpoint on some of the key questions arising from the PwC survey findings.*

*PwC: Is the power utilities sector underestimating the speed of energy transformation taking place and where it is taking us? Four-fifths see market transformation as largely coming in the next decade. But doesn't 'success or fail' action need to be taken now?*

Earley: I believe the utilities sector is very much in tune with the speed of energy transformation. We have to remember that change is not new in our industry. For over a century, utilities have been leaders and innovators in building an infrastructure that has helped enable economic development on a scale and at a pace unmatched in history. Of course, we have also seen examples of companies getting too far ahead of changes and failing in their critical present-day mission. Today, change is happening faster than ever, and every utility is in a different place in terms of the pace of change within their market. At PG&E, for example, which serves nearly 16 million people in Northern and Central California, we recently crossed the 165,000 mark for the number of customers with rooftop solar—by far the most of any US utility. We've also seen the number of electric vehicles double in less than two years. And other consumer technologies are entering the market seemingly every day—from smarter appliances and thermostats to new battery storage options.

Regardless of how quickly these technologies are emerging in various parts of the country, utilities need to take action today to prepare for a future where more of our customers want and have access to these technologies. At PG&E, we're doing this by focusing foremost on investing in the underlying infrastructure. To be relevant for our customers in the future, our systems must continue to be safe, reliable and affordable. But they must also be smarter, more flexible and more dynamic—incorporating layers of information technology and data analytics capabilities. Creating this type of infrastructure for the 21st century will require continued investment from utilities, and importantly, policies at the federal, state and local levels that pave the way for doing so.

*PwC: Is there a danger that companies in the sector will find themselves following not leading? For example, many report they are struggling to respond to the pace of technological change and are not setting that pace themselves.*

Earley: The reality today is that a lot of the innovation happening in energy is being driven by non-traditional players. It used to be that utilities were the sole innovators in our sector—that's simply not the case anymore. Instead, we have to look for ways to collaborate. In recent years, PG&E has worked with dozens of companies in California to develop and pilot new technologies, and we want to expand these partnerships. You can compare it to what Bill Ford, executive chairman of Ford Motor Company, said recently about the auto industry. He predicted that automakers will not own or develop a lot of the technology that's changing their business. Instead, they have to be "thoughtful integrators" of other companies' technology. I think that applies every bit as much to utilities, which means we need to be open and excited about partnering with non-traditional players.

*PwC: Give us your vision for where energy transformation is heading in your main market.*

Earley: At PG&E, we envision a future where the grid that we own and operate functions as a Grid of Things™—like the internet of things—where all of the energy technologies that our customers want to pursue are connected together to an integrated grid. Through the Grid of Things, we can accommodate increasing amounts of those technologies, adding tremendous value for our customers and to the grid itself. Think about the potential to offset dips in renewable energy with power from stationary electric vehicle (EV) batteries, for example. Our nation is on the cusp of an incredibly bright energy future. With continued investment, the right policies, and openness to new partnerships, the path to that future runs through the 21st century utility.



# A different future world

*Technological innovation is at the heart of the shifts that are heralding the prospect of a very different future power sector world. The spread of wind and solar generation is the most visible manifestation of this. But advances are happening in many other parts of the sector – for example, in large-scale technologies such as high-voltage DC transmission, in distributed and smaller-scale customer-based energy systems, in smart grids and on the load side. These developments in power technology are running in parallel with the digital revolution, which is opening up new easier ways of controlling, managing and trading energy.*

Power is being transformed from a top-down centralised system to one that is much more interactive but also decentralised and fragmented. Technological advances are being accompanied by price falls, most strikingly in the cost of solar modules. A recent analysis by Deutsche Bank notes that unsubsidized rooftop solar electricity costs anywhere between \$0.13 and \$0.23/kWh today, well below retail price of electricity in many markets globally. And it goes on to anticipate further cost reductions resulting in solar achieving grid parity in around half of the target markets that were studied, with the potential for another 30 per cent of countries to have solar grid parity within the next five years or so if forecast further cost reductions materialise.<sup>4</sup>

The economics of solar are now comparable with that of onshore wind power. Grid parity is now increasingly well established for both these renewable energy sources and we are reaching a point where their growth is becoming market-driven rather than subsidy-driven. And because the economics are attractive on both a small scale and a large scale, more and more households and businesses are deciding to generate their own electricity.

It's a scenario that a big majority of our survey respondents recognise – 85 per cent predict falling technology costs will mean new sources of power generation will become widespread and accessible, with half believing there is a high or very high likelihood of this happening (see panel on p. 17). However, few go on to conclude that falling technology costs are going to translate into cheaper power prices (see p. 18 panel).

*We are reaching a point where the growth of renewable energy is becoming market-driven rather than subsidy-driven.*



## *Future scenario* Falling technology costs

### *Falling technology costs will make new sources of power generation plentiful*

85 per cent predict falling technology costs will mean that new sources of power generation become widespread and accessible. Indeed half (51%) of all survey respondents say there is a high or very high likelihood of this happening with a further third (34%) rating it as a medium probability. Only 15 per cent said there is a low probability of such a scenario becoming reality.

Scale used 0% = zero probability;  
100% = maximum probability.  
Low = 0–40%; Medium 40–60%;  
High/very high 60–100%.



**15%**  
attach a low probability score to this scenario.



**85%**  
give it a medium to high/very high probability score.



## ***Future scenario*** An era of cheaper power prices

### ***Falling technology costs will make power cheaper for end customers***

On balance, survey respondents rule out the likelihood of falling technology costs and breakthroughs heralding an era of cheap electricity. A majority (59%) attach only a low probability to this scenario and, of the rest, only 15 per cent are bold enough to give it a high probability. Across the regions, interestingly it is only respondents in the Middle East and Africa who are inclined to buck the trend, with a third giving it a high rating, perhaps mindful of the possibilities of the falling cost of standalone renewable generation to bring power to rural areas.

Scale used 0% = zero probability;  
100% = maximum probability.  
Low = 0-40%; Medium 40-60%;  
High/very high 60-100%.



**59%**

*attach a low probability score to this scenario.*



**41%**

*give it a medium to high/very high probability score.*

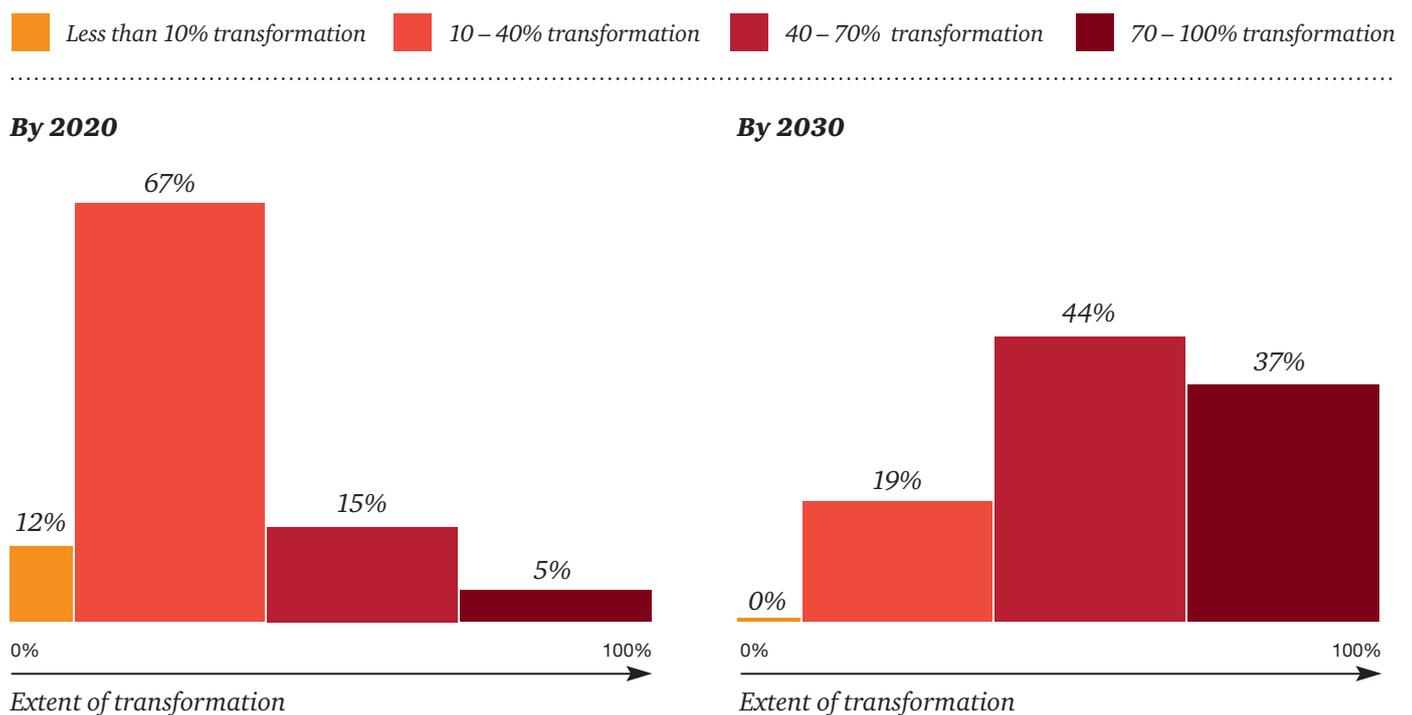
## The extent and pace of energy transformation

The convergent effects of technological advances, policy measures, the growth of distributed generation, new forms of competition and changes in customer behaviour are having a transformative impact on power markets. We asked the survey participants about the extent and pace of energy transformation in their main home markets. Some expect it to intensify in the next five years but most anticipate transformation will take real hold in the 2020s.

Only 14 per cent expect that their main home market will be more than '50% transformed' by 2020. But by 2030, three-fifths (60%) anticipate transformation of this magnitude. Indeed, over a third (37%) expect transformation of the order of 70–100% by 2030 (figure 6). Expectations of 'near 100%' transformation are strongest in Europe, where nearly half (48%) predict 70–100% transformation by 2030.

**Figure 6: Extent of energy transformation**

What will be the extent of energy transformation in the 'home market' that your company serves?\*



\* % of respondents.

Source: 14th PwC Global Power & Utilities Survey

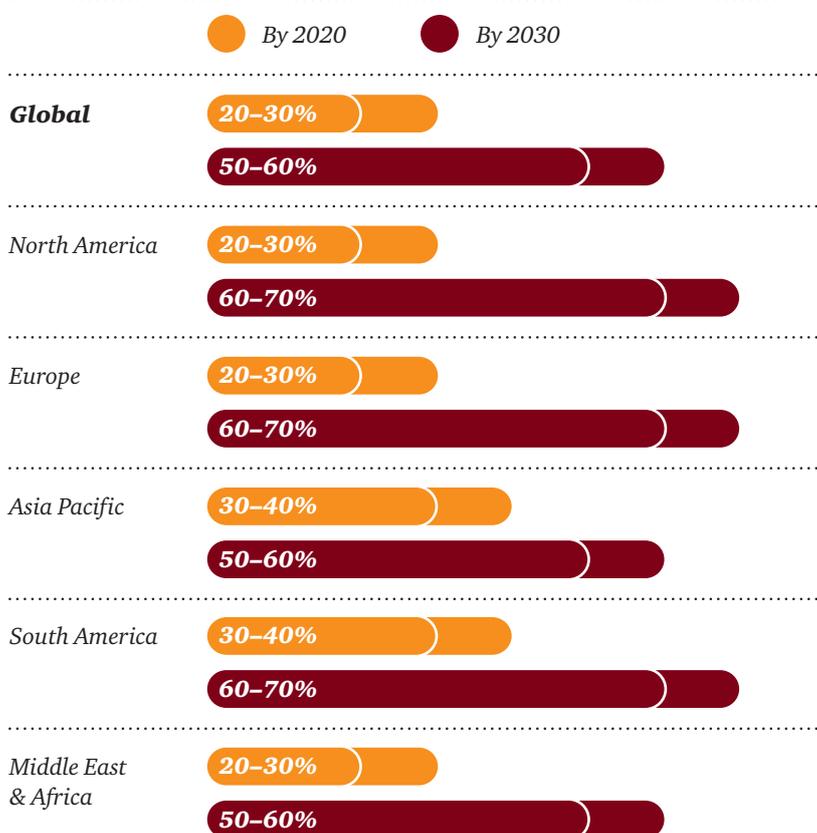
## A different future world

We report the average for each region in figure 7. Clear regional differences emerge. The strongest expectations of transformation are in Europe, North America and South America where, on average, survey respondents predict 60–70% transformation by 2030. In the Asia Pacific and Middle East and Africa regions, the average expectation is for 50–60% transformation by 2030.

Much of the ‘push’ to energy transformation is coming from government policy. Regulatory direction tops the list of factors that survey participants perceive as having a major impact on their market. But other factors are not far behind, not least technological advances and the new energy sources and distributed generation that they make possible. And there are interesting regional differences that suggest that, while regulatory change and technological advances may be ‘push factors’, customer behaviour is likely to become a strong ‘pull factor’.

*While regulatory change and technological advances may be ‘push factors’, customer behaviour is likely to become a strong ‘pull factor’.*

**Figure 7: Regional analysis: extent of energy transformation\***



\* Extent of energy transformation in 10% bands on a scale of 0–100 where 0 = no transformation; 100 = 100% transformation. Results reported are the average responses from all survey respondents globally and in each region.

Source: 14th PwC Global Power & Utilities Survey

**Figure 8: Drivers of energy transformation**

Which of the following factors play a major role in energy transformation in the ‘home market’ where your company operates?\*

Factor	Average score	% rating high or very high impact
Regulatory direction	4.16	75%
New energy sources	3.67	60%
Technological advances	3.67	55%
The growth of distributed generation	3.64	59%
New forms of competition	3.58	52%
Changes in customer behaviour	3.41	42%

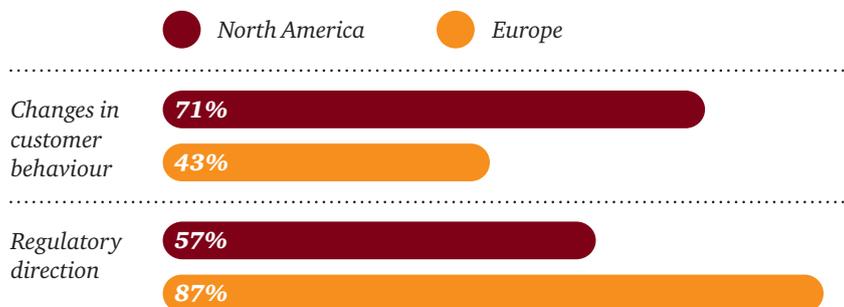
\* Scale of 1–5 where 1 = no impact; 5 = very high impact.

Source: 14th PwC Global Power & Utilities Survey

All regions except the Americas report that regulation is the factor having the biggest impact. In South America, new energy sources are seen as most important. But in North America, it is changes in customer behaviour that are cited by most respondents as driving energy transformation. The contrast can be seen by comparing Europe and North America (figure 9). In Europe, 87 per cent say regulatory change is having a high or very high impact compared to just 43 per cent saying the same about customer behaviour. But in North America it is the reverse – more (71%) point to customer behaviour as the factor having a high or very high impact than choose regulatory direction (57%).

The impact of energy transformation is being felt in all parts of the value chain, particularly in generation and services that interact with customer energy usage. Both these areas are expected to be the ones most affected by energy transformation in the near future. Forty per cent of survey participants expect energy transformation to have a high or very high impact on services, 36 per cent on generation and a quarter (26%) on distribution and retail by 2020. Looking further ahead to 2030, the consensus is that energy transformation will have a major impact on most parts of the value chain. Eighty four per cent predict a high or very high impact on services, 75 per cent expect a similar impact on distribution, 68 per cent on generation, and 64 per cent on retailing. And transmission is not immune, with a quarter forecasting it too will be affected in a major way.

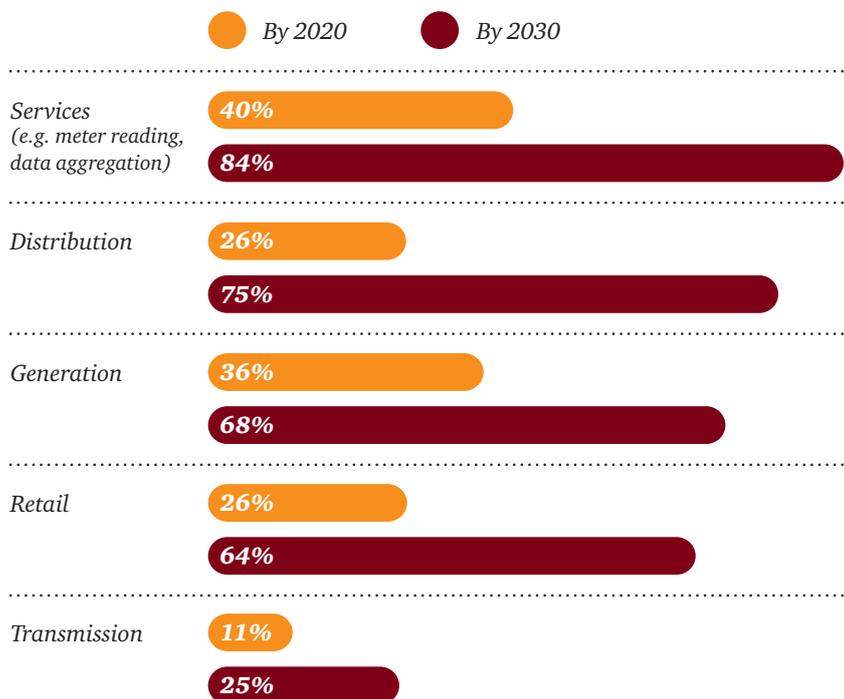
**Figure 9: Energy transformation – regulatory push versus customer pull\***



\* % saying it is having a high or very high impact.  
Source: 14th PwC Global Power & Utilities Survey

**Figure 10: Impact of energy transformation on different parts of the power and utilities' value chain by 2030**

% of respondents forecasting a high or very high impact\*



\* Rated on a scale of 1-5 where 1 = no impact; 5 = very high impact. Scores 4/5 reported.  
Source: 14th PwC Global Power & Utilities Survey

**A different future world**

**The rise of distributed generation**

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.

It is clear that distributed generation is a key transformative element but how far does the sector expect it to take over from centralised generation? We presented four different energy transformation visions as part of the survey interviews. We report the global results in figure 11. The visions are not all mutually exclusive so rather than select one vision alone, respondents were invited to score all the scenarios, according to how well they matched their own vision.

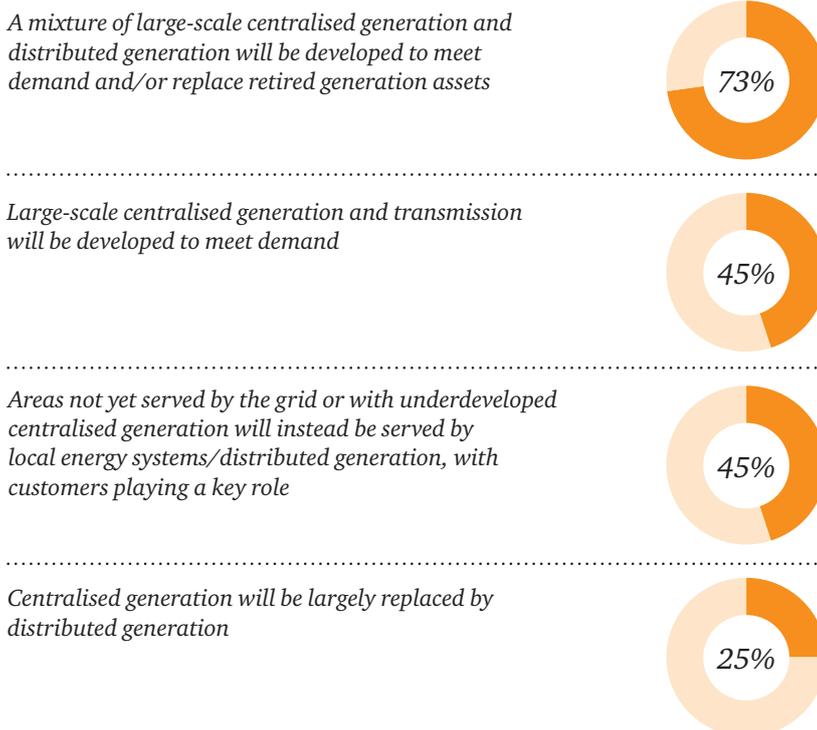
Three quarters (73%) envisage a mix of centralised and distributed generation but there is also significant support (45%) for centralised generation and transmission continuing to be the main response to demand. But an equal proportion (45%) of all survey respondents see local energy systems and distributed generation being the main response in areas that are not yet served by or that are currently underserved by the grid. A quarter envisage a more radical future, saying they expect distributed generation to take over from centralised generation.

The 'energy transformation visions' vary considerably between different parts of the world. The lead scenario for survey participants in Europe, North America and South America is for distributed generation to be playing a role alongside centralised generation, with 87 per cent, 79 per cent and 83 per cent respectively expecting this to be the case.

In contrast, in the Asia Pacific and Middle East and Africa regions it is centralised generation and transmission that is the lead expectation – 65 per cent and 77 per cent respectively. In both of these regions, though, the mixed scenario of distributed generation being developed alongside centralised generation also won support – with more than half of respondents (59 per cent in Asia Pacific and 54 per cent in the Middle East and Africa) scoring it highly.

In all regions (except the Asia Pacific region, where it is just over a third) around half of survey respondents expect local energy systems and distributed generation to be the main power provision in areas that are not yet served well or not served at all by the grid. The radical scenario of centralised generation largely being replaced by distributed generation won support from a sizeable minority of respondents in North America (29%), Europe (48%) and the Middle East and Africa (23%) but had no support from Asia Pacific and South American respondents.

**Figure 11: Which of the following energy market transformation visions most closely matches your expectation for your 'home market' by 2030? % reporting close or very close match to their expectation\***



\* Scale of 1-5 where 1 = no match; 5 = very close match. 4/5 scores reported. Source: 14th PwC Global Power & Utilities Survey

In some territories, distributed generation is already taking a large chunk out of the market for centralised generation, undermining the classic power utility business model and adding complexity into the task of balancing supply and demand.

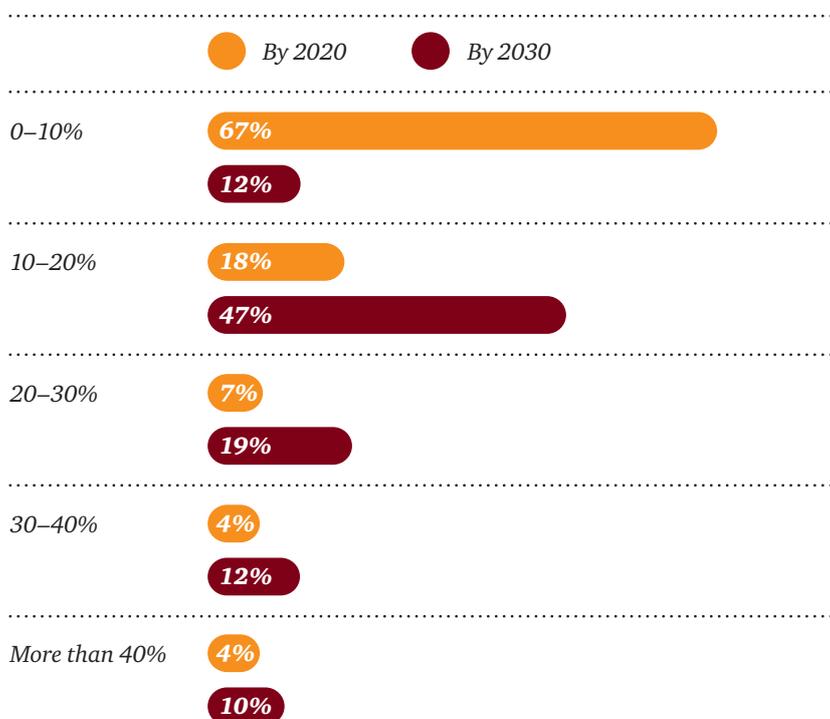
In many parts of Germany, for example, it is not uncommon for more than 80 per cent of the local demand to come from distributed generation, much of it in the form of rooftop solar and landowner wind projects.

The economics of centralised generation are being hit hard. This is a trend that is most advanced in Germany, spurred on by strong policy encouragement for renewables, but it is also becoming strongly evident elsewhere. In California, for example, a study by the California ISO predicts that by 2020 as much as 60% of the energy production in times of low load and high renewable generation would come from renewable generators that displace conventional generation.<sup>5</sup>

Some of this distributed generation is owned by power utility companies and many companies are making moves to build a greater presence in distributed generation. But much of it is not, removing a significant slice of the market from power companies. We asked survey participants what share of total generation they expect to come from distributed sources by 2020 and by 2030 (figure 12). On average, a 10–20% share is expected by 2020, rising to 20–30% by 2030. But a significant minority think the distributed generation share could be higher.

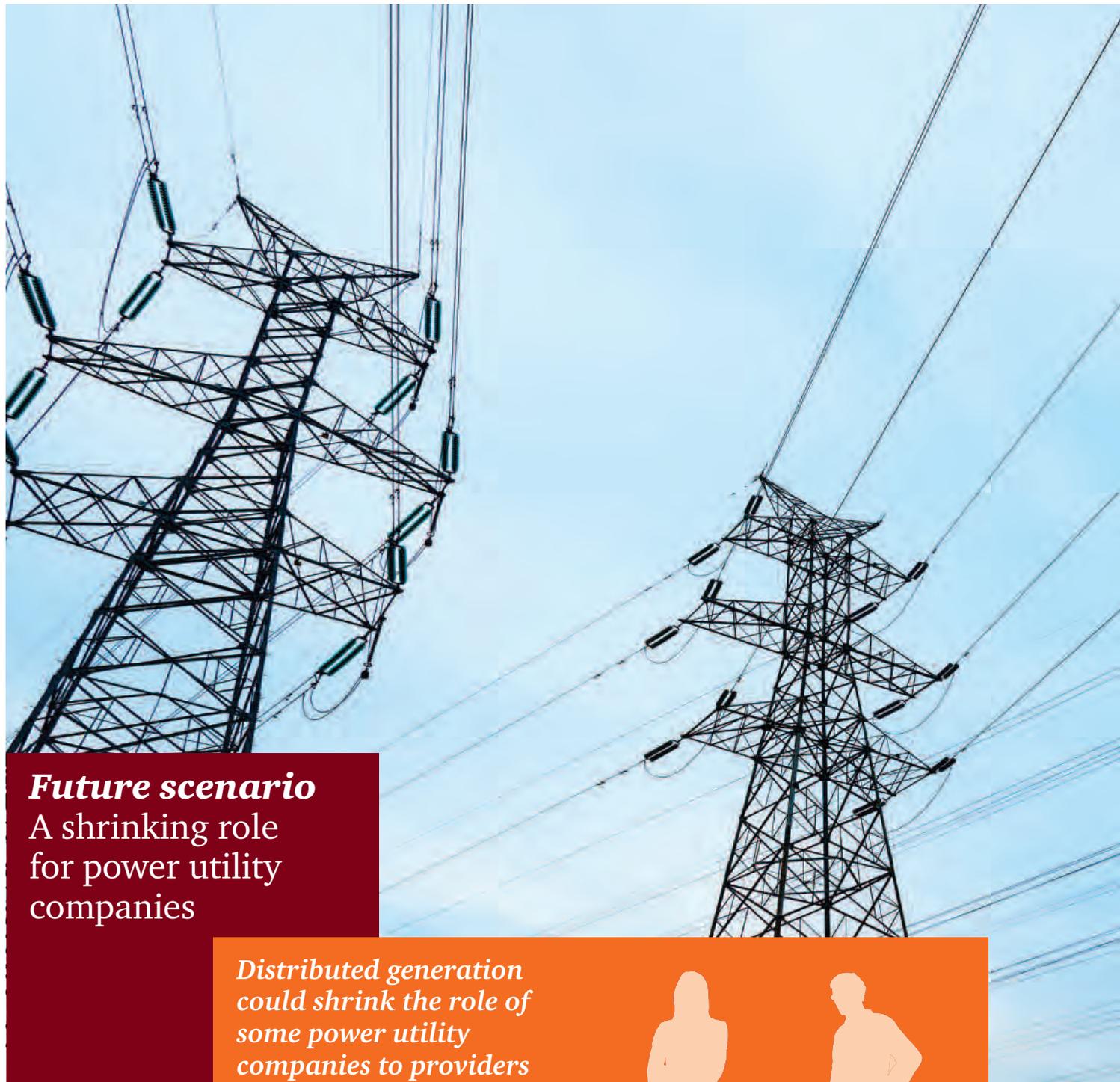
Over a fifth (22%) anticipate a ‘30% plus’ share for distributed sources by 2030. Much of this is due to sentiment in Europe and North America where 39 per cent and 29 per cent of respondents anticipate ‘30% plus’ shares. Any business that faced such a large slice of their market being jeopardised would move quickly to change course. Many power utility companies in both these regions are doing exactly that, increasingly switching their business model focus away from centralised generation and onto distributed energy and other new parts of the energy value chain, as we discuss in the next section.

**Figure 12: What share of electricity demand do you expect to be served by distributed generation in your ‘home market’?**



Source: 14th PwC Global Power & Utilities Survey

*The economics of centralised generation are being hit hard in some markets.*



***Future scenario***  
**A shrinking role  
for power utility  
companies**

***Distributed generation  
could shrink the role of  
some power utility  
companies to providers  
of back-up power***

The sector is alert to the danger of such a scenario unfolding but most (53%) rule it out, giving it a low probability score. But this leaves nearly half (47%) giving it either a medium (19% of all survey participants) or high (27%) probability rating. Across the regions, European respondents are most likely to believe this scenario could become a reality – 43 per cent rate it as a high probability compared to 27 per cent of global respondents.

Scale used 0% = zero probability;  
100% = maximum probability.  
Low = 0–40%; Medium 40–60%;  
High/very high 60–100%.



<b>53%</b> <i>attach a low probability score to this scenario.</i>	<b>47%</b> <i>give it a medium or high probability score.</i>
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## The impact of other technologies

Market erosion is not just coming from the rise of distributed generation. Energy-efficient technologies are having a major impact on the power requirements of a wide range of end-user applications, from heavy industrial processes through to the home. Indeed, more so than any other technological development, energy-efficient technologies are singled out by survey respondents as having the biggest impact on their home power markets between now and 2030 (figure 13). Nearly three-quarters (71%) expect such technologies to have a major impact.

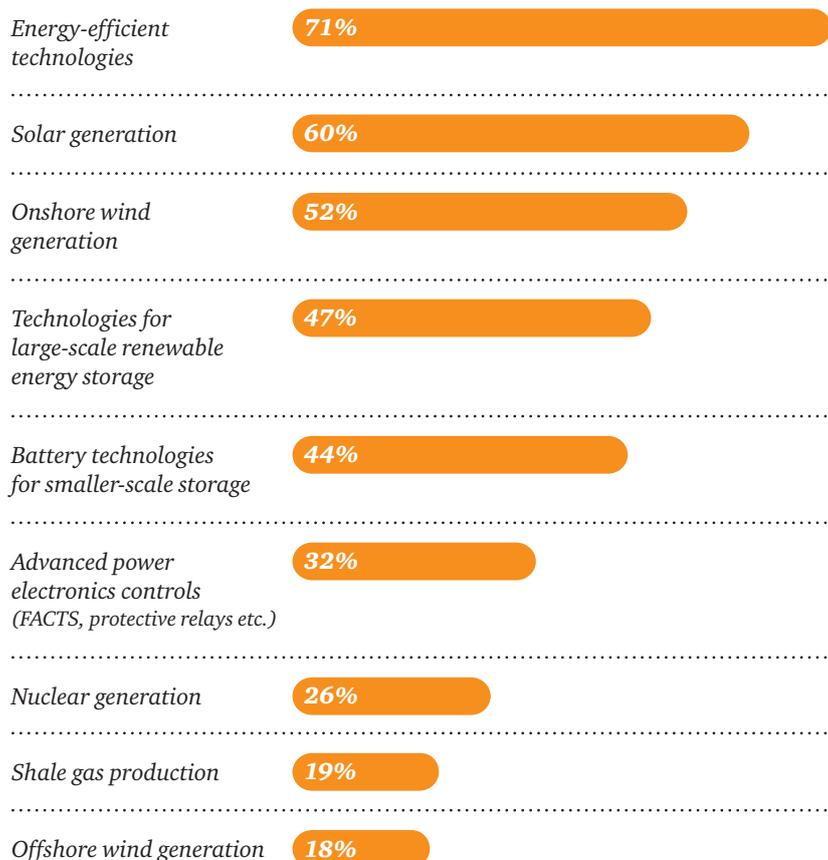
The drive to encourage greater energy efficiency is being backed by significant regulatory encouragement in the US, China, Europe and in many other parts of the world. And there is also considerable scope for greater efficiencies in the power sector. It is estimated, for example, that global transmission and distribution losses in 2012 amounted to 1,880 terawatt-hours, equivalent to 8.8 per cent of total generation (or the annual output of about 250 one-gigawatt nuclear power plants).<sup>6</sup> In thermal generation, the average efficiency of gas- and coal-fired plants across the world is approximately 41 per cent for gas and 34 per cent for coal, but new advanced technology is capable of achieving 60 per cent for gas and nearly 50 per cent efficiency for coal.<sup>7</sup>

Renewable generation from solar and wind are also ranked high in their impact on power markets in the next fifteen years and around half of survey respondents also anticipate technological progress in energy storage, both large-scale and smaller-scale, to have a major impact. Breakthroughs in the storage of electricity could provide a real tipping point. It would boost the viability of large-scale renewable energy in national power systems. Being able to store electricity economically would also further reduce reliance on the central grid and alter the economics of self-generation and local energy systems.

Peaks and troughs in intermittent renewable generation could be smoothed by storage. Instead of viewing the connection with the grid as the power supply to the premises, owners of distributed generation would begin to see it primarily as a connection for trading electricity, depending on the size of their installed capacity.

The impact of some other technologies, such as nuclear generation and shale gas production, will vary from territory to territory and this geographic variability makes it not surprising that they are only rated as likely to have a major impact by 26 per cent and 19 per cent of all survey respondents.

**Figure 13: Which of the following technologies do you expect to have the biggest impact on your 'home market' by 2030?**  
% reporting high or very high impact\*



\* Rated from 1–10, 1 = no impact, 10 = very high impact, Scores 7–10 reported.  
Source: 14th PwC Global Power & Utilities Survey

6 International Energy Agency, World Energy Outlook 2014.

7 World Energy Council, World Energy Perspective: Energy Efficiency Technologies, 2013.

**A different future world**

**Disruption and market change**

The pace of change is clearly different in each market and each specific situation. But it is clear from the survey responses that a degree of disruption is anticipated, if not already taking a strong hold, in most markets worldwide. We asked how disrupted markets are now and about expectations for the extent of near-term disruption in the period to 2020 (figure 14).

Over half (55%) report that their market is experiencing a medium degree of disruption now, with a further 16 per cent reporting a high level of disruption. Only a minority (less than one in three) say their market is relatively undisrupted now and hardly any expect that situation to continue to be the case in the next five years. Looking ahead to 2020, nearly half (47%) expect a high or very high amount of disruption with a further 51 per cent anticipating medium levels of disruption.

In our ‘The Road Ahead’ report<sup>8</sup> we looked at five areas where disruption is taking hold and where it will be important for companies to assess their strategies: customer behaviour, competition, the production service model (the infrastructure, products and services provided by the sector), distribution channels (how the sector reaches and delivers to customers), and government and regulation. 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. We invited survey participants to assess each area and we then constructed a ‘market disruption index’ to compare the different regions around the world.

**3x**

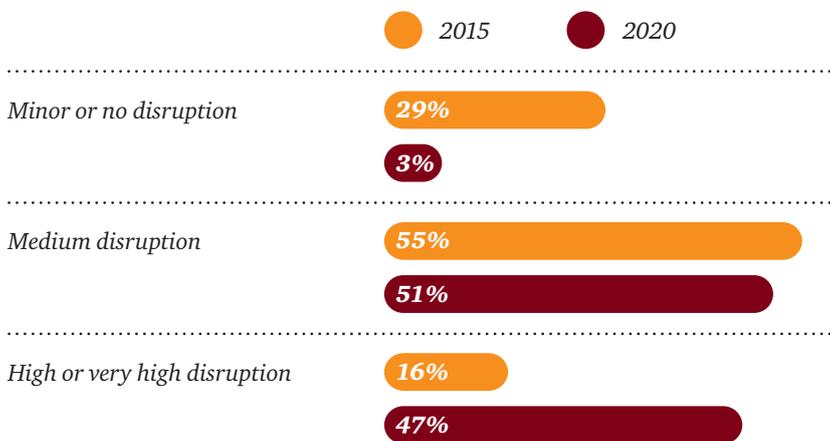
The proportion reporting major disruption in their market rises threefold – up from 16% in 2015 to 47% in 2020.

**Changing nature of disruption**

The responses show very clearly why disruption is likely to intensify between now and 2020. In 2015, the principal disruption factor is government and regulation, with over half (52%) of survey respondents reporting a high or very high amount of disruption arising from policy directives. By 2020 nearly two-thirds (64%) rate this as a high source of disruption. But whereas only a small minority of respondents attach much weight to other disruption factors in 2015, many more expect all of these other factors to have grown in significance by 2020. Most notably, disruption arising from competition is seen as a major force by only 22 per cent of respondents in 2015 but by nearly half (48%) in 2020. There is also a big increase – from seven per cent to 40 per cent – in the numbers expecting disruption to arise from changes in the production service model and an increase from four per cent to 34 per cent for distribution channels.

**Figure 14: Market disruption**

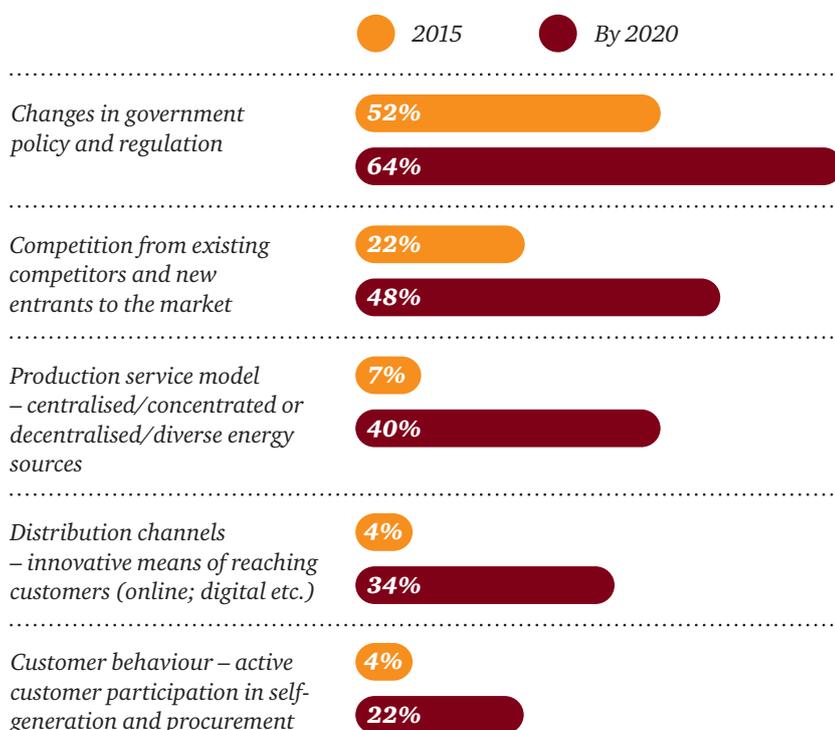
How disrupted is your market now and what are your expectations by 2020?\*



\* % of respondents reporting.  
 Rated on a scale of 1–10 where 1 = no disruption; 10 = very disrupted.  
 Minor or little disruption = 1–3. Medium disruption = 4–6. High or very high disruption = 7–10.  
 Source: 14th PwC Global Power & Utilities Survey

**Figure 15: Disruption factors**

% reporting high or very high level of change\*



\* Rate on a scale of 1–10 where 1 = no change; 10 = major change. Scores 7–10 reported.  
Source: 14th PwC Global Power & Utilities Survey

*The intensity of all five disruption factors is expected to increase significantly in the next five years.*

Perhaps the only surprise is the relatively low number of respondents rating customer behaviour as a highly disruptive factor – moving from four per cent of respondents in 2015 to 22 per cent in 2020. In part this may be because customer behaviour, as defined for this part of the survey, was linked quite specifically to self-generation. Nonetheless, a rise from four to 22 per cent is significant and, as we discussed earlier, customer behaviour in general is seen as a relatively strong driver for energy transformation, particularly in North America and Europe (see figure 9).

*Disruption is coming from five key areas – customer behaviour, competition, the production service model, distribution channels, and government policies.*

**A different future world**

**Market disruption index**

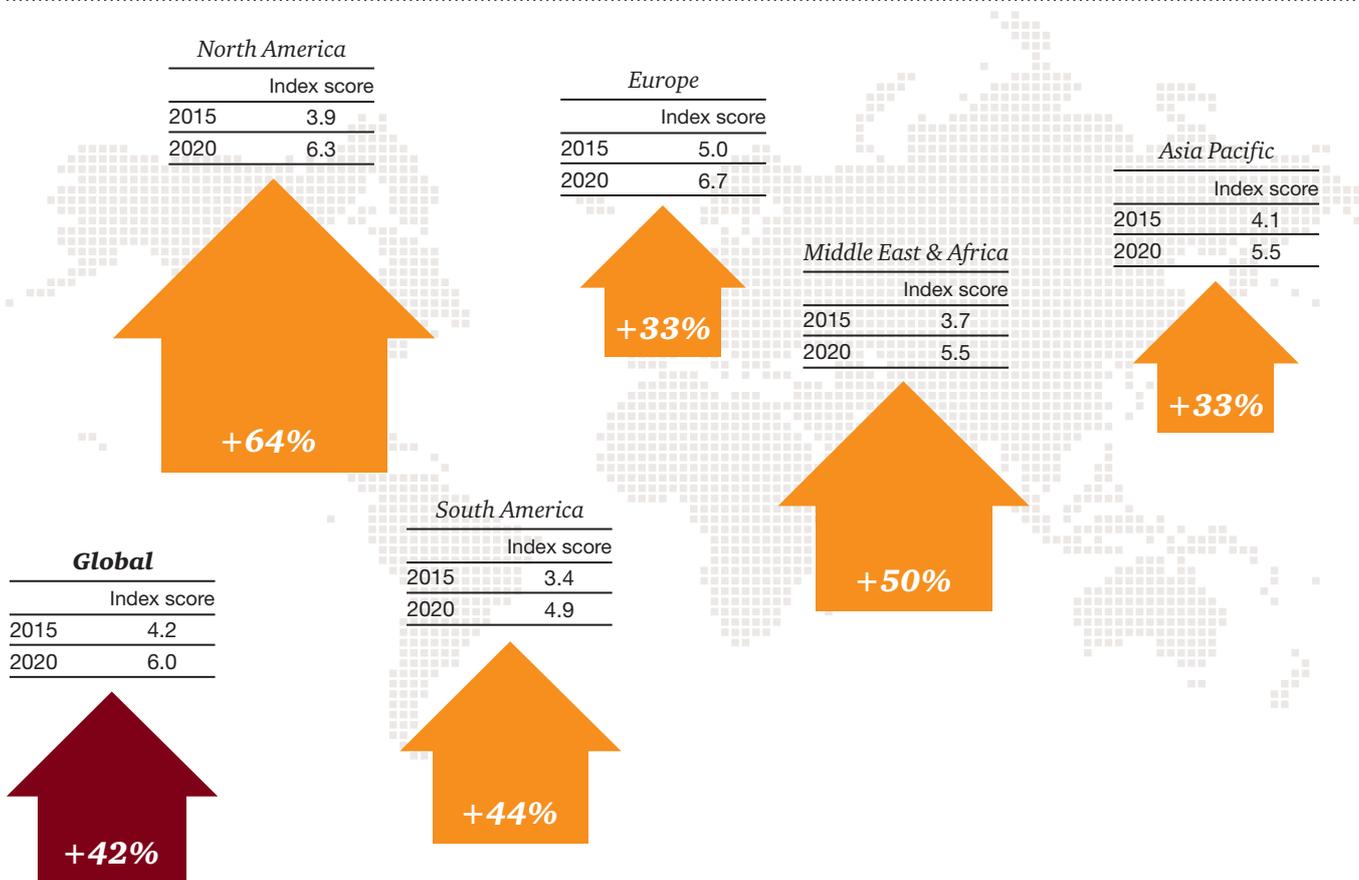
Translating these results into a market disruption index which measures the ratings for this basket of five disruption factors (figure 16), we can see that disruption is most strongly felt in Europe currently and least felt in South America. On a global level, the market disruption index rises by 42 per cent between 2015 and 2020. Europe remains the most disrupted region in 2020 but, because it is already experiencing a relatively high degree of disruption, the 2015–2020 rise is one of the smallest. Survey participants in North America anticipate the biggest market disruption index increase, up 64 per cent from 3.9 to 6.3, to take the region to disruption levels comparable with Europe by 2020. All regions record significant increases in the market disruption index. North America moves above the Asia Pacific region to second place in the ranking by 2020. South America is the region expecting the least disruption in both 2015 and 2020.

**70%**  
say current market models won't be sustainable and the need for change is becoming urgent.

**Market change**

Market change is going hand in hand with energy transformation. ‘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.

**Figure 16: The Power & Utilities Market Disruption Index**  
Rate the extent of disruption now and in five years’ time



The index comprises the mean scores recorded for a basket of five disruption factors (policy & regulation; technology change; production service model; distribution channels; customer behaviour; and competition. Each disruption factor is given an equal weighting. Rated on a scale of 1–10 where 1 = no disruption; 10 = very disrupted.

Source: 14th PwC Global Power & Utilities Survey

## CEO perspective

### Getting into the energy transformation driving seat



*Tata Power is India's largest integrated power company and also has a significant international presence. Anil Sardana, Managing Director and CEO, discussed the implications of energy transformation with PwC India Energy, Utilities and Mining Leader Kameswara Rao.*

*Rao: How does Tata Power view transformation in the Power & Utilities sector, and how is it responding to it?*

Sardana: We view energy transformation not as a threat, but as an opportunity to work with new technologies and business models to deliver better performance for the consumers. Tata Power is investing in fuel cell technology and several other decentralised distributed generation options including off-grid storage options, which can be very economical if used to replace expensive diesel-based generating sets used for back-up power in cities. In rural areas, we are training communities to deploy biomass-based generation. Much of the biomass comes from plantations that we have seeded alongside our projects, most significantly at our hydropower locations, with the rest coming from local bio-wastes.

For our commercial consumers, such as hotels, we have installed thermal storage systems that use non-peak energy to deliver air-conditioning in daytime, which happens to be peak hours from a consumption point of view. We are also collaborating with a US university to generate hydrogen gas using off-peak power. Given all this, we see ourselves not on the receiving end, but as actively driving fundamental transformation in the power and utilities sector. The outlook has to be towards decentralised distributed generation (DDG) options and alternative technologies which are more sustainable from environment and economic viewpoints.

*Rao: How does Tata Power respond to climate change imperatives and the emergence of renewable energy?*

Sardana: The policy evolution has been positive, as seen in the government's emphasis on renewable energy and coal cess (tax) going up four times since its inception. Tata Power responds to these proactively and we reshape our strategy based on government policy and market trends. For instance, we use a dummy carbon tax in our coal project internal assessments. So, while there is an automatic and positive bias towards renewables, a good coal project with the right economics stands an equal chance and would also be considered.

As a country we can do a lot more and must not shy away from the debate on keeping the future benign from the climate change and environment points of view. Energy policy must give clearer signals for use of clean coal technologies. Regulators should permit the procuring utilities to offer some price advantage or weightage for use of washed or low-ash coal. Or at least provide a clear road map so that project sponsors can plan new projects on that basis.

*Rao: How are the pressures of retail market competition and rising customer expectations driving Tata Power's strategy?*

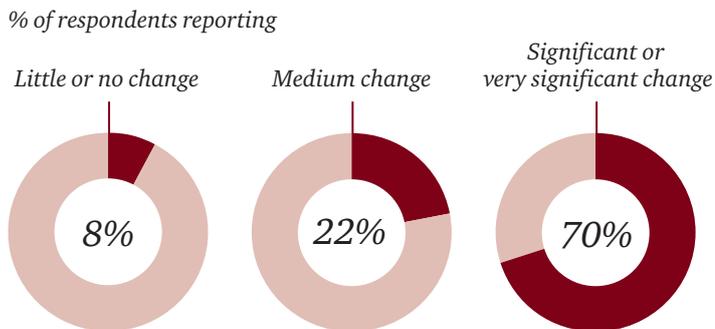
Sardana: The emergence of retail competition and more active consumer groups have definitely made traditional utilities rethink and we have invested heavily in improving network access, quality of supply and customer response. The regulators can also help by considering the customer impact more objectively, instead of adopting a legal or contractual position. For example, consumers may gain from lower cost of power purchased if a certain rearrangement of long-term power purchase agreements (PPAs) is permitted. Or they can benefit from lower financing costs if utilities are allowed to repackage their deferred revenue assets into long-term bonds. The policies and regulations can be designed so that the beneficiary in all these is the end-consumer, but it is achieved from real gains and not at the expense of the industry.



**A different future world**

**Figure 17: Extent of market model change**

How much change do you expect your current market model will undergo by 2030?\*



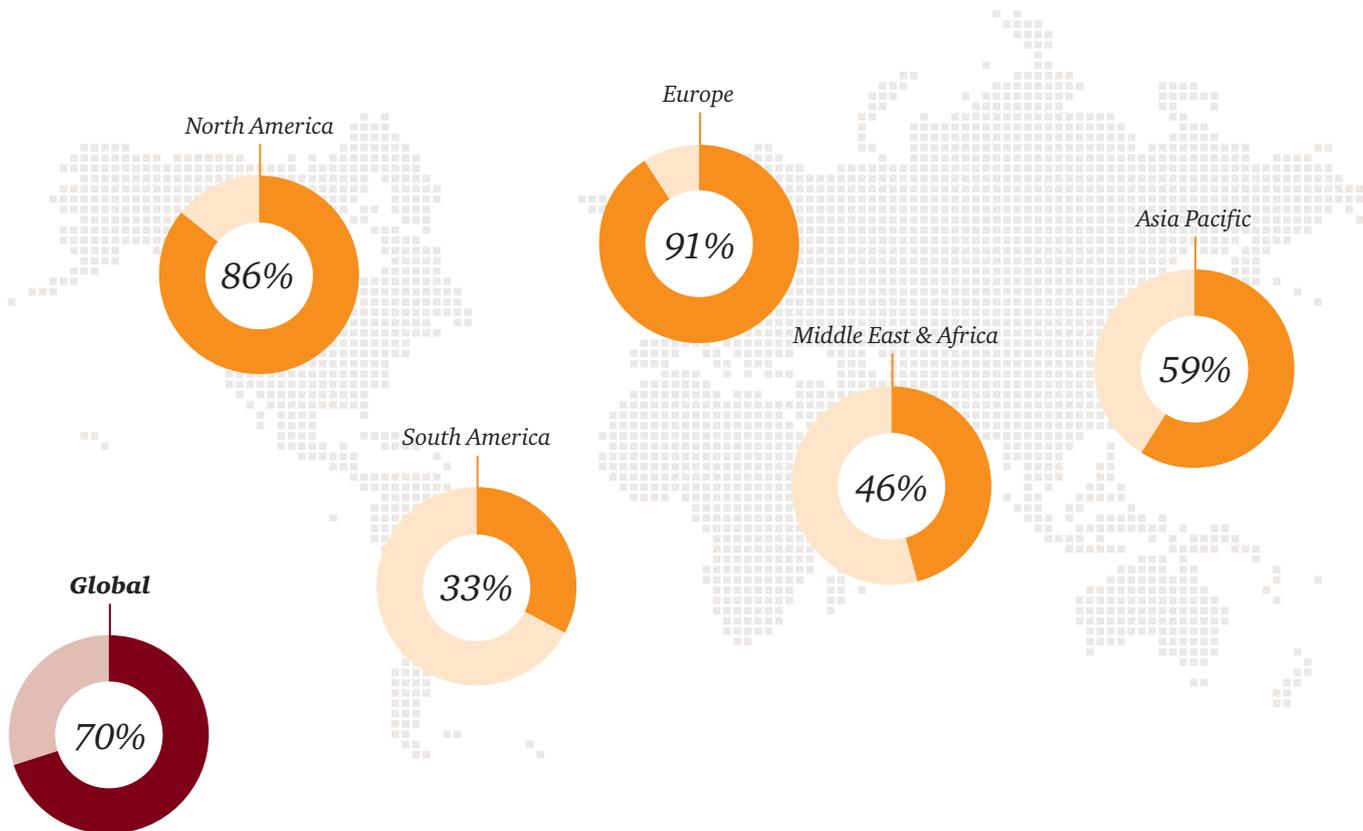
\* Scale of 1-5 where 1 = no change; 5 = very significant change. Source: 14th PwC Global Power & Utilities Survey

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 distributed and smart energy technologies, we are likely to see the emergence of a number of new market models<sup>9</sup> (see ‘The Road Ahead’ for a discussion of these<sup>10</sup>).

Our view seems to be shared by survey participants. Across all regions, 70 per cent expect significant or very significant market model change by 2030 (figure 17). A further 22 per cent anticipate medium change. Less than one in twelve think there will be little or no change. The global figures mask significant regional differences, with the expectation of change most intense in Europe and North America where 91 per cent and 86 per cent predict major change. There is less consensus about the extent of market change elsewhere although a clear majority (59%) in the Asia Pacific region and nearly half (46%) in the Middle East and Africa share the viewpoint of their peers in Europe and North America (figure 18).

**Figure 18: Regional analysis: How much change do you expect your current market model will undergo by 2030?**

% of respondents expecting significant or very significant market model change by 2030\*

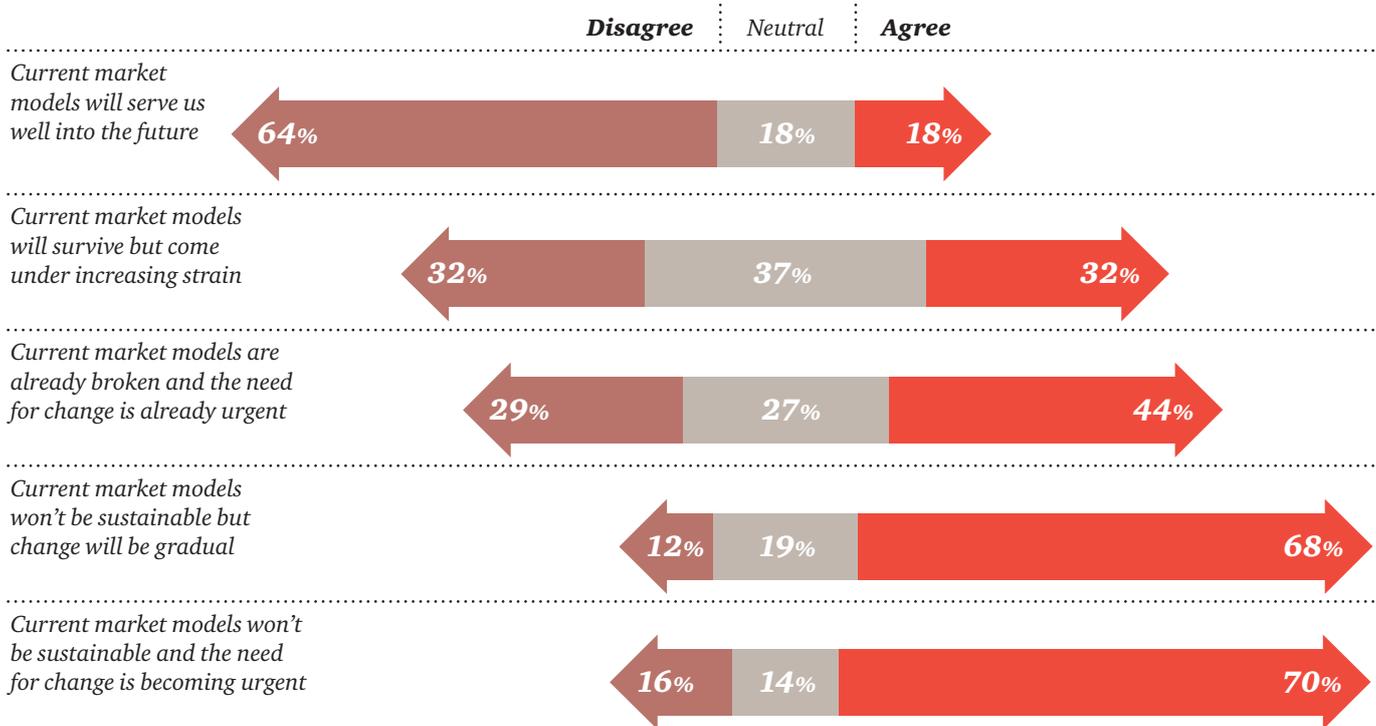


\* Scale of 1-5 where 1 = no change; 5 = very significant change. Scores 4 & 5 reported. Source: 14th PwC Global Power & Utilities Survey

9 By ‘market models’ we mean the way a market is structured and designed, whether it is regulator-led, market-led or a mixture of both, the extent of competition, separation or integration of roles and the ‘policy goals’ that are promoted.  
10 Op. cit.

**Figure 19: The future for current market models**

% of respondents



Rated on a scale of 1–5, where 1 = fully disagree; 2 = partially disagree; 3 = neither agree nor disagree; 4 = partially agree; 5 = fully agree.  
 Source: 14th PwC Global Power & Utilities Survey

So what's the future for current market models? We presented a series of scenarios to survey participants and asked them to assess each one (figure 19). Less than one in five believe 'current market models will serve us well into the future'. Instead, a majority of respondents (70%) in the global survey believe that current market models are not sustainable. Opinion was undecided between whether change can be gradual or whether 'the need for change is becoming urgent'. Both scenarios received similar levels of agreement and this was a pattern across all regions.

#### Market model change

# 70%

say there is a strong likelihood of a major expansion of renewable energy. Much of this may be smaller-scale distributed power sources but it is also likely to be in the form of large-scale renewables, in addition to existing thermal plants, linked to an expanded transmission network. 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 renewable and thermal generation.

**A different future world**

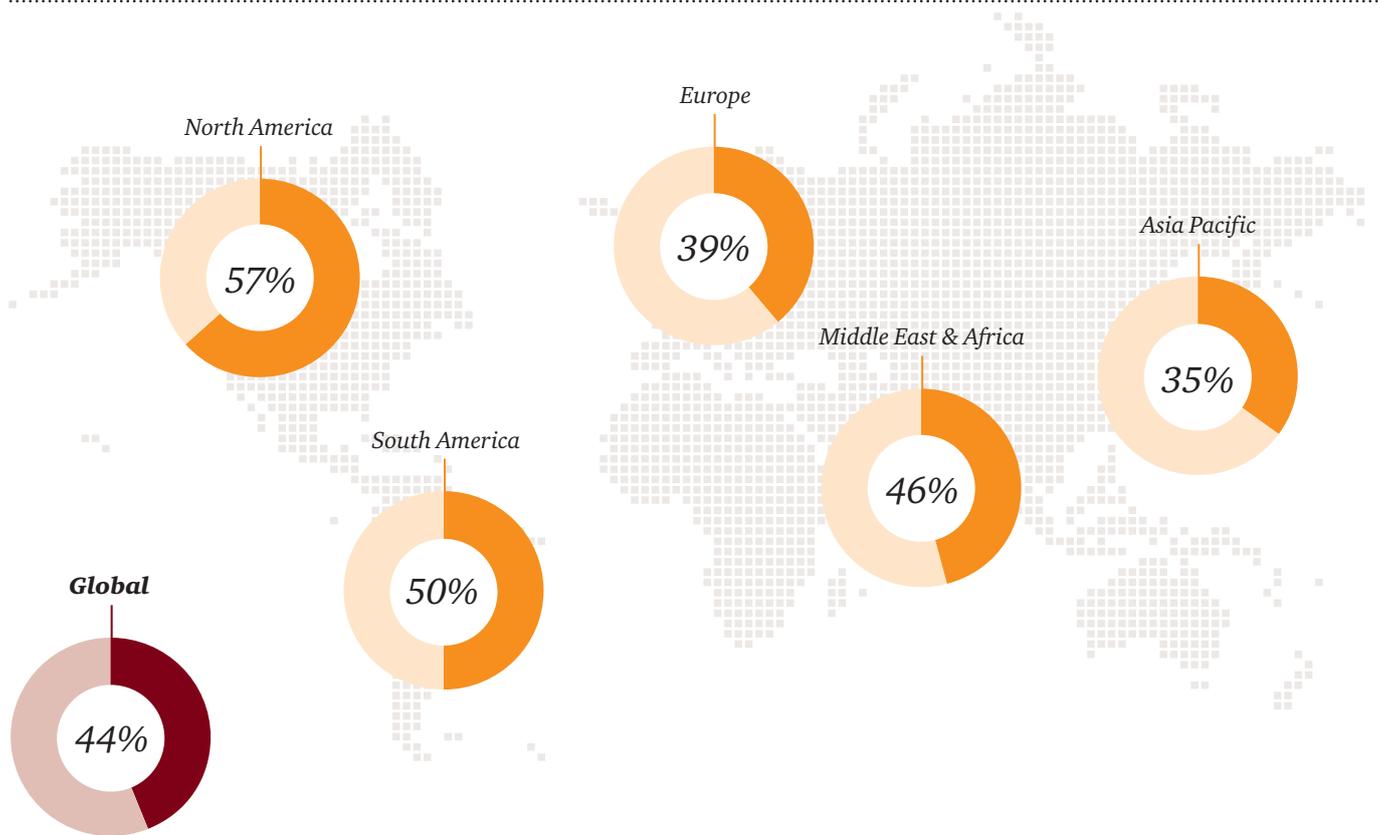
But a significant minority (44%) also agreed with the more far-reaching statement – ‘current market models are already broken and the need for change is already urgent’ (figure 20). Agreement with this more urgent description of power sector market models was highest in North America, with 57 per cent agreeing, and lowest in the Asia Pacific region, where just over a third (35%) agreed. Agreement from those in Europe was also relatively low, perhaps an indication that some of the difficulties with market models are already beginning to be worked through.

Market model change

**55%**

say there is a strong likelihood of local energy systems evolving. Local energy system markets would entail significant fragmentation of the existing transmission and distribution grids with local communities having greater control over their energy supply. They would also include markets in which a local approach is adopted for serving remote communities.

**Figure 20: Current market models are already broken and the need for change is already urgent**  
 % of respondents scoring 4/5\*



\* Rated on a scale of 1–5, where 1 = fully disagree; 2 = partially disagree; 3 = neither agree nor disagree; 4 = partially agree; 5 = fully agree.  
 Source: 14th PwC Global Power & Utilities Survey

## More open and competitive markets

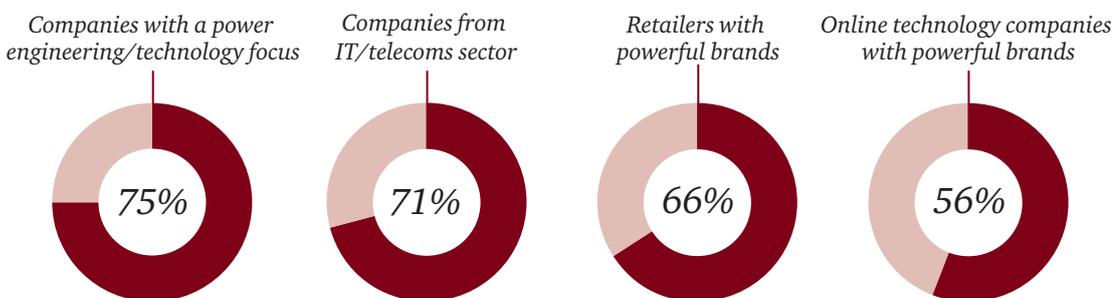
Energy transformation is opening up the opportunity to compete in the power sector. New roles for companies come into view. In a distributed energy community with its own micro-grid, players other than power utilities can play an energy management role. This could be for local systems such as transport networks, residential communities or industrial communities. There is potential for the bulk of the value in this space to be captured by data and technology-oriented players rather than traditional utility companies.

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.

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. 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.

This outlook for a more open and competitive power market is shared by many of the survey participants. Nearly four-fifths (78%) anticipate greater competition and competition from outside the sector is being taken very seriously. Three-quarters see a medium to high-level competitive threat coming from companies with a technology or engineering focus and nearly as many (71%) from companies from the IT/telecoms sector. Powerful brands from the retailing or online sectors are also seen as a threat (figure 21).

**Figure 21: Power utility companies face significant competitive threat from outside the sector**  
% of respondents reporting medium to high-level future competitive threat\*



\* Rated on a scale of 1–5 where 1 = low; 5 = high. Scores 3, 4 & 5 reported.  
Source: 14th PwC Global Power & Utilities Survey

Market model change

# 52%

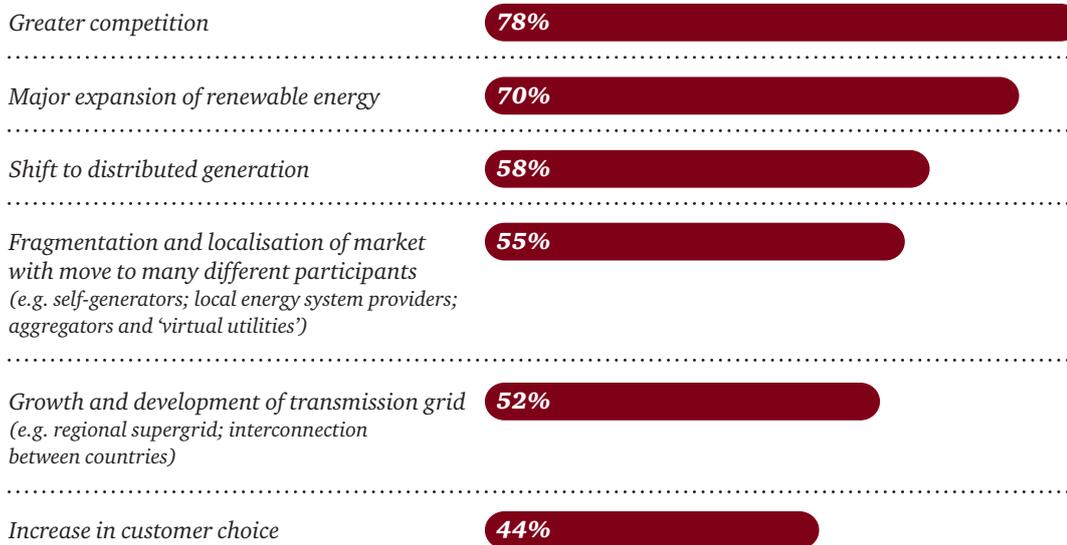
anticipate the growth of the transmission grid to boost cross-border connections and to develop regional supergrids. This regional supergrid market scenario is designed to utilise large-scale renewable and other large-scale generation and transmit it pan-nationally over long distances. It is likely to embrace some degree of unbundling and customer choice. It requires large-scale generation, interconnectors, large-scale storage and significant levels of transmission capacity.

**A different future world**

More than half (55%) expect to see a more fragmented and localised market characterised by many different participants (figure 22). But the move to more localised grids is only one part of the global story. In parallel, many also anticipate an expansion of transmission networks to accommodate new large-scale power generation, some of it renewable, and to improve interconnections between countries.

Better interconnection is being encouraged by policymakers in many parts of the world. In Africa, for example, regional power generation and interconnection projects have the potential to play a significant role in delivering increased access to electricity. They also reduce the price of electricity because they allow the development of more larger generation plants which, particularly in the case of large-scale hydro, produce lower-cost power.

**Figure 22: What kind of market model change do you expect to see in your country by 2030?**  
 % of respondents rating high or very high likelihood\*



\* Rated on a scale of 1–5 where 1 = no likelihood; 5 = high likelihood. Scores 4 & 5 reported.  
 Source: 14th PwC Global Power & Utilities Survey



**70%**

anticipate a major expansion of renewable energy and 58% expect a shift to distributed energy in their markets by 2030.

## CEO perspective

### Momentous transformation justifies caution



*Empresa Distribuidora y Comercializadora Norte S.A. (Edenor) is the largest electricity distribution company in Argentina. Chairman of Edenor, Ricardo Torres, outlines the importance of getting the balance right between speed and caution as the sector transforms.*

I have no doubt that our sector faces some of the biggest challenges in its history. They come from the role of new players who, through technology, are breaking into what, for many years, had been a relatively passive and unchallenged relationship between regulatory bodies and companies. There's also the challenges from the fast expansion of the customer base in emerging countries with different socio-economic realities; and from increasing social awareness of the effect of new environmentally-friendly technologies and, especially in developed countries, acceptance of 'greener' and less economic criteria when it comes to consumption.

I am sure that most sector participants – companies, regulatory bodies, customers, and suppliers – see the expected changes as 'very significant'. I also think that we would agree that such significant changes are inevitable. So a question arises: why is it that an industry which has incorporated technology so well into work team management, equipment, commercial operations and customer relations now appears hesitant in confronting key decisions in relation to the energy transformation and digital options that lie ahead?

The changes are of great magnitude and are coming from different places at a speed which is hard to predict. This is difficult for a sector which has not been accustomed to react quickly to changes and has a business model that has been unchallenged for many years. But, given the consequences of hasty decisions in an industry with millions of participants, huge capital requirements and high state regulation, a prudent and cautious approach is justified given the uncertainties involved. I suggest an alternative where companies outline their points of view, regulatory bodies and governments can then explain the long-term and short-term consequences, and the society can agree decisions and timing that guarantee the lowest social sacrifice while encouraging innovation and expansion of benefits.

In Argentina, after a decade marked by dramatic geographic expansion and growth in consumption, we are facing the probability of a change in the paradigm of the sector. Since the 2001 crisis the sector has been working in 'emergency mode', with the roles of the state, the companies and regulatory bodies undergoing deep changes. We are in the process of a new government which will have to decide whether to continue with the current plan or to define a new one. In any case, it's an opportunity to incorporate some of the experiences of more advanced markets in areas such as technologies related to work organisation and control of assets, as well as those of demand management, smart meters, telesupervision and remote networks, and the whole concept of a smart grid future.

Countries such as Argentina need to prioritise issues such as network expansion, universal access to the service, and the protection of those whose social situation could prevent access to services, while also having the signals necessary to encourage saving and innovation. Many of the risks and uncertainties I mentioned earlier will be played out in more mature markets, and markets like ours can incorporate that experience in the near future.



**A different future world**

**Future business models**

Given the scale and extent of energy transformation and market change, what’s the future for the current power utility business model? It’s clear that it will be heavily determined by the future direction of each country’s market and regulatory situation. And it’s unlikely that there will be a single winning business model but rather a range of business models that will deliver success in the new, different and evolving market environments.

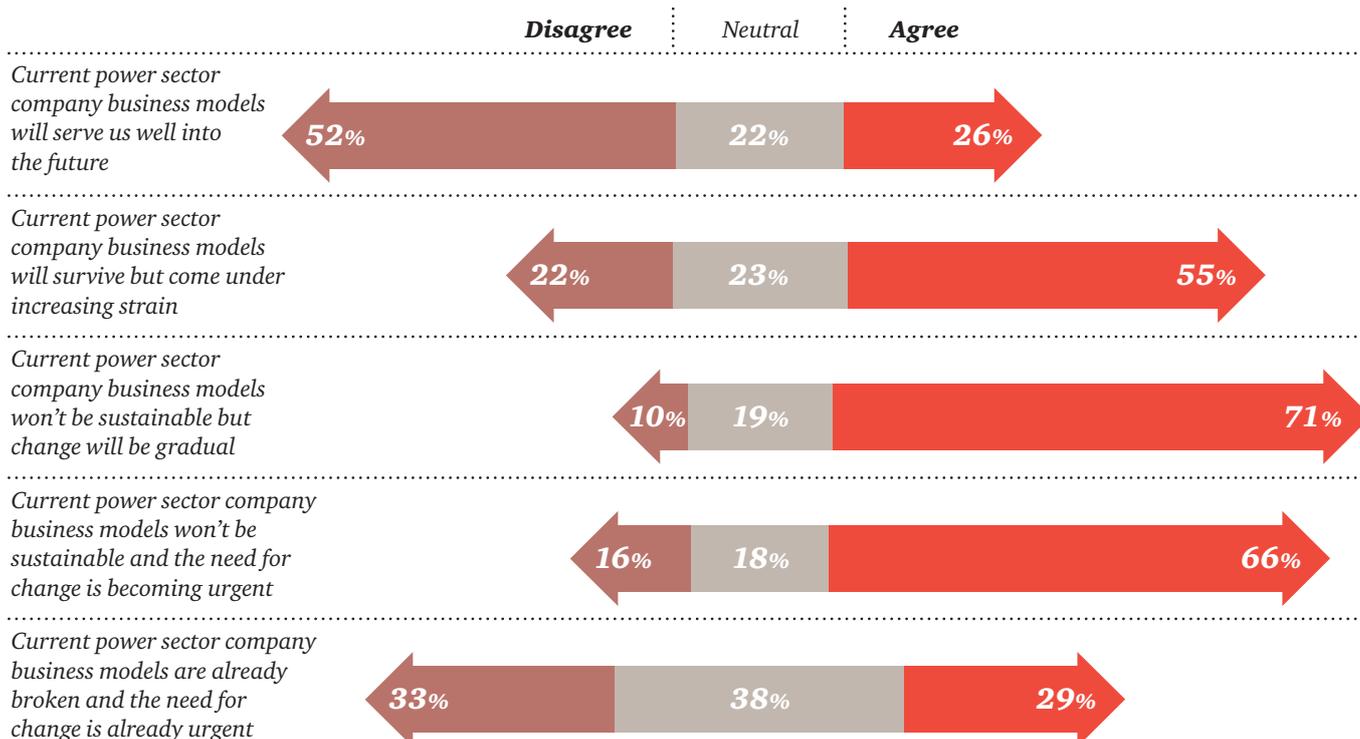
This location-specific shaping of business models is reflected in the wide variety of answers we got from different regions of the world on the outlook for existing power sector business models.

In North America, only seven per cent of survey participants feel that current business models will ‘serve us well into the future’ but nearly half (47%) of those in the Asia Pacific region think that current business models will remain durable. However, globally, only a quarter (26%) agreed with this optimistic outlook, with just over half (52%) disagreeing (figure 23). In part, these different regional outlooks reflect the different patterns of state ownership and market opening of the sector across the world, with developing countries, in particular, having a higher number of state-owned utilities and less necessity to consider business model change.

The largest number of responses were in agreement with the view that current business models ‘won’t be sustainable but change will be gradual’. Nearly three-quarters (71%) agreed with this viewpoint, although many (66%) were also inclined to the view that ‘change is becoming urgent’. These responses were broadly similar across all regions.

**Figure 23: The future for current power sector company business models**

% of respondents



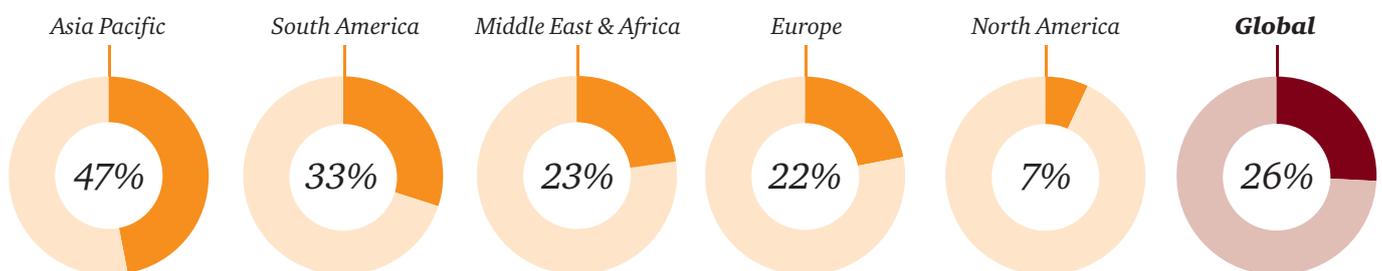
Rated on a scale of 1–5, where 1 = fully disagree; 2 = partially disagree; 3 = neither agree nor disagree; 4 = partially agree; 5 = fully agree. Source: 14th PwC Global Power & Utilities Survey

The area where there were significant regional differences was whether current business models might survive or, at the opposite extreme, whether they were already broken (figures 24 and 25). None of the respondents in South America, for example, agreed with this pessimistic view of current business models whereas it did win support from 43 per cent of North American and 35 per cent of European survey participants. These results indicate that, while there is a significant global consensus that current power sector business models are not sustainable, there is less unanimity about the urgency of change and, indeed, there remains significant support in some parts for the view that current business models may still remain viable.

Whether this is the case or not will depend on the regulatory and market models in place to support the continuing viability of current business models. But perhaps significant is the finding that, while only 29 per cent in the global survey feel that current business models are 'already broken and the need for change is already urgent', 44 per cent agreed with a similar statement about the inadequacy of current market models. It's an indication of the extent to which the forces of energy transformation are exerting urgent pressure on market models. Perhaps it is only the delay of some market frameworks to react and reform that is extending the sustainability of current business models.

**Figure 24: Current power sector company business models will serve us well into the future**

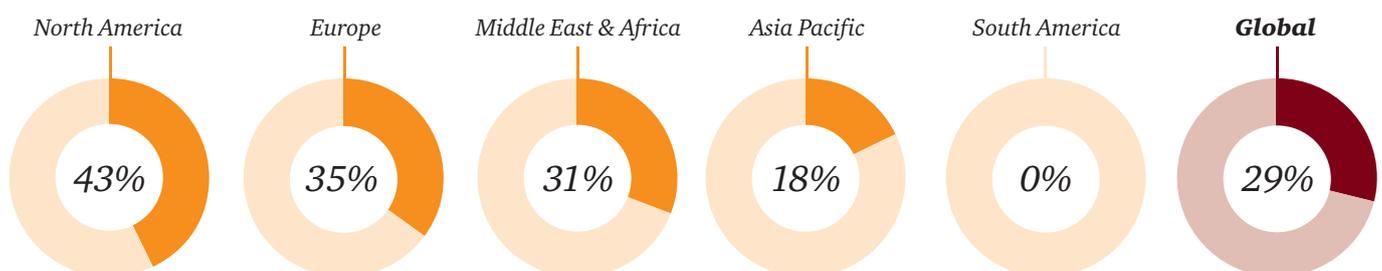
% of respondents scoring 4/5\*



\* Rated on a scale of 1–5, where 1 = fully disagree; 2 = partially disagree; 3 = neither agree nor disagree; 4 = partially agree; 5 = fully agree. Scores 4/5 reported.  
Source: 14th PwC Global Power & Utilities Survey

**Figure 25: Current power sector company business models are already broken and the need for change is already urgent**

% of respondents scoring 4/5\*



\* Rated on a scale of 1–5, where 1 = fully disagree; 2 = partially disagree; 3 = neither agree nor disagree; 4 = partially agree; 5 = fully agree. Scores 4/5 reported.  
Source: 14th PwC Global Power & Utilities Survey



***Future scenario***  
The end of the traditional power sector business model

*In the coming decades, we could see the end of the current traditional energy sector business models in some markets because of the rise of distributed generation*

The consensus among a majority of our survey population is that this is probable, although this is not shared by those in all regions. Exactly two-thirds (66%) say it is a medium to high probability, with most (40%) rating it as a high probability. However, a third (34%) are less sure, giving it a low probability score. There is a big difference across the regions. In North America and Europe, 71 per cent and 52 per cent respectively rate it a high probability versus only 12 per cent in the Asia Pacific region, 38 per cent in the Middle East and Africa and none in South America.

Scale used 0% = zero probability; 100% = maximum probability.  
Low = 0-40%; Medium 40-60%; High/very high 60-100%.



**34%**  
attach a low probability score to this scenario.

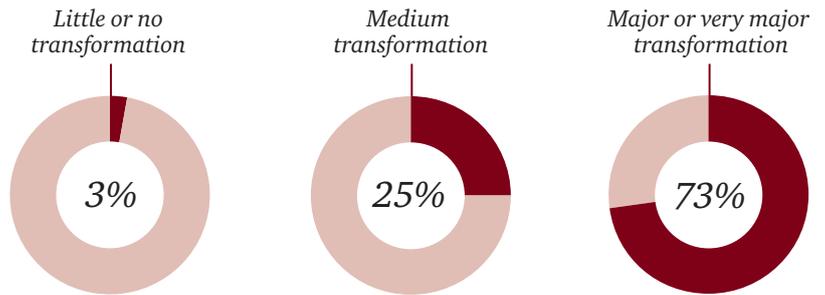
**66%**  
give it a medium or high probability score.

Although there are clear regional differences in the outlook for the sustainability of current power sector business models, hardly anyone in the sector expects them to remain unchanged in the coming period. Only three per cent said there will be little or no transformation (figure 26). No-one in North America, Europe or the Middle East and Africa expects the status quo to prevail. Instead, nearly three-quarters (73%) were of the view that there will be major or very major transformation and there is a sizeable majority in agreement across all the regions, from the Middle East and Africa at 62 per cent to Europe at 78 per cent (figure 27).

**Figure 26: Extent of business model transformation**

How do you anticipate your company's current business model to be transformed by 2030?\*

.....  
% of respondents reporting

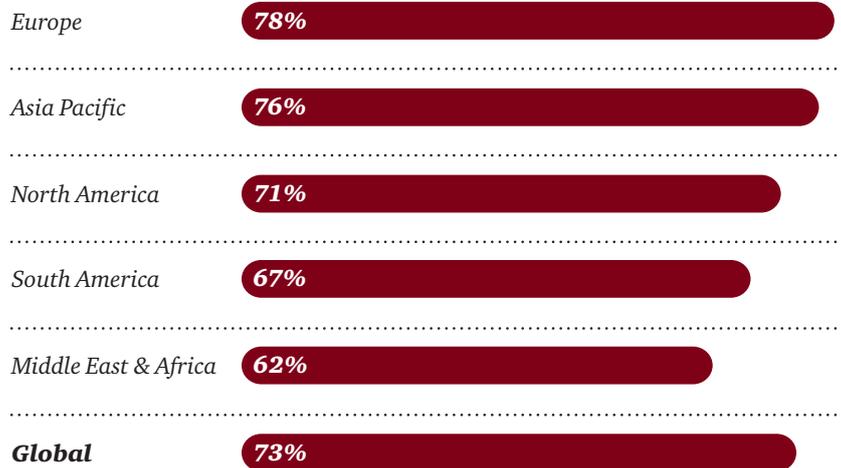


\* Scale of 1–5 where 1 = no transformation; 5 = very major transformation.  
Source: 14th PwC Global Power & Utilities Survey

**Figure 27: Regional analysis: extent of business model transformation**

How do you anticipate your company's current business model to be transformed by 2030?

.....  
% of respondents reporting major or very major transformation



\* Scale of 1–5 where 1 = no transformation; 5 = very major transformation. Scores 4 & 5 reported.  
Source: 14th PwC Global Power & Utilities Survey

**73%**

anticipate major transformation of their company business model by 2030.

**A different future world**

**Impact on the value chain**

We asked survey participants what parts of the value chain business model transformation would impact most and on what timescale. The near-term impact, between now and 2020, is expected to be confined to specific parts of the value chain and is most intense in North America and Europe. But all regions anticipate that business model transformation will have a high impact across all parts of the value chain, with the exception of transmission, by 2030 (figure 28).

In North America, half (50%) said that they expect business model transformation to have a major impact on energy retailing by 2020 (compared to 36 per cent in the global sample) and nearly a third (29%) expect a similar big impact on distribution (compared to 18 per cent of the global sample). The near-term view of many European survey participants was also generally ahead of that in other regions. Nearly a third (30%) expect a high impact on generation (global – 19%), 35 per cent on retail (global – 36%) and 43 per cent on services such as meter reading and data aggregation (global – 40%).

It's not surprising that the impact is felt earliest and is most widespread in North America and Europe, as these are relatively open markets where competition and customer choice can have a greater impact. They are also places where policy directives have provided a significant impetus for energy transformation. But all regions expect business model transformation to be having a high and far-reaching impact by 2030.

One of the biggest impacts is expected in the 'services' area, where a wave of energy control and management, data handling and 'behind the meter' services to customers are expected to take hold. Four-fifths of respondents (81%) foresee a big business model transformation impact on services and high impacts are also expected in distribution (78%), retail (73%) and generation (67%).

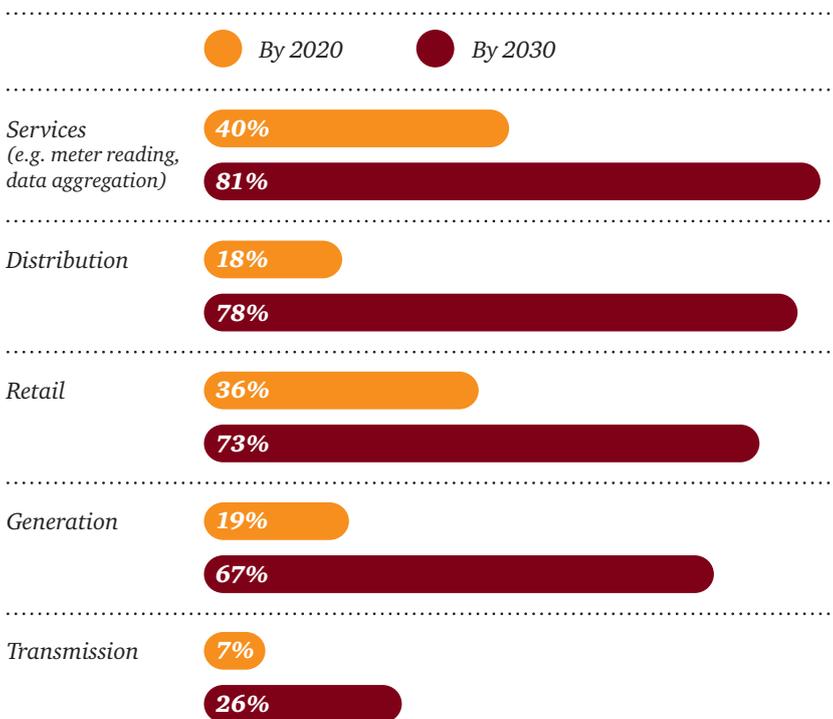
Only a quarter (26%) anticipate that transmission will be heavily impacted. If local energy systems take hold, the role of the transmission network might be greatly reduced, with the potential for significant overcapacity in transmission. On the other hand, markets that develop along regional supergrid lines, taking a regional approach to renewable energy sources and other large-scale power generation, will require significant new levels of transmission capacity.

**81%**

foresee a big business model transformation impact on services and high impacts are also expected in distribution (78%), retail (73%) and generation (67%).

**Figure 28: Impact of business model transformation on different parts of the power and utilities' value chain by 2030**

% of respondents forecasting a high or very high impact\*



\* Rated on a scale of 1–5 where 1 = no impact; 5 = very high impact. Scores 4/5 reported. Source: 14th PwC Global Power & Utilities Survey

## CEO perspective

The opportunities are there if we have a forward-looking vision



*Enel Green Power has an installed capacity of approximately 9,600 MW from a mix of sources including wind, solar, hydroelectric, geothermal and biomass in Europe, the Americas and Africa. Francesco Venturini, Chief Executive Officer and General Manager of Enel Green Power, explains why the long-term impact of transformation needs to be matched with a long-term view from policymakers.*

Market transformation is already happening today! Looking back at the past ten years, global investments in clean energies have increased five-fold to US\$310bn, compared to 2004 levels. Compared to the early 2000s, worldwide renewable installed capacity more than doubled, reaching almost 1,800 GW in 2014. In 2014, for the first time, new photovoltaic (PV) installations almost equalled wind additional capacity and approximately two-thirds of additional PV capacity is estimated to be distributed generation.

These are just a few of the impressive numbers that are representative of the scale and pace of change that is affecting the electricity sector at a global level. However, renewables are not the only element of disruption in energy markets. Climate and environmental legislation, liberalisation policies, technology breakthroughs and international and regional prices of primary feedstocks are all components of the energy equation whose outcome is getting more and more difficult to predict and fully understand.

The challenges that energy markets have to face are very diverse, depending on the economic and market context of each area and region. The EU market is an emblematic case of the failure of the current energy paradigm and of the desperate need for a new market model. Indeed, a stable and forward-looking regulatory framework is crucial in a sector that is setting long-term climate and renewable targets and whose operators have to invest their capital in assets that will last for 20–30 years or even more.

However, the current market configuration in Europe does not provide long-term price signals. Market participants only have at their disposal price information up to two to three years ahead. Due to this mismatch, in different parts of Europe, market operators are not able to take consistent decisions on present and future investment plans. This situation is worrisome if we consider that the EU is moving towards an energy system based on low-carbon technologies and energy-efficiency measures.

Most of the other regions and countries, such as Latin America, Africa and Asia, are evolving in very different market contexts. Consequently their concerns and challenges vary accordingly. In particular, most of these areas are in desperate need of further energy resources to satisfy their increasing energy demand and sustain their economic growth. Environmental concerns and the price volatility of primary energies are pushing governments to rely more and more on renewable technologies as they are becoming more competitive and their costs are reducing at a steady pace. Unfortunately, in the least developed countries and sub-Saharan Africa, the current lack of infrastructure is undermining efforts to achieve more rapid social and economic development and ensuring access to energy is arguably one of the major challenges.

However, within these distressed areas, small and medium-sized communities, with the support of some operators, are testing new potential business models. They're setting up pilot projects for the supply of energy in remote areas, using a diverse set of technologies and innovative processes.

Opportunities are out there. Utilities have to continuously adapt to the ever-changing context, look outside of their normal boundaries and comfort zone and challenge themselves. It means changing their behaviour, way of thinking, accepting and taking risks to manage uncertainty.



**A different future world**

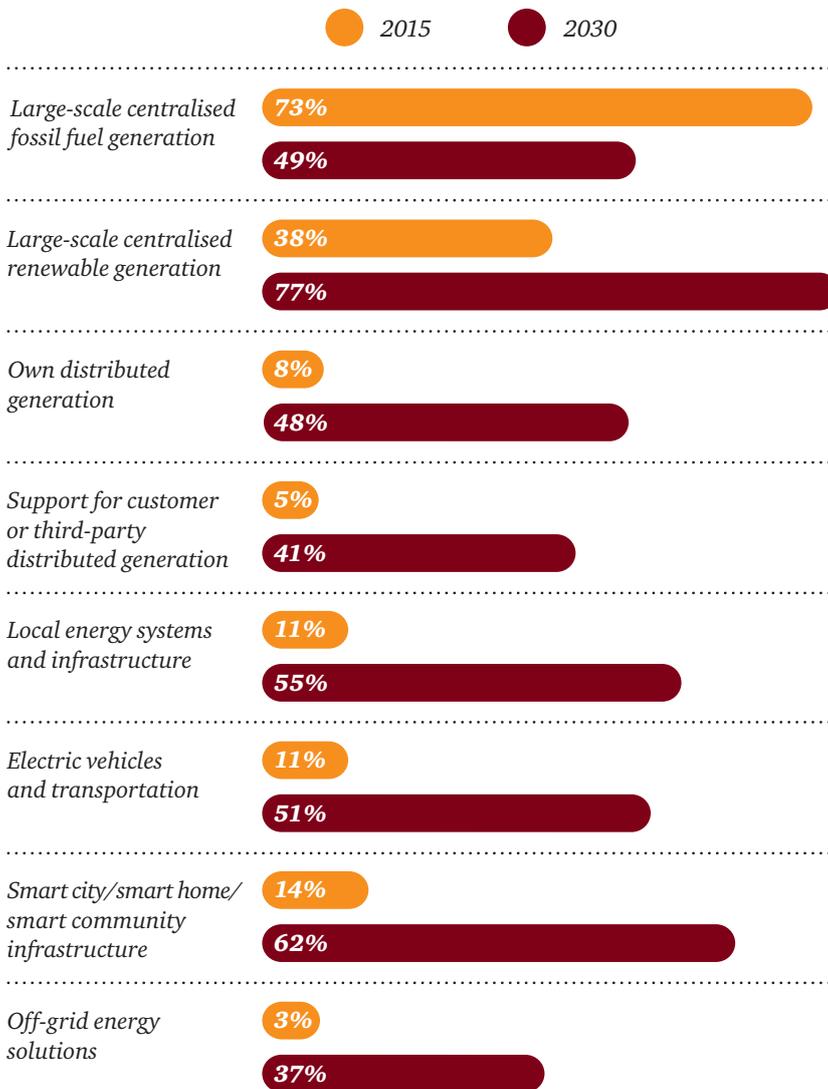
**New operational strategies**

So, with business model change very much to the fore for many survey participants, where are they directing their transformation sights? We asked them to rate the importance of key operational strategies for their company now and what will be important in 2030. The responses indicate the scale of the big shifts that are planned (figure 29). There is a big reduction in the importance of thermal generation in favour of renewable generation. The proportion expecting renewable generation to be of high importance jumps from 38 per cent now to 77 per cent in 2030 while fossil fuel generation drops from 73 per cent to 49 per cent.

There is a big step-up in activity in areas that are of limited or only emerging importance to the sector at the moment. The number saying involvement in smart city, smart home and smart community infrastructure will be of major importance rises from 14 per cent now to 62 per cent in 2030. Similar big increases are evident across a range of areas:

- Local energy systems and infrastructure – up from 11 per cent now versus 55 per cent in 2030;
- Electric vehicles and transportation – 11 per cent now versus 51 per cent in 2030;
- Own distributed generation – 8 per cent now versus 48 per cent in 2030;
- Support for customer or third-party distributed generation – 5 per cent now versus 41 per cent in 2030;
- Off-grid energy solutions – 3 per cent now versus 37 per cent in 2030.

**Figure 29: Operational strategies – now and in the future**  
What operational strategies are most important to your company now and what will be most important in 2030?\*



\* Scale of 1–5 where 1 = not important; 5 = very important. Scores 4/5 reported. Source: 14th PwC Global Power & Utilities Survey

**77%**  
vs  
**49%**

Many more expect renewable than centralised fossil-fuel generation to be of major importance in 2030.

## New capabilities

Moving successfully into these areas will require the power utility of the future to develop a wider set of capabilities. Traditionally, utility companies have focused on energy generation, trading and retailing. While these will continue to be a major driver of value in the future, data services and a broader services portfolio will become part of the mainstream for utility companies and energy services companies.

To survive and prosper, the ‘utility of the future’ will have to provide much more than reliable energy supply – it must respond to a diverse range of customer, business and community demands and do so in a rapidly changing regulatory and technological environment. The utility of the future is unlikely to control the value chain but will need to enable or facilitate customer energy solutions – they will become ‘energy enablers’.

Some of the capabilities needed are highlighted in figure 30. Judging from the range of strong scores given to them, survey respondents already recognise the importance of them for their future business success. New focuses such as ‘behind the meter innovation’ and digital customer management are ranked in importance alongside existing and continuing important power utility capabilities such as asset management and energy trading.

The high importance attached to pricing and margin enhancement recognises that a greater emphasis will need to be placed on obtaining a higher margin from prices/revenues rather than cost reduction to get higher earnings and profit growth. Although they appear at the bottom of the average ranking list, strong scores are recorded for areas such as big data management and data security, which are ‘business critical’ areas. When we delve behind the averages, hardly any companies are saying these factors will be any less than of medium to high importance for them in the future.

*Strong scores were given to all the capabilities we listed, recognising the range of strategies that will be needed to deliver future success.*

It is one thing recognising the new data, innovation and customer capabilities that will be required, but making sure they are in place is another thing. Many incumbents are likely to find it difficult to develop a complete portfolio of capabilities to meet customer needs. In such circumstances, they may determine that market opportunities (and market position preservation) are best enhanced through an extension of relationships with outside companies. These may be companies that they already have a supply chain relationship with or they might be entirely new relationships. In such cases, a ‘partner of partners’ business model approach may be attractive. Becoming a ‘partner of partners’ recognises that the energy ecosystem is broad but interconnected and complicated to navigate. Customer positioning can be improved by integrating ‘high-grade’ internal capabilities with external skills and offers.

**Figure 30: Future capabilities**

How important will the following company strategies/capabilities be to delivering future power sector business model success?\*

Company strategies/capabilities	Average score
<i>Pricing and margin enhancement</i>	4.3
<i>Asset management and optimised supply chain/field service</i>	4.2
<i>Behind-the-meter innovation (e.g. user-friendly smart control and price optimisation systems for homes and businesses)</i>	4.0
<i>Managing partnerships and alliances</i>	4.0
<i>Digital customer management</i>	4.0
<i>System operation data analytics</i>	4.0
<i>Customer data analytics</i>	3.9
<i>Innovation of grid, generation or other ‘core’ operational technologies</i>	3.9
<i>Energy trading and hedging</i>	3.8
<i>Data security and confidentiality</i>	3.6
<i>Product innovation</i>	3.6
<i>Managing ‘big data’ platforms</i>	3.4

\* Scale of 1–5 where 1 = not important; 5 = very important.  
Source: 14th PwC Global Power & Utilities Survey

**A different future world**

**89%**

say there is a medium to high probability of a 'flat and declining role for power utility companies and current central grid-based energy systems'.

**The end game – golden age, slow decline or death spiral?**

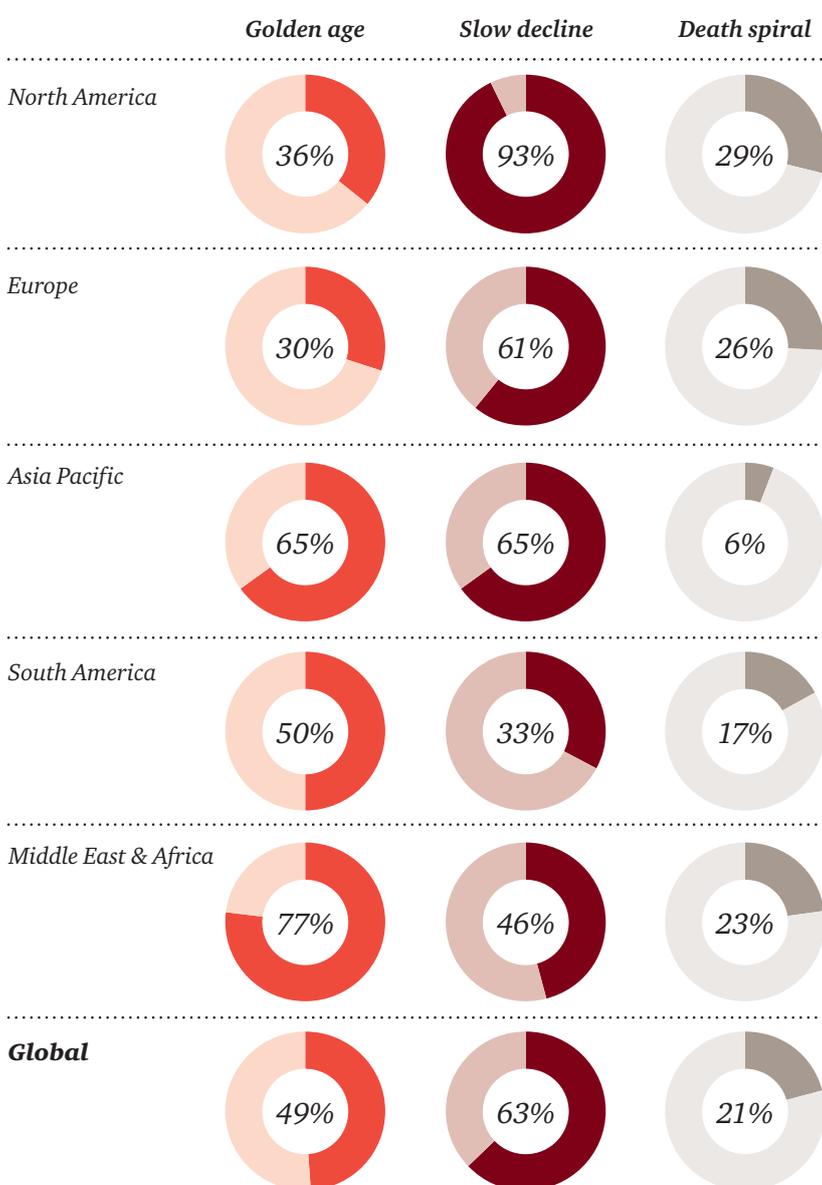
Looking ahead, we think predictions of a 'death spiral' for companies in the power and utilities sector are overstated. But how optimistic are incumbent companies about the future of the sector? We presented a trio of future scenarios to survey participants – an optimistic 'golden age' one in which power utilities flourish and grow, a pessimistic 'death spiral' scenario in which the sector declines rapidly, and a more middle-ground scenario of flatter growth and a slow transition away from the current central grid model.

Respondents were asked to rate each scenario rather than choose between them. Opinion is evidently undecided on exactly where transformation and disruption is taking us:

- 89 per cent say there is a medium to high probability of a 'flat and declining role for power utility companies and current central grid-based energy systems';
- But 70 per cent also attach a medium/high probability to a 'golden age' of utility reinvention in which power utilities enjoy significant success and growth';
- Yet 58 per cent don't rule out a 'downward' or even 'death spiral' from disintermediation, technology disruption and customer behaviour, with power utility companies and current energy systems undergoing a major decline.'

As with many of the other survey results, there are strong regional differences. In the North America and Europe regions, where energy transformation is exerting the strongest influence to date, survey participants are far less likely to take an optimistic stance (figure 31). On the other hand, they do not tilt any more than others towards the pessimistic scenario. Instead, a majority favour the middle-ground scenario of a 'flat and declining role for power utility companies and current central grid-based energy systems.'

**Figure 31: Scenario outlook – 'golden age', 'slow decline' or 'death spiral'**  
% of respondents rating high or very high likelihood



“Golden age’ of utility reinvention/power utilities will enjoy significant success and growth”.  
 “Slow decline’: Flat and declining role for power utility companies and current central grid-based energy systems.”  
 “Downward’ or even ‘death spiral’ from disintermediation, technology disruption and customer behaviour/power utility companies and current energy systems will undergo a major decline.”  
 Respondents were asked to rate each scenario separately so totals do not sum to 100%. Rated on a scale of 1–5 where 1 = no likelihood; 5 = very high likelihood. High/very high = 4/5.  
 Source: 14th PwC Global Power & Utilities Survey

What is certain is that if companies in the power sector don't stay ahead of change, the challenges they face will intensify. New market models and new business models will become established as a result of energy transformation and could quickly eclipse current company strategies.

The importance of change is increasingly well recognised throughout the power utilities sector and companies are aware of the added capabilities that will be needed. The challenge will be to make timely moves to gain the most of the market opportunity of 'old energy' systems and business models while, at the same time, transitioning to the new business models required as energy transformation takes hold. In parallel, companies will need to judge carefully what capabilities they can successfully add themselves and what will need to come from partnerships, joint ventures or M&A strategies.

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**About the survey**

The 14th PwC Global Power & Utilities Survey is based on research conducted between January and March 2015 with 73 senior executives from power and utility companies in countries across Europe, the Americas, Asia Pacific, Middle East and Africa. The Europe region includes Russia.

The majority of participants were senior vice-presidents, senior general managers, directors or other department heads from power and gas utilities, with interests covering supply, transmission, generation and trading.

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