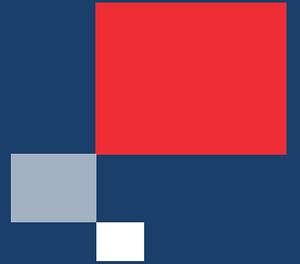


**Baker
McKenzie.**

THE SMART POWER REVOLUTION:

Opportunities and Challenges



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Smart power defined

The power sector is on the cusp of transformation. The combination of the rise of cost-effective renewable energy, the decentralization of energy production, and improvements in energy storage, smart metering and other digital technology have the potential to revolutionize the way power is generated and consumed.

Industry incumbents will need to reshape their businesses to seize the opportunities and to meet the challenges. The opportunities include energy storage; smart cities and buildings; data monetization and new ways of buying and selling power, all of which are blurring the lines between utilities and technology companies. We refer to these trends collectively as “smart power”.

This report, based on a survey of over 200 senior executives from corporates, developers, investors, banks and service providers worldwide, makes sense of smart power, separates the hype from the reality, and focuses on some of the key issues for businesses globally.

Smart Power Glossary (for terms used in this report)

- **Behind-the-meter generation:** energy generating systems providing power directly to a single home, office building or facility without using transmission or distribution networks
- **Demand-side response:** actively reducing consumer’s electricity consumption, particularly during peak times
- **Distributed generation:** generating power at or close to the point of consumption instead of centrally
- **Electric vehicles/EVs:** cars powered by electrical energy from rechargeable batteries
- **Energy efficiency:** using less energy to produce the same output, such as replacing traditional incandescent bulbs with compact fluorescent ones
- **Energy storage:** capturing produced energy to use at a later time, often by a battery
- **Internet of energy/enernet:** an online network that automates electricity infrastructures and manages smart grids
- **Monetizing power data:** generating value or revenue from data generated by smart meters and the internet of energy
- **Smart city:** an urban area designed to make maximum use of smart power technologies
- **Smart grid:** an electrical grid which supports energy efficient and renewable power, smart meters and appliances and is actively managed using sophisticated IT systems
- **Smart meters:** devices that record electric energy consumption and transmit the information back to the energy supplier and energy consumer

Executive summary

Our research reveals the following conclusions:

1 Investment in smart power is rising, with the majority of energy companies investing in smart power to create new business lines and other types of businesses investing for cost stability and savings and to meet green aspirations. More than 40% of the energy companies in our survey said smart power is now a core part of their business, and 37% have established at least one business line related to smart power. Among financial investors, 65% say they have financed at least one smart power project in the last year while an additional 30% are in the process of negotiating the financing of a smart power project. As to the reasons for pursuing smart power initiatives, 51% of energy companies said they are investing to generate new business. 53% of non-energy businesses, such as those in the technology, automotive and industrial sectors, are investing for economic reasons, primarily to lock in long-term energy cost stability; 18% are investing for green reasons, e.g., reducing carbon emissions.

2 Of all the types of smart power initiatives, energy storage tops the list. In our survey, 62% of businesses said they are planning to invest in energy storage technology in the next 18 months, followed by renewable energy projects with a smart power component (58%). Financial investors are also showing great interest in energy storage, with 93% of our respondents stating they consider these projects to be viable financing opportunities.

3 Smart buildings and smart cities are gathering pace but face hurdles to scale. Our survey shows that over 50% of building owners and occupiers are focusing on installing energy efficient

systems such as LED lighting. A much smaller number are pursuing large-scale smart power initiatives, such as on-site generation (17%), installing smart meters (8%) and demand-side response (6%). At the municipal level, city officials often find themselves stymied by outdated procurement rules when trying to procure smart solutions.

4 Energy data monetization is hindered in part by privacy and data usage restrictions. Although many energy companies are using data analytics to improve the efficiency of their operations, only 6% of our respondents said they have sold the information they collect about household energy consumption to third parties. Some 19% of respondents cite laws that prevent personal data from being shared without consumer consent as the greatest obstacle to monetization.

5 The divide between utilities and technology companies will likely blur with the rise of the “tech-utility”. This report reveals a wide divergence in utilities’ attitudes around exploring and adopting smart power. This is often influenced by the regulatory environment. The utilities who embrace smart power will likely blur the line between utilities and technology companies, with 75% of respondents stating that utilities will increasingly become more like technology companies.

6 Unfit and outdated regulatory regimes are hurdles to smart power advancement. In our survey, 77% of respondents said legal and regulatory frameworks are inadequate to address the coming smart power changes, while 91% believe governments and regulators are not well-prepared for advancements in smart power technology.

Survey insight: who's investing in smart power and why?

Energy companies

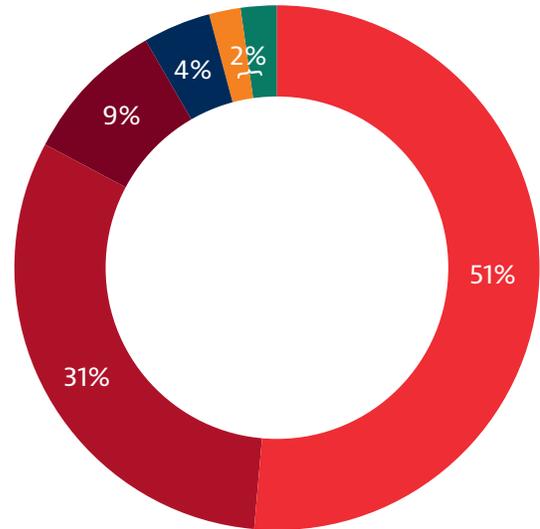
Some 41% of energy companies (including utilities, independent power producers ("IPPs"), project developers and other energy businesses) stated that smart power is core to their business and is part of most of their activities. A further 37% of respondents have developed some business lines related to smart power and 22% are making major changes to their business to address the implications of smart power. Tellingly, fewer than 10% stated that smart power is not important to their business.

Smart power relates to a wide range of different technologies and infrastructures. We therefore asked respondents to specify which aspects of smart power they are exploring. Two areas stand out: some 62% of energy businesses plan to develop or invest in energy storage in the next 18 months and 58% plan to engage with smart power through investment in renewables.

According to the survey data, respondents plan to do this by augmenting traditional renewables through energy efficiency investments in new smart power initiatives. In particular, 37% are planning to integrate distributed/behind-the-meter renewable energy, 32% are planning to provide demand side response services and 28% are planning to provide energy efficiency programs.

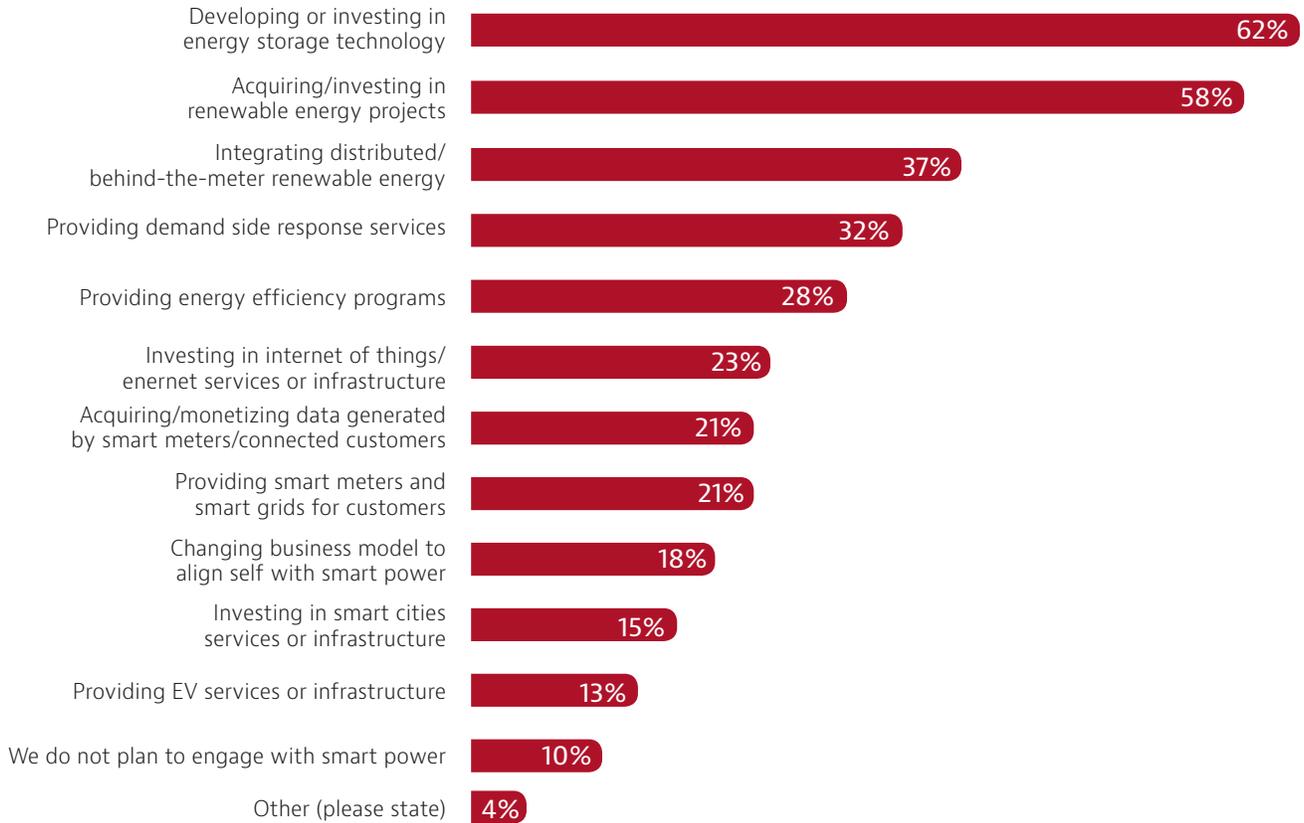
Why are energy businesses engaging with smart power? The majority (51%) are doing so primarily to develop completely new business lines and revenue streams. A further 31% are doing so to improve predictability, and 9% are doing so to better attract and retain customers.

What are the main opportunities to your business associated with smart power? (Energy companies)

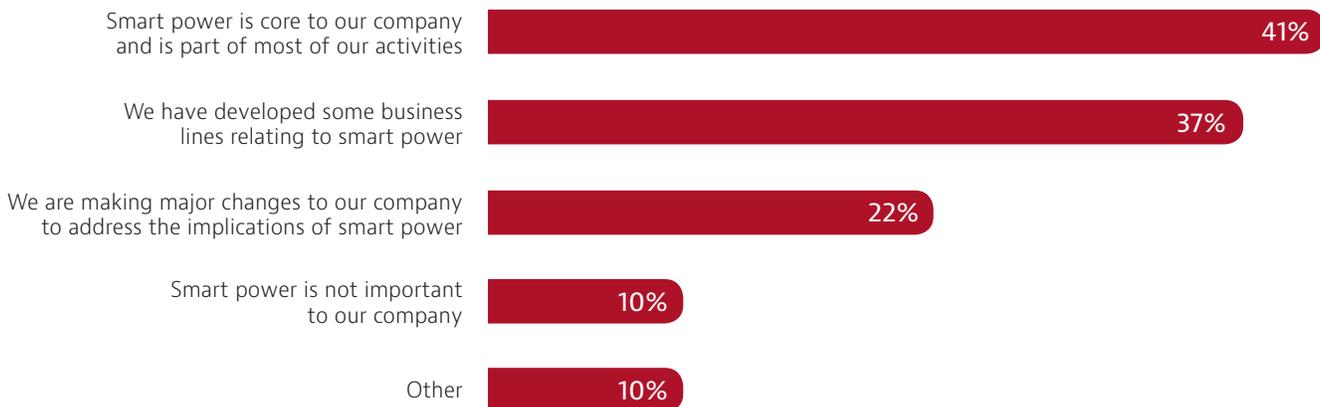


- New business lines/revenue streams (e.g. distributed energy)
- Predictability (e.g. using energy storage to even out unpredictability of renewables; using smart grids to make service delivery more predictable)
- Attracting and retaining customers (e.g. with apps)
- Better margins in different parts of the value chain
- Revisiting unfavorable regulations/laws/tax regimes
- Monetization of data (e.g. making customer/power systems data available)

**Does your company plan to engage with smart power in the next 18 months?
If so, how do you plan to do this? (Energy companies)**



To what extent has smart power affected your company in the last 12 months? (Energy companies)



Non-energy companies

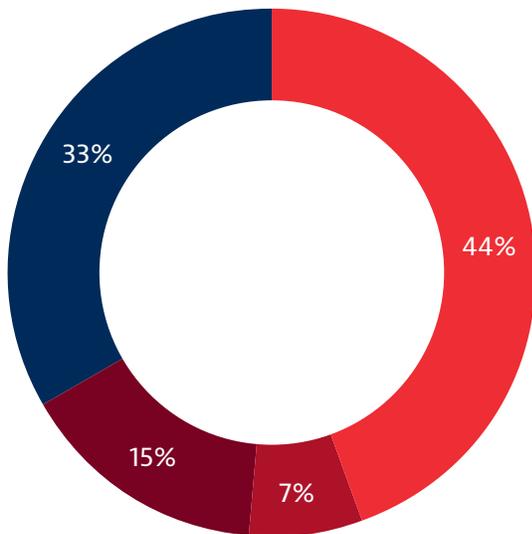
Non-energy businesses, such as technology, automotive and industrial companies, are also engaging with smart power. Of those we surveyed, 44% said they have pursued at least one smart power initiative in the last 12 months, and another 22% are exploring smart power opportunities.

Like energy businesses, non-energy businesses are primarily interested in storage and renewables opportunities with a smart power element. Some

40% of respondents are exploring these types of opportunities while a further 32% plan to use smart meters and 28% plan to install energy efficient devices, smart appliances and fixtures.

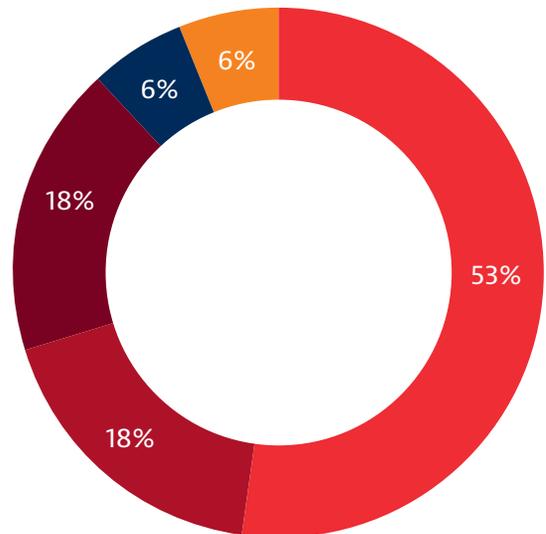
Interestingly, non-energy businesses are investing in smart power for completely different reasons to energy companies. The majority of non-energy businesses are doing so for economic reasons, primarily to lock-in long term energy cost stability. A further 18% are doing so because they have green aspirations.

To what extent has your company engaged with smart power in the past 12 months? (Non-energy companies)



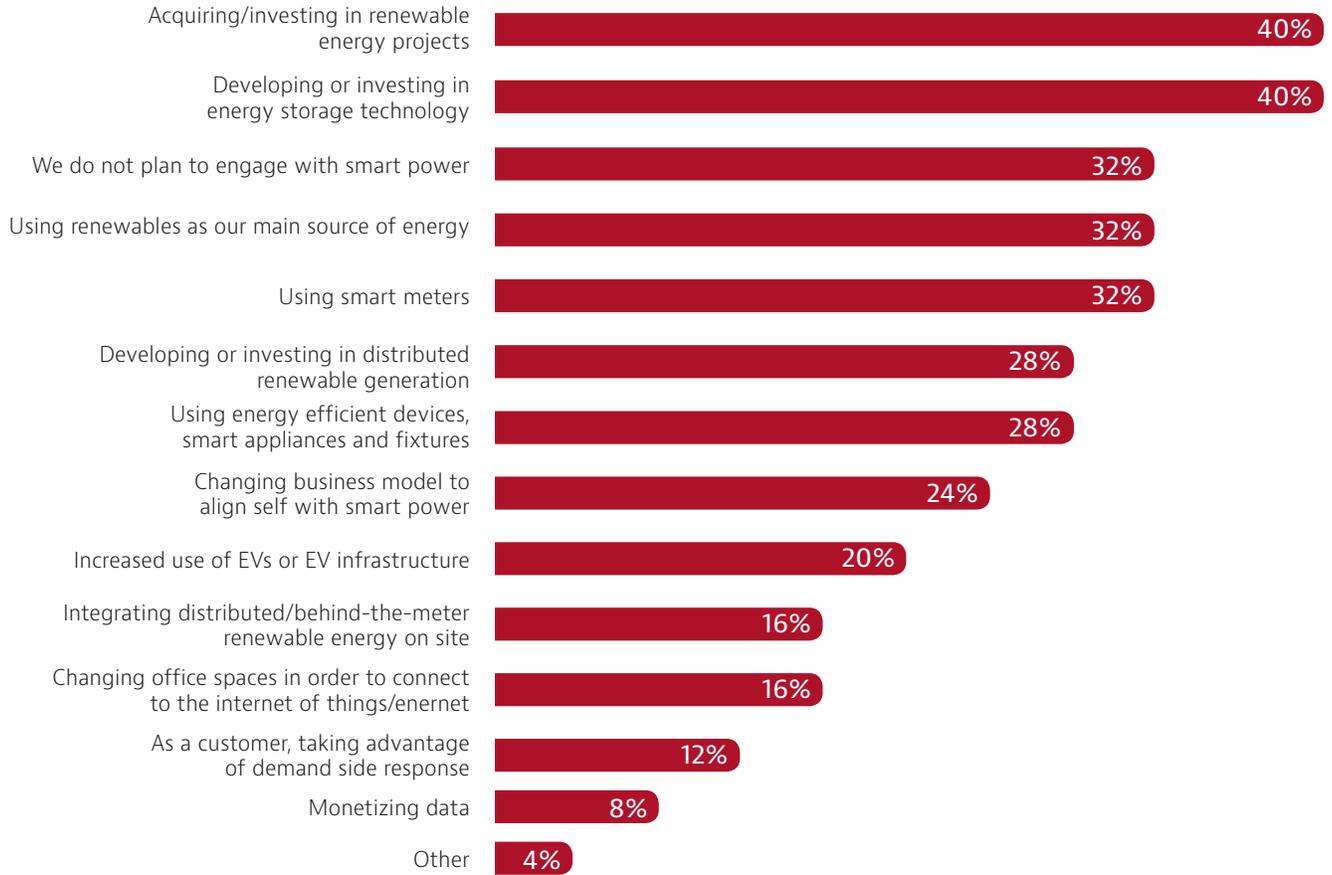
- We have been involved in at least one initiative involving smart power
- We are in the advanced stages of considering at least one smart power initiative but have not yet made a final decision
- We are exploring opportunities to develop smart power initiatives but have not yet commenced a decision making process in respect of those initiatives
- We have not explored any opportunities to develop smart power initiatives

What are the main opportunities for your business associated with Smart Power? (Non-energy companies)



- Economic factors (e.g. long-term energy cost stability)
- Green factors (e.g. reducing carbon emissions)
- New business lines/revenue streams (e.g. retail electricity market)
- Revisiting unfavourable regulations/laws/tax regimes
- Acquisitions

Does your business plan to engage with smart power in the next 18 months? If so, how do you plan to do this? (Non-energy companies)



Financial investors

Financial investors are also excited by smart power opportunities. 95% of surveyed debt providers have already explored opportunities to finance smart power projects. Furthermore, the majority (65%) have financed at least one smart power project in the last 12 months and a further 30% are either exploring doing so or are at the negotiation stage.

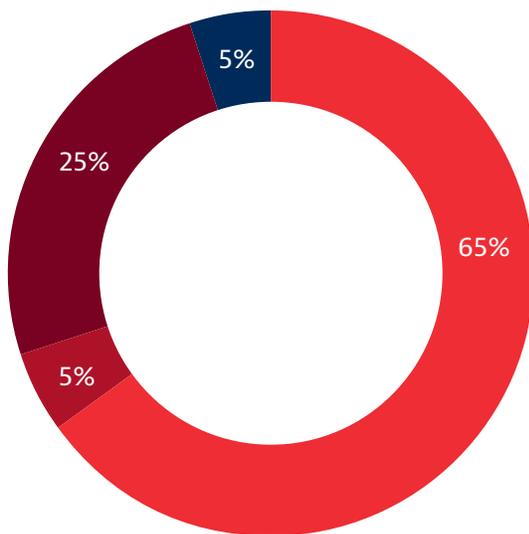
Of those that have financed a smart power project, the majority (61%) have financed a distributed generation project. Some 56% have financed energy efficiency projects while 50% have financed smart meters.

SMBC is an active financier of smart meters and energy projects. It has financed the roll out of millions of smart meters and is evaluating other

smart energy investment opportunities. "We have made a number of investments in smart meters as part of the UK's rollout," explained Luca Gatto, Head of Infrastructure at SMBC Europe. "We are interested in this sector and see these investments as an enabler to the smart grid and smart power more broadly as they allow further assets and applications to be connected."

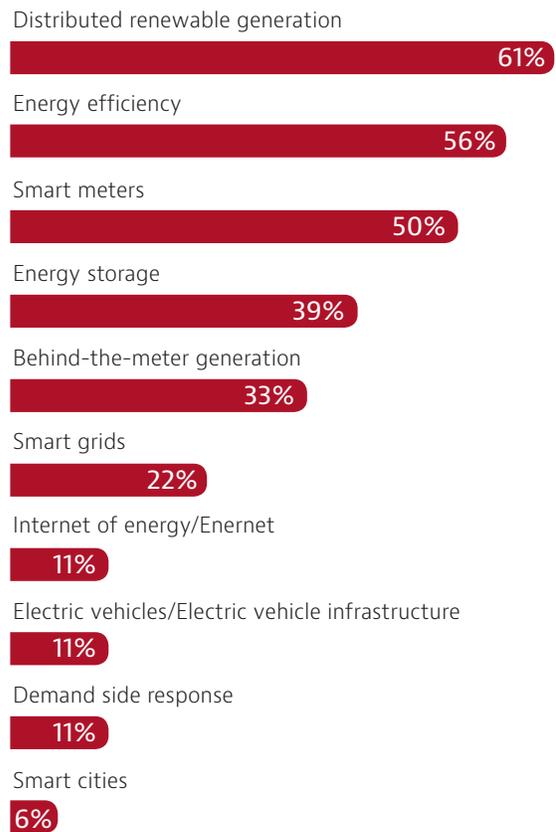
"There will continue to be low-capex, high-volume opportunities once the meters are installed. The consumer concept needs to be thought through a lot more but there might be opportunities relating to consumers generating their own electricity. We might be able to capture the assets they install at their house. There is also energy storage and different types of batteries are in vogue and this ricochets to EV charging points, so we are looking at all these opportunities from various angles."

To what extent have you considered financing a smart power project in the past 12 months? (Debt providers)



- We have financed at least one smart power project
- We are at the negotiating stage for at least one smart power project
- We are exploring opportunities to finance smart power projects but have not yet started formal negotiations
- We have not explored any opportunities to finance smart power projects

What type of projects are these? (Debt providers)



The growing popularity of energy storage

Capturing investors' attention

Of all the different smart power technologies and infrastructures, energy storage is of greatest interest to corporates and financial investors. When presented with a list of smart power initiatives, both energy businesses and non-energy companies stated they are most likely to invest in storage above everything else.

The enthusiasm for energy storage is driven by its growing track record and potentially lucrative financial, economic, security and environmental benefits. Furthermore, in some jurisdictions, regulators and governments have collaborated to create a stable and secure enabling environment for investment in storage projects.

In California, for example, the state has mandated utilities to procure 1,325 MW of chemical, mechanical and thermal storage by 2020. Around 500 MW have already been procured. In the UK, the grid system operator National Grid has

procured over 200 MW of enhanced frequency response while in Australia, a 100 MW lithium-ion battery storage facility came online in November 2017 to help meet South Australia's power deficit.

These projects demonstrate the significant potential for storage. However, at the moment there is a gap between the enthusiasm about storage and the number of genuine investment opportunities.

A key issue remains cost. Batteries have come significantly down the cost curve in the last five years, but have not yet sufficiently reduced in price to be economically viable on a stand-alone basis. Some governments are therefore reluctant to put in place specific schemes to support storage due to technology uncertainty and the expectation of declining costs - why spend public funds supporting an expensive storage project today when costs may halve in a couple of years?



“The technology is becoming more trusted but you still have lots of start-up battery developers,” explains Richard Saines, Energy and Climate Change Partner at Baker McKenzie in Chicago. “There are different technologies coming through and lots of different options. At some point the market will coalesce, maybe around lithium ion or nickel cadmium and there will be both winners and losers, but it’s still fairly nascent. This means the cost of the batteries themselves have not come down the cost curve in the same way that solar panels have, which makes them more expensive to finance.”

At current prices, battery storage makes most sense in regions where there is a significant volume of intermittent renewables generation and where there are large disparities in power prices at different times of the day, as well as in developing regions and island communities that are off-grid due to lack of infrastructure. Storage has also flourished in jurisdictions where its procurement has been directly mandated by the regulator or local government authority.

However, in certain jurisdictions, regulatory frameworks prevent certain types of businesses from owning storage projects (see “Regulations hold back storage” below). An even more fundamental barrier is the structure of power markets and, specifically, whether the market is for energy-only or includes capacity. Storage projects are significantly more economically viable and can more easily be integrated into capacity markets, i.e., markets in which power plant owners are paid to guarantee capacity that can be used to meet peak demand.

That’s not to say that storage is a non-starter in jurisdictions where there is no capacity market. In the energy-only Australia market, for example, an upcoming rule change that spot power prices will be set every five minutes instead of every 30 minutes will likely benefit efficiently dispatchable storage.



In energy-only markets there is no real economic incentive for storage as projects are typically treated as generators

Paul Curnow, Energy and Climate Change Partner at Baker McKenzie, Sydney

Paul Curnow, Energy and Climate Change Partner at Baker McKenzie in Sydney explains, “In energy-only markets there is no real economic incentive for storage as projects are typically treated as generators, and every generator is paid the same spot price for the relevant pricing period. In Australia which is an energy-only market, we have one rule change commencing in 2021 which will settle the spot price for every five minutes instead of the current 30 minute average. This means that storage generators who can dispatch quickly when the spot price is high will receive this higher price rather than the typically much lower half hour average.”

Even in capacity markets, battery storage faces challenges due to inherent risks with current technology. The UK’s 2016 capacity market auction saw 500MW of capacity awarded to battery storage. However, following that, the government reduced the de-rating factor of battery projects that cannot provide power for more than 30 minutes. This metric reflects the predicted availability of battery storage projects in the theoretical case of a system stress event. The result was that only 153 MW of battery storage was successful in the February 2018 capacity market auction.

The next leap forward – integrating storage with renewables and co-locating storage alongside utility-scale projects

Our data reveals that companies, investors and governments are starting to explore co-locating storage alongside renewables projects. In utility-scale applications, this enables large wind and solar farms with integrated storage to delay the release of electricity to times of peak demand, when the project may not necessarily be generating power. This may also enable the project to benefit from peak electricity prices.

In small-scale settings, integrating storage with renewables enables the creation of self-contained microgrids, where infrastructure and residential, commercial and industrial buildings can be powered by renewables in an off-grid setting.

There are increasing examples of integrated renewables and storage projects, though they remain a small proportion of renewables projects. In Arizona, NextEra Energy Resources and E.ON have developed separate 10 MW battery projects alongside PV installations, while in Australia Juwi's De Grussa project is one of the world's largest off-grid integrated renewables (10.6 MW solar) and storage (4 MW) projects, supplying a mine owned by Sandfire Resources.



Marc Fevre, Energy and Infrastructure Partner at Baker McKenzie in London, adds that projects such as this have major potential in markets where much of the population has no access to the electricity grid. "We are seeing a shift in a number of markets such as sub-Saharan Africa towards decentralized energy systems with the potential for integrated storage, better enabling off-grid or microgrid renewables projects, whether as a means of powering industrial scale sites like mines or remote communities. However, for this market really to take off, the costs of storage will need to come down much further."

Our interviewees commonly stated that both energy companies and financial investors are starting to explore seriously the potential for co-locating storage alongside utility-scale projects. For example, in 2016 EDF Energy Renewables won a contract from National Grid to provide 49 MW of battery storage to EDF Energy's West Burton Combined Cycle Gas power station in Nottinghamshire, England.

Reliability challenges

According to our series of interviews, the main risk associated with integrated projects is the reliability of the technology and systems that integrate renewables with storage.

"People really need to get comfortable with the smart systems and control systems that integrate the storage with the generation," confirms Susan Nickey of Hannon Armstrong. "Some of the bigger companies are either acquiring this technology or are developing it in-house. If you are doing an integrated PPA you need to know how it works and that it works. With an integrated product you need to know who is responsible for making it all work and who will provide the performance guarantees. This is all evolving and it's interesting to see what different models will evolve to make this happen and get these projects financed."

Banks warm to storage but regulatory risk is an obstacle

Our survey data reveals that financial investors are now comfortable with financing energy storage projects. Some 93% of surveyed debt providers say that storage projects are viable financing opportunities.

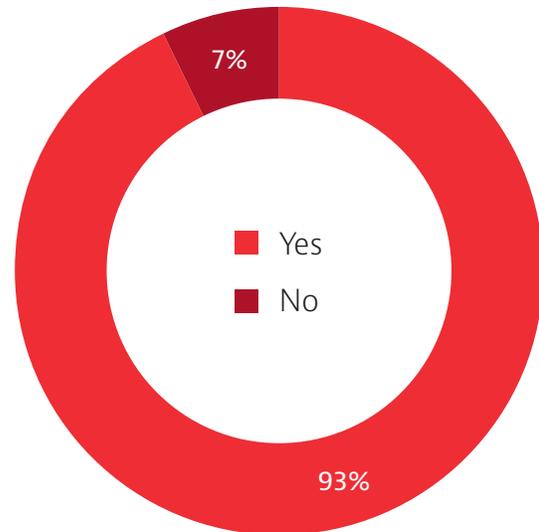
While investors are generally comfortable with financing storage projects, careful consideration needs to be given to certain risks. One of the most important risks is the length of the contract. "No storage project based on exotic technology, such as compressed air storage, has ever been built without a long term contract," explains Martin Wilcox, Senior Consultant, Mott MacDonald in Brighton. "With batteries, investors are often concerned that the length of the contract is not sufficient to generate an adequate return in the term of the contract. So investors have to take a bet on the price they can achieve at the end of their contract."

Therefore, while many banks are now prepared to finance storage projects, the opportunities to do so are limited because of this and regulatory hurdles. It is therefore incumbent on governments and regulators to create the environment in which storage projects can be developed to the stage at which they are ready for bank financing.

The UK's 2016 capacity market auction led to a wave of investment in the sector there, which has since been tempered by the changes to the regulatory regime mentioned above. This highlights the need for regulatory certainty to enable the sector to develop and for lenders to get comfortable with the sector in the longer term.

"We have financed a number of projects in the smart grid sector but from a debt perspective opportunities are still relatively limited," explains Marco Schweer, Director, Infrastructure Finance, Head of Smart Grids and Utilities Infrastructure at SMBC Europe. "We need more projects with predictable revenue streams for the sector to really

Are energy storage projects a viable financing opportunity? (Debt providers)



take off. It's particularly difficult for banks to assess the viability of small-scale energy efficiency or storage projects, unless it is e.g. wrapped up into a smart city solution with an authority covenant."

In a comment on the UK, which resonates in other markets, Schweer continues: "We really need OFGEM and the government to establish a framework in which projects can be developed, as it is the case for smart meters. The government is excited and also overwhelmed about the opportunity. Sandboxes are useful but we need more regulatory engagement."

Regulations hold back storage

This comment is borne out by our survey results: the regulatory landscape in many jurisdictions is holding back investment in storage generally. Survey respondents state that unfit regulatory frameworks are the third greatest challenge to the implementation of storage, behind a lack of incentives to encourage investment and perceived inadequate returns.

The precise nature of the regulatory challenge depends on the jurisdiction, but a common issue is

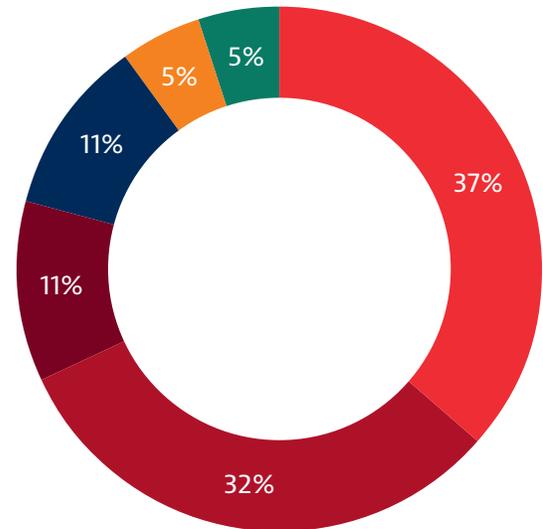
the categorization of storage projects as generation projects by many regulators. In many markets, this categorization restricts distribution companies, who may best benefit from storage to manage the grid, from legally owning storage projects.

For example, in Europe, EU unbundling legislation prohibits transmission system operators (TSOs) from owning or controlling assets that produce or supply electricity. In the UK, this means that National Grid, the operator of the UK's electricity network, and other network operators, cannot own or control storage projects. Many network companies have lobbied the government to relax these laws, but the UK gas and electricity regulator OFGEM has consistently stated that allowing network companies to own storage might stifle competition.

"Unbundling is a real problem because storage is useful for distribution companies to manage the grid," confirms Marc Fevre, Energy and Infrastructure Partner at Baker McKenzie in London. "This is particularly the case with local grids or distribution networks which were developed on the basis of taking power from the transmission network and supplying consumers and now have to deal with surplus distributed generation by those consumers. Ultimately the laws need to recognize storage and its characteristics because the laws were based on the technology in place when they were drafted, when it was assumed that power was generated at point A, and is transmitted along a system and consumed at point B. Now point B may both consume and generate electricity itself that needs to be transmitted and consumed at point C."

In addition, regulations have not always caught up where storage is integrated into existing renewable energy projects that benefit from some form of subsidy. The storage can be deemed to change the nature of the original project and so render the subsidy ineffective. Encouragingly, regulators are starting to realize the benefit of storage and that

To what extent has your company engaged with smart power in the past 12 months? (Non-energy companies)



- Political: Lack of incentives to encourage investment
- Economic: Lack of investment/finance/profit
- Legal: Regulatory framework not fit for purpose and can't keep up
- Social: Lack of consumer demand for solutions
- Social: Changing consumer energy demands
- Technological: Lack of proven/adequate technology and legacy systems; subject to malfunction

such an interpretation of regulations is counterproductive to its implementation. Recently, for example, UK developer Anesco successfully challenged OFGEM's decision that the addition of storage to a solar farm development would render the project ineligible for renewable obligation certificates.

In some jurisdictions the regulatory environment for storage is improving. For example the Federal Energy Regulatory Commission (FERC) in the US finalized rules in February 2018 that direct regional operators to establish market rules and revise tariffs such that storage is recognized. This is a clear sign that in certain jurisdictions the regulatory environment is becoming more conducive for storage.

Smart buildings and smart cities are gathering pace but face hurdles to scale



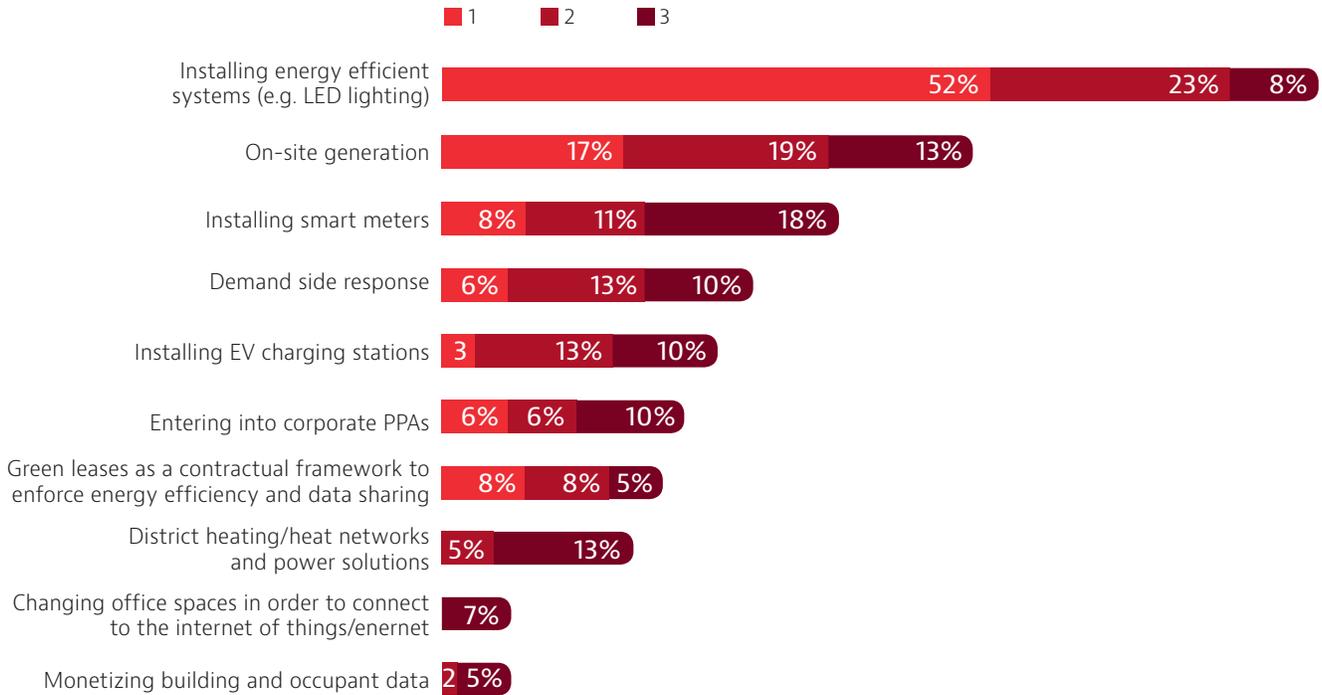
Smart buildings

The transition to smart power does not just involve the deployment of new technologies and infrastructure along the generation, transmission and distribution network. It also involves the investment in new devices within buildings that make the consumption of power smarter.

What smart devices are building owners and occupants investing in? According to the survey data, over 50% are focused on installing energy efficient systems such as LED lighting. A much smaller number are focusing on on-site generation (17%), installing smart meters (8%) and demand side response (6%).

Sector experts interviewed for this report agree that the majority of building owners are reluctant to invest in smart building technology, although there are some notable exceptions. "A small number of large companies, like Deloitte with their Edge building, are right at the forefront of sustainable thinking and having a smart building is part of that," explains Ben Farnell, Real Estate Partner at Baker McKenzie in London. "But the majority of building owners are just concerned with meeting minimum energy efficiency standards. Really the only technology people are investing in beyond the bare minimum is LED lighting because the cost savings are clearer for this compared with things like on-site generation and demand response."

Which of the following initiatives are building owners/occupiers exploring or actually participating in? (Please rank your top three, with one being the most challenging) (All respondents)



So, why aren't building owners and occupiers investing more in smart building initiatives when the technology is available? One of the main issues is the misalignment between the interests of building owners and occupiers. Occupiers will reap the benefits of retrofitting smart energy systems but are unlikely to finance them due to uncertainty as to how long they will remain in the building.

There are some bilateral financing structures that can be used to accommodate the tension between building owners and occupiers, but they are not commonly used. Our interviewees stated that impending tighter regulatory standards relating to green buildings could stimulate investment in smart building technology.

Behavioral changes required to realize full benefits of digital technologies

The primary motivation for installing smart digital systems is to reduce long-term energy

costs and to lock-in long term price stability. However, interviewees were keen to point out that investment in new systems will achieve limited results unless it is accompanied with a program to educate occupants.

"There are hard and soft savings," explains Tom Ciarlone, Director, Facilities Management, Real Estate, Comcast Cable in Philadelphia. "Our hard savings will account for about 30% and that's about investing capital to put technology in place. The 70% are soft savings and these come about by cultural change through an education process. People need to understand that they maybe need to change their lifestyle a bit in order to continue to add those additional savings to grow from 30% of savings to 50% savings. But it takes time because it's a cultural change. You can only do so much to make a building smarter through investment and equipment; the rest of it is down to people's behavior."

Consumer inertia

Our series of interviews also revealed that consumer inertia is a significant barrier to more widespread adoption of smart energy consuming appliances, particularly in residential dwellings. This is partly because power prices are relatively low in some regions, but also because some individuals are generally getting used to consuming services on-demand, be that Uber taxis or TV. So why should energy consumption be any different? Optimism prevails, however, partly because technological improvements to household appliances are increasingly automating smart processes.

Kevin Smith, CEO at SolarReserve in Los Angeles, explains. "I don't think that consumers will significantly shift their energy demand profile when they have visibility of real time pricing," he says. "We are an on-demand society and we want things when we want them. But it will work if appliances are set up automatically, such as a

fridge only running in the morning and at times when power prices are low, because it doesn't need to be on the whole time. Then consumers will say sure why not. But if people have to shut their own refrigerator down they just won't do it."

Smart cities

Smart, digital energy devices are not just being installed in individual buildings. Cities are increasingly taking a lead and investing in a variety of devices, be they sensors, LED lighting, traffic management and other systems across urban areas. According to data compiled by the European Parliament, there are currently 240 cities with a population of over 100,000 that have at least one smart city feature. This might include a project that uses technology to improve energy efficiency, limit pollution or improve public transport.

"Cities are increasingly taking an active role in looking at power and infrastructure as an overall system and the opportunities associated with





Cars could be part of the power system because they can store energy in a bi-directional way and cities can play a part in bringing this together

Richard Saines, Energy and Climate Change Partner, Chicago

looking at how buildings integrate with the power and energy networks and also how that links up with transport infrastructure and systems,” explains Richard Saines, Energy and Climate Change Partner at Baker McKenzie in Chicago. “Cars themselves could be part of the power system because they can store energy in a bi-directional way and cities can play a part in bringing all of this together.”

Data will play a huge role in smart cities. Many smart initiatives involve collecting, analyzing and then visualizing vast quantities of city-wide data to create actionable information for city authorities. This data might relate to energy usage, traffic flows or pollution levels. There are significant opportunities for the private sector to work with cities to help them do this.

“Cities will soon possess or have access to massive amounts of information – some produced by civil servants and public places and others by third parties,” explains Stephen Goldsmith, Daniel Paul Professor of the Practice of Government and the Director of the Innovations in American Government Program at Harvard’s Kennedy School of Government; former Deputy Mayor of New York and former Mayor of Indianapolis. “Value will

be created when a private company can assist public officials in securing insights from the data generated from transaction systems and internet of things sensors and then translate those insights into action. Digital analytics will help public entities produce customized responses that will drive down energy costs while broadly increasing efficiency.”

“The massive amount of digital information will create opportunities for the truly smart city. Officials will be able to see and manage the energy footprint broadly and narrowly – from discrete floor to floor and hour to hour usage and management in a single building to a fully modeled understanding of all sources and uses in a city. Conservation (demand) and supply both will benefit from these insights.”

City authorities can play a vital role in implementing smart power solutions because they often have the authority to do so. However, even cities that have a strong smart vision or air quality quotas to meet frequently face hurdles. Interviewees often cited political wrangling within city councils as a barrier to smart power initiatives being agreed.

Political issues aside, cities are often hamstrung by procurement regulations that specify that the lowest cost bid must be selected. This might prevent smart, energy efficient solutions from being procured if such solutions have a higher upfront cost, even where they have a lower long-term cost once energy efficiency savings are accounted for.

In parallel, procurement frameworks often require cities to give very specific details regarding the specifications of the technology they want to procure. But for smart solutions, cities might not know what the best solution is. They may therefore prefer to specify a problem and then see how suppliers might be able to tackle the issue. However, unfortunately this approach is typically not permitted under most procurement frameworks.

Monetizing data: the opportunities and challenges



Monetizing energy consumption data

Data monetization in its most basic sense is finding ways to derive value from data. The transition to a digital power system, the rapid growth in smart meter installation and the increasing use of internet-connected domestic appliances, such as kettles and washing machines, is creating a huge amount of data about households' energy usage. This might include the total amount of power consumed, when this power is being consumed or even more granular statistics about how much individual appliances are consuming.

This data could be monetized. For instance, retailers of household appliances might be willing to pay an energy provider a fee for data relating to the energy consumption of its appliances in order for the retailer to understand when a particular device is faulty or not operating efficiently. If aggregated, this data could be shared with consumers to also enable individual households to benchmark their energy consumption against households of similar size in the same location. Such information would also be extremely useful to companies offering home energy efficiency solutions as they could

target customers with the most need for their solutions.

Accenture estimates that the US market alone for selling anonymized data is USD 1.3 billion and attributed customer data is USD 3.3 billion.

Data analytics

The opportunities to monetize data extend well beyond selling household energy consumption information to third parties. Increasingly, utilities, energy businesses and large energy consumers are using sophisticated data analytics tools to reduce energy consumption and to more efficiently manage the grid.

As Samuel Kramer, Information Technology Partner at Baker McKenzie in Chicago explains, data centers are starting to explore how they can leverage new data analytics tools to reduce energy consumption.

"We are doing lots of work with high energy users like data centers, who are working with tech companies to leverage artificial intelligence to be able to structure their usage of energy in more

efficient ways," he says. "We don't know what the output of this will be, but it will probably be more sophisticated than shifting time of usage. It's a really exciting area. We've only recently got the computing power to analyze all historic energy consumption data. It will reveal possibilities that we haven't been able to think about before."

Data analytics are also being used by utilities and grid operators to improve the efficiency of the grid. For example, Texas' largest power transmission and distribution company, Oncor Electric Delivery, is using the information collected by smart meters to better manage its response to power outages.

"The installation of smart meters and the analysis of the data that they produce has brought significant operational benefits for us," explains Don Clevenger, Senior Vice President, Strategic Planning at Oncor Electric Delivery in Dallas. "Now we know where power is out because the meter sends a signal just before it loses power. That causes some issues because meters go out momentarily a lot, so we've developed algorithms that tell us when we have to look at a problem. In addition, we now know when a meter comes back on, so restoration has improved. We've been able to cut down on tampering too."

Data privacy and data ownership barriers to data monetization

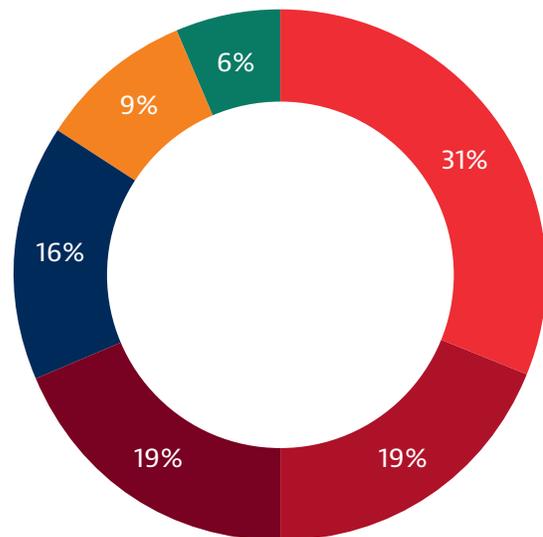
The opportunities to make use of the data generated by smart power systems are clear. However, only 6% of survey respondents that hold or have licenses in data are already monetizing it. While a further 19% of respondents are planning to monetize data they already own and 9% are looking to acquire data, some 31% have no plans to monetize the data they hold and 34% are unlikely to do so due to contractual or regulatory concerns. Other obstacles may be that businesses simply do not know how to monetize data and may have doubts about the accuracy and reliability of the data.

Data privacy

Some of the most important obstacles to this data being monetized are concerns related to data privacy and whether individuals should be (or could be) paid to hand over their personal data.

"The US Public Utility Commissions have pretty stringent restrictions on data sharing," explains Samuel Kramer, Information Technology Partner at Baker McKenzie in Chicago. "These regulations were written before data monetization was ever really dreamed up. So, often people trying to monetize this type of data can run into older

To what extent is your organisation monetizing data? (Respondents that own or have license to data)



- We own/have license to data but have no plans to monetize it
- We own/have license to data but are not sure we can monetize it due to legal/regulatory reasons (e.g. data privacy laws)
- We own/have license to data and are planning to monetize it though haven't done so yet
- We own/have license to data but are not sure we can monetize it due to contractual reasons (e.g. contracts silent on how data can be used)
- We are looking to acquire data regarding energy consumption and usage
- We are already monetizing data we own/have license to

regulation which is more sweeping than it was intended to be." "Of course, newer regulations such as the EU's General Data Protection Regulation (GDPR) could also prove challenging to comply with" adds Harry Small, Information Technology Partner at Baker McKenzie in London.

These challenges are certainly not insurmountable, but care must be taken to adhere to the precise nature of data protection regulation in certain jurisdictions. "Privacy laws can be a challenge to monetizing data in the power sector because a lot of data will be personal data," explains Anne-Marie Allgrove, Information Technology Partner at Baker McKenzie in Sydney. "Transparency and proportionality are key principles of privacy law consistent across most jurisdictions. As a result, data subjects need to be given notice of the purpose for which personal data is collected and such collection must be proportional and limited for the relevant purposes. Energy companies will have to consider both these principles in assessing what use they can make of the data they hold and ensure they have processes in place to meet these requirements."

Data ownership

As companies are looking at ways to monetize data, data privacy issues are not the only key legal concerns. According to Sue McLean, Information Technology Partner at Baker McKenzie in London, there is also the key question of who "owns" the data. "In some cases, it may be clear who has the right to exploit the data," she says. "However, in some jurisdictions (like the UK) there aren't any intellectual property rights that attach to data in the general sense. Although there are intellectual property rights that could be used to establish rights in data, it can be difficult for non-structured machine data to meet the criteria needed."

"Accordingly, companies may need to rely on contractual rights. But there again, they may run into problems as historic contracts do not always deal directly with issues regarding the ownership



Privacy laws can be a challenge to monetizing data in the power sector because a lot of data will be personal data"

**Anne-Marie Allgrove,
IT Partner, Sydney**

of data or with licensing/usage rights associated with such data. Therefore, it may not always be clear who "owns" the data, and this lack of certainty can inhibit parties from exploiting the data. If a company wants to monetize its data, its first step is to establish that it has the right to do so."

Even when ownership of data is clear, laws may prevent effective use of that data. In Texas, for example, data protection regulation has prevented large technology companies from aggregating and then monetizing household energy consumption data. "Organizations such as Google have been interested in purchasing data collected by smart meters we've installed in Texas, but the law states that the customer owns the data," explains Don Clevenger, Senior Vice President, Strategic Planning at Oncor Electric Delivery in Dallas. "In order for someone to monetize the data they would have to get all customers' consent, which always proves too complex and costly."

"The likes of Google and others have the dream of showing households how much energy you use compared to your neighbors and what others are doing to save energy, but the regulatory environment prevents them from doing so. In other states the regulation is different and the utility owns the data. But often in this scenario the utility doesn't want the likes of Google to have it."

The blurring divide between utilities and technology companies

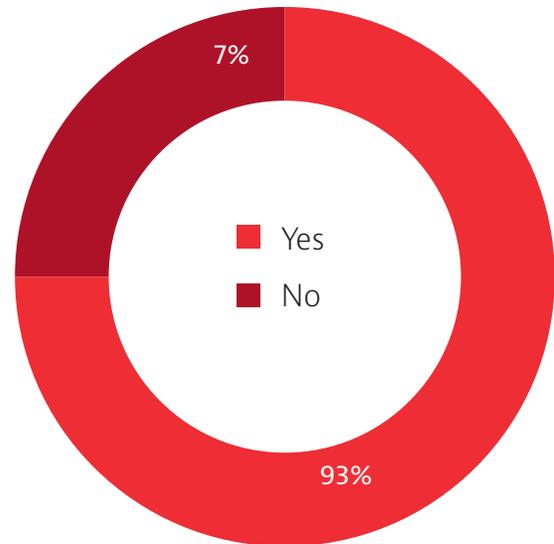
Investing in smart power to stay ahead

The digitalization of the power sector is happening. However, our interviews reveal that there is a significant divergence in the willingness among utilities to embrace smart power. At one end of the spectrum, utilities are investing in numerous smart initiatives in order to distinguish themselves from their competitors. However at the other end of the spectrum, some utilities are not investing at all in exploring any smart initiatives and consider such ventures to be an erosion of their revenues.

Often, the extent to which utilities explore smart projects depends on the regulatory environment. "In the US, there is a real gap and different perspective from utility to utility on smart initiatives," confirms Mona Dajani, Energy and Infrastructure Partner at Baker McKenzie in Chicago. "Utilities in innovative states where the regulatory hurdles have been cleared have been most active, but there is a huge difference in other states in which smart power is not viewed as an opportunity but as a challenge."

In markets where the regulatory environment allows, utilities must explore relevant smart initiatives to remain competitive. Failure to do so might result in new entrants eroding their market position. "The smart utilities are getting on board and the ones that are entrenched in their own ways will be surpassed by new entrants into the market," predicts Skip Rankin, Energy and Infrastructure Partner at Baker McKenzie in New York City. "The trend is gathering pace and the utilities that do not join in may find themselves outdated. Deregulation has accelerated over the last couple of years but it varies state by state. Generally, regulators are opening up the market to new market entrants. Utilities should not count every year on an automatic renewal."

Are energy storage projects a viable financing opportunity? (Debt providers)



The rise of the tech-utility

Utilities

So, how are utilities embracing smart power? The most frequently cited approach by survey respondents and interviewees is to integrate technology across their service offerings. Indeed three quarters of surveyed energy businesses (including utilities) stated that utility providers will increasingly become more like technology companies.

Anecdotal evidence suggests that utilities are exploring ways to make better use of technology across the entirety of their operations, from asset repair and maintenance systems that optimize power generation and distribution, to apps that improve the customer experience.

One example is Chubu Electric Power, Japan’s third largest utility, which has partnered with US software company Bidgely to provide a suite of digital consumer solutions, such as a web portal that segments its customers’ energy usage by appliance in their energy bill and provides personalized recommendations on how customers can become more energy efficient.

Some utilities have launched initiatives to encourage the internal development of smart technology. For example ENGIE Latin America in Chile has launched an incubator called ENGIE Factory. Pablo Martinez, VP Customer Solutions, Latin America at ENGIE, explains how it works.

“We have an incubator in Chile and Mexico that is quite active in smart power, specifically green mobility, energy efficiency and things that generally relate to digitalization, decentralization and decarbonization. The unit will either invest corporate venture capital or identify an area with market potential and then go and identify the right entrepreneur to develop this idea. The unit will take an initial minority stake in the business and continue to invest as it grows.”

While utilities are primarily developing this technology in-house, there are a small number of examples of utilities acquiring businesses to gain access to specific technologies. Enel has been most active in this regard, acquiring three smart energy businesses – EnerNOC, Demand Energy and eMotorWerks – in 2017. In addition, Centrica acquired leading European demand response aggregator REstore in November 2017 for £62 million. And in March 2017 ENGIE acquired electric vehicle charging services provider EV-Box.

As summarized by Anne-Marie Allgrove, Information Technology Partner at Baker McKenzie in Sydney, “From our experience, the focus for utilities has been to date primarily on developing their offerings and expanding their services particularly by the use of data analytics to improve for example energy efficiency or provide greater

control to customers on the use of energy, rather than being acquisitive in the tech space. Some utilities have acquired start-ups to do this but that is in its early days.”

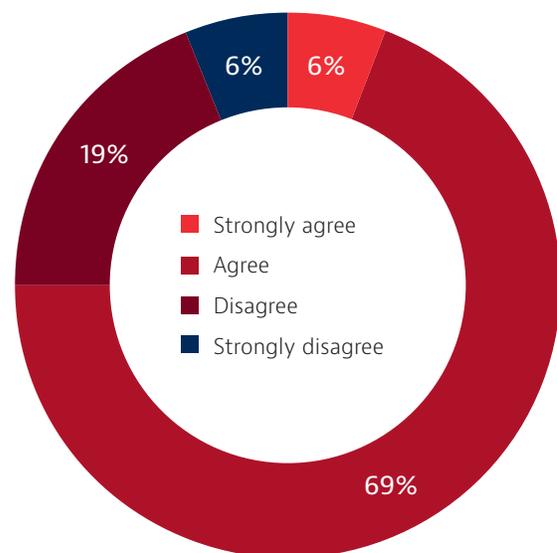
Technology companies

Utilities are not innovating in isolation. As they strive to develop more technology-enabled offerings, technology companies are exploring ways to enter the energy market. Indeed three quarters of respondents agree that technology companies will increasingly become more like utility providers.

Some of the world’s largest technology companies have already made forays into the energy sector. Most already actively purchase power in the form of corporate power purchase agreements (PPAs) and some have applied for licenses to sell excess power to customers. Meanwhile, Google acquired smart thermostat company Nest in 2014.

The real game-changer will be if and when technology companies start to sell energy to

Are energy storage projects a viable financing opportunity? (Debt providers)



consumers. None have thus far explicitly stated an intention to do so. But this may change. In the UK for example, the regulator has relaxed licensing laws in a bid to encourage technology and other non-energy companies to introduce new time-of-day pricing schedules, where the power price is influenced by the availability of power. As part of these plans, technology companies could potentially switch domestic appliances on and off to save customers money. In many countries, utilities do not currently offer time-of-day tariffs.

Differentiating by offering energy services and distributed generation

Utilities are not just embracing the smart agenda by implementing technology across their value chain. In addition, many are exploring or have already established completely new service lines that complement their traditional business models.

Interviewees and survey respondents frequently mentioned two new business areas that utilities are exploring most – energy service companies and distributed generation.

Some utilities have offered energy services such as power generation and energy supply, energy infrastructure and risk management for years. In Europe, Centrica, for example, has evolved from being a traditional large-scale nuclear and offshore wind company to operating a fully-fledged energy services division, which currently employs 12,000 engineers and technicians.

US utilities are also exploring offering energy services to their clients. “A client that has traditionally been involved in conventional energy is going to its corporate customers and, in addition to establishing a renewable system on the premises, is coupling that with overall monitoring of energy usage and will pretty much guarantee savings over the lifetime of the contract by monitoring the best and most efficient use of power,” explains Skip Rankin, Energy and Infrastructure Partner at Baker McKenzie in New

York City. “Their compensation is based upon the savings. Many utilities are starting to explore this business model!”

Many utilities are also exploring the distributed energy market. EDF Renewable Energy, for example, is developing a distributed renewables business in North America following its acquisition of distributed solar developer and EPC provider groSolar in 2016. Enel’s purchase of Demand Energy and Centrica’s acquisition of REstore also give them a footing in the distributed energy space, as does Ormat’s acquisition of Viridity.



[US Utilities] will pretty much guarantee savings over the lifetime of their contract by monitoring the best and most efficient use of power”

Skip Rankin, Energy and Infrastructure Partner, New York City

Establishing distributed energy divisions will assist utilities in expanding into emerging markets, where distributed energy projects are increasingly deemed vital in meeting the energy requirements in areas not served by the grid. For example ENGIE has expanded into Africa through acquiring off-grid home solar system company Fenix International in October 2017. Fenix, which primarily serves customers in Uganda and Zambia, combines digital payment technologies with self-installed rooftop solar systems.



"This will be storage ready and capable of, for example, powering telecoms towers in remote areas," explains Marc Fevre, Energy and Infrastructure Partner at Baker McKenzie in London. "Large investors such as Japanese trading houses and the big IPP developers are now looking at decentralized generation. This is a very interesting shift because these sorts of projects were previously off the radar for large investors because they were considered too small. But they've realized that if you want to work in those markets, that's where the real opportunities are and they are developing business models to roll out these technologies at a sufficiently large scale."

The opportunities for distributed generation lie both in emerging markets and those with

developed electricity systems. "It's really interesting to see storage being integrated with solar and energy efficiency in behind the meter projects, effectively creating micro grids," says Susan Nickey, Managing Director at Hannon Armstrong. "It's energy plus resiliency. We've financed those types of projects and seen demand for integrated solutions rise. It could be on a military base or somewhere else."

"After some of these natural disasters lots of buildings will be thinking about how they have more backup. Small one-off microgrids projects don't create a market overnight, but utilities are thinking about owning them as an alternative to upgrading the transmission system."

Conclusion: smart power opportunities and challenges

As this report confirms, smart power is here to stay and will provide tremendous opportunities for energy companies, non-energy businesses and financial investors.

While there is most excitement about energy storage - 62% of surveyed businesses are planning to invest in energy storage technology in the next 18 months – there is also much enthusiasm about data monetization, distributed generation, smart buildings and smart cities.

As utilities and other energy businesses explore smart power opportunities, many will increasingly resemble technology companies. Likewise, as technology companies move into smart power, many will increasingly operate like utilities.

However, many challenges need to be overcome in order to maximize the potential of smart power. Most of these relate to navigating the complex regulatory environment. The private sector needs to engage advisers who understand the issues to navigate the legal obstacles and to help change the current laws, in part by speaking to regulators. Similarly, regulators and governments must be bold in updating laws so that smart power can flourish.

Tellingly, a sizeable 77% of respondents consider existing legal and regulatory frameworks inadequate for smart power, while 91% felt that governments and regulators were not prepared for the changes that smart power will bring.

So, while there is much excitement about smart power, the entire industry needs to work closely with regulators around the world to ensure that the benefits can be realized.

Putting it all together

We recommend considering the following when investigating smart power projects:

1. Can smart power create a new business line for your entity?
2. Can smart power increase cost savings or stability or meet green targets for your entity?
3. Is the smart power project you are considering supported by current regulatory regimes; will those regimes be changing; or, if a regime currently exists, will it hinder the investment?
4. Does maximizing the project's full benefit depend on consumer behavior and is that something you can control?
5. How does the project fit into the broader power ecosystem and the changes occurring within it?

To what extent do you agree with the following statements? (All respondents)

Existing legal and regulatory frameworks are adequate



Governments and regulators are well-prepared for the coming changes



■ Strongly agree
 ■ Agree
 ■ Disagree
 ■ Strongly disagree

About the Research

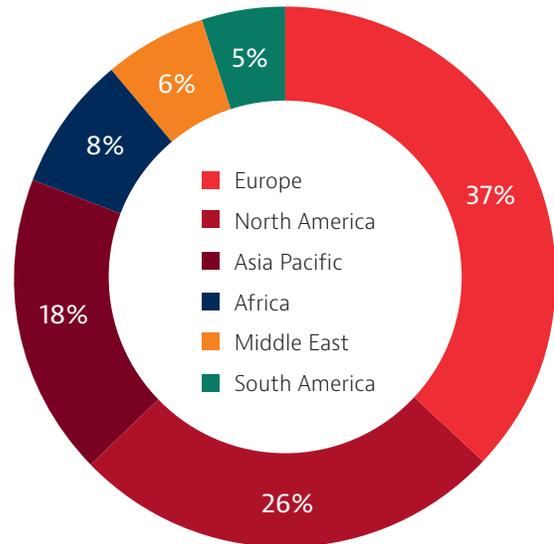
The findings in this report are based on a late 2017 survey of over 200 senior executives from corporates, developers, investors, banks and service providers worldwide.

The report also includes comments from interviews conducted with the following individuals:

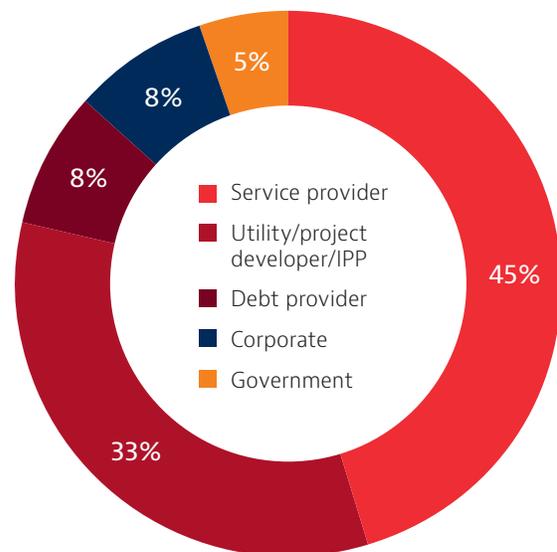
- **Tom Ciarlone**, Director, Facilities Management, Real Estate, Comcast Cable, Philadelphia
- **Don Clevenger**, Senior Vice President, Strategic Planning, Oncor Electric Delivery, Dallas
- **Luca Gatto**, Head of Infrastructure, SMBC Europe, London
- **Stephen Goldsmith**, Daniel Paul Professor of the Practice of Government and the Director of the Innovations in American Government Program at Harvard’s Kennedy School of Government; former Deputy Mayor of New York; former Mayor of Indianapolis
- **Pablo Martinez**, VP Customer Solutions, Latin America at ENGIE, Chile
- **Susan Nickey**, Managing Director, Hannon Armstrong, Annapolis
- **Marco Schweer**, Director, Infrastructure Finance, Head of Smart Grids and Utilities Infrastructure, SMBC Europe, London
- **Kevin Smith**, CEO, SolarReserve, Los Angeles
- **Martin Wilcox**, Senior Consultant, Mott MacDonald, Brighton

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Respondent breakdown by region



Respondent breakdown by organization



A number of Baker McKenzie partners were also interviewed for this report. These include:

- **Anne-Marie Allgrove**, Information Technology Partner, Sydney
- **Mona Dajani**, Energy and Infrastructure Partner, Chicago
- **Paul Curnow**, Energy and Climate Change Partner, Sydney
- **Ben Farnell**, Real Estate Partner, London
- **Marc Fevre**, Energy and Infrastructure Partner, London
- **Samuel Kramer**, Information Technology Partner, Chicago
- **Sue McLean**, Information Technology Partner, London
- **Skip Rankin**, Energy and Infrastructure Partner, New York City
- **Richard Saines**, Energy and Climate Change Partner, Chicago

The report was written in collaboration with Clean Energy Pipeline, a specialist provider of research, news and data on the clean energy sector globally. Clean Energy Pipeline is a division of Centaur Media plc.





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