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Watt's the plan?

Pioneering profits with digital business models in the energy sector

PwC

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Dr. Oliver Kalsbach and Jonas Bruns also contributed to this report.

INTRODUCTION

Utilities now face the digital reckoning that industries such as media and retail went through years ago. The experience of other sectors shows that there are only two options: transform your business to generate new value for customers by adding profitable digital business models – or lose your market. In other words, change or die. The good news for utilities is that, amid the clean energy transition, adding services that are an extension of their established business of generating, transmitting, or selling energy offer great opportunities. Companies that position themselves at the forefront of the transformation will have the advantage.

This study elaborates on the opportunity and challenge for digital business models (DBMs), where the greatest potential for synergies with the core business lies, and how to establish the necessary capabilities. We surveyed more than 300 industry experts across the utilities' value chain, predominantly in Europe, about their expectations for digital transformation, their progress in adding new products and services, and the factors holding back change.

The results show that since our last study of the digital business maturity in 2019[1], utilities have increased the share of their digital business as predicted from 17% in 2019 to 24% in 2023, yet still lag behind their own ambitions. As a result, they risk falling behind investors' expectations and the competitive challenges facing the industry. Our survey, accompanied by interviews with leaders in the sector, also makes clear what the factors holding back progress are, and how forward-looking companies are tackling them.

> Other industries already leverage digital business models to understand their customers better and offer improved services. Energy companies must urgently digitalize their business models to meet customers' higher expectations beyond just selling kWhs and stay competitive in the longrun."
>
> **Prof. Dr. Norbert Schwieters,**
> **World Energy Council board member**

1 Eul, M., Trepte, F., Jean, P., Deboudt, D., & Höhler, J. (2019). 2019 Digital Operations study for energy: Power and utilities. Strategy& | PwC. https://www.strategyand.pwc.com/gx/en/insights/2019/2019-digital-operations-study-for-energy/2019-digital-operations-energy-insights.pdf

The key takeaways are:

- Utilities are focusing on **integrating digitally-enhanced offerings** into their core business instead of establishing fully digital new services.
- Digitally-enhanced products and services are expected to double to make up **almost half of total revenue** in ten years' time.
- Survey respondents see **Electric Vehicle (EV) charging** and **"smart" digital business models** that facilitate demand-side and in-grid flexibility (such as smart metering, smart grid, and smart home) as most relevant to their businesses.
- The **capabilities** companies require to succeed are highly skilled staff with the right tech expertise; enabling technologies including energy analytics, cloud computing and AI; and adequate funding provision to allow digital leaders to pursue their vision.
- Cost-efficient transformation also requires **partnerships**: the majority of respondents say collaboration with external partners is the most promising way to kick-start digital business models.

What is a digital business model and how does it create value?

Digital business models give value to private and commercial consumers and expand potential profit pools for companies through new technologies including artificial intelligence (AI), the Internet of Things (IoT), cloud computing and energy analytics.

The perceived value generated by the DBM determines a customer's willingness to pay for a product or service, for reasons including quality, convenience, innovation, and experience. For companies, the benefits come down to the profit potential, looking not just at revenue streams, but also cost savings and optimization from offering a specific product or service.

Digital technologies are the enabler of the value and profit pools, making them a necessary requirement – but they are not sufficient on their own. It is through synergies with traditional business models that utilities will create the greatest advantage. A good example are smart meters: the devices measure energy consumption and enable live data tracking and direct communication between the consumer's home and the utility. The two-way communication enables flexibility and lets companies make use of dynamic pricing by showing consumers when prices are lowest, so they can adapt their electricity use to take advantage of lower prices. This keeps bills down for consumers and reduces the need for utilities to invest in expensive energy storage solutions to capture the energy generated by renewable sources. This is because demand can be better matched to the times when wind and solar power are being generated.

EV Charging
Providers offer comprehensive electric vehicle charging solutions and services and generate revenue through pay-per-use or subscription models. Digital technologies are used to provide customers with real-time charging information, reservation systems, and demand-response charging.

> Connecting EVs to the grid has the potential to disrupt the entire energy system. Firstly, the European car fleet electrification creates a vast shift from gasoline to electricity demand yielding revenue opportunities for utilities. Secondly, utilizing the EVs' battery capacity for grid stabilization, i.e. off-peak charging incentives, decreases the need for grid expansion and adds thus a unique value to the energy system."
>
> **Andreas Hoffknecht,**
> **COO DB Energie (subsidiary of Deutsche Bahn AG)**

The value the service offers to electric vehicle users is convenience, through accessibility and fast charging. For utilities, it is also an opportunity to enhance grid stability by encouraging off-peak charging and reducing load during peak hours. In Copenhagen, for example, the power company Enel has established a “vehicle to grid” hub in a partnership with Nissan and Nuvee, an EV charging company, in which the power stored in EV batteries can be fed back into the grid when the vehicles are not in use and demand for power is high.

The profit pool lies in the installation and operation of the EV charging infrastructure: Utilities can install and operate charging stations in public spaces, commercial properties, or private homes. EV owners are billed for charging, creating a recurring revenue stream. For instance, the US utility PG&E has programs to help businesses install charging stations, and they earn revenue through the charging tariffs. Starting partnerships with EV charging networks like ChargePoint or Blink Charging denote one possibility to earn revenue from charging fees.

Smart X

Smart digital business models, whether it is smart meters, smart home or smart grid all make demand more flexible by enabling to shift electricity consumption into periods and/or locations where volatile renewable energy production is high.

With **smart metering**, utilities accurately collect real-time energy data from homes and businesses, using applications for centralized reading and usage tracking. This creation of transparency is crucial to enable shifts in consumption in the first place.

> “Smart meters are essential to enable a transparent, bi-directional communication between consumers and utilities. This helps utilities understand their customers better and, more importantly, enables immediate customer responses, which has been historically one of the most serious market frictions in the energy system.”
>
> **Constantin Eis,**
> **CEO at LichtBlick SE (major German energy supplier)**

Smart homes, which include smart buildings and elements of the smart city, use IoT to integrate energy management solutions. Digital twin technology is used to simulate and optimise energy usage scenarios in buildings, while AI and machine learning (ML) are used for automation and to prompt adaptations in user behaviour in systems such as lighting, heating and cooling.

Ison Energy: A smart home case study

Ison Energy' smart home energy management system monitors households' energy consumption and production in real-time, improves inefficiencies by task automation and enables household to benefit financially by selling their energy back to the grid and participating in demand response programs. On top, Ison Energy's technology can be integrated into other businesses' products and services, offering customers more sophisticated energy management solutions.

Ison Energy's commitment to open source, community, and education is helping to create a more sustainable and efficient energy future. As utilities continue to embrace digital transformation, companies like Ison Energy are leading the way in creating new value for customers and generating new revenue streams.

The **smart grid**, meanwhile, leverages IoT, AI, and big data for efficient grid management. Smart grid provides real-time monitoring, outage detection, and predictive maintenance to grid operators. The value is to facilitate the integration of renewable energy and distributed energy resources into overall power supply at minimal grid expansion investment costs.

The **profit pool** for smart meters and smart home devices is generated firstly by hardware sales or leasing. Utilities can sell or lease smart meters to their customers, billing them for the device or a recurring lease fee, while in smart homes, utilities can sell smart thermostats, smart lights, and other IoT devices, billing the end users. Profits from smart grid come from lower maintenance costs and grid stabilisation fees. Another profit stream is to monetize the benefits of providing flexibility to the energy system. The dutch platform GOPACS, for instance, offers actual payments for demand/ production shifts that reduce congestions in the electricity grid. Thirdly, data can also be monetized, yet monetization models are far from being deployed in a large-scale way, as data access and quality remain a major issue in many large utilities.

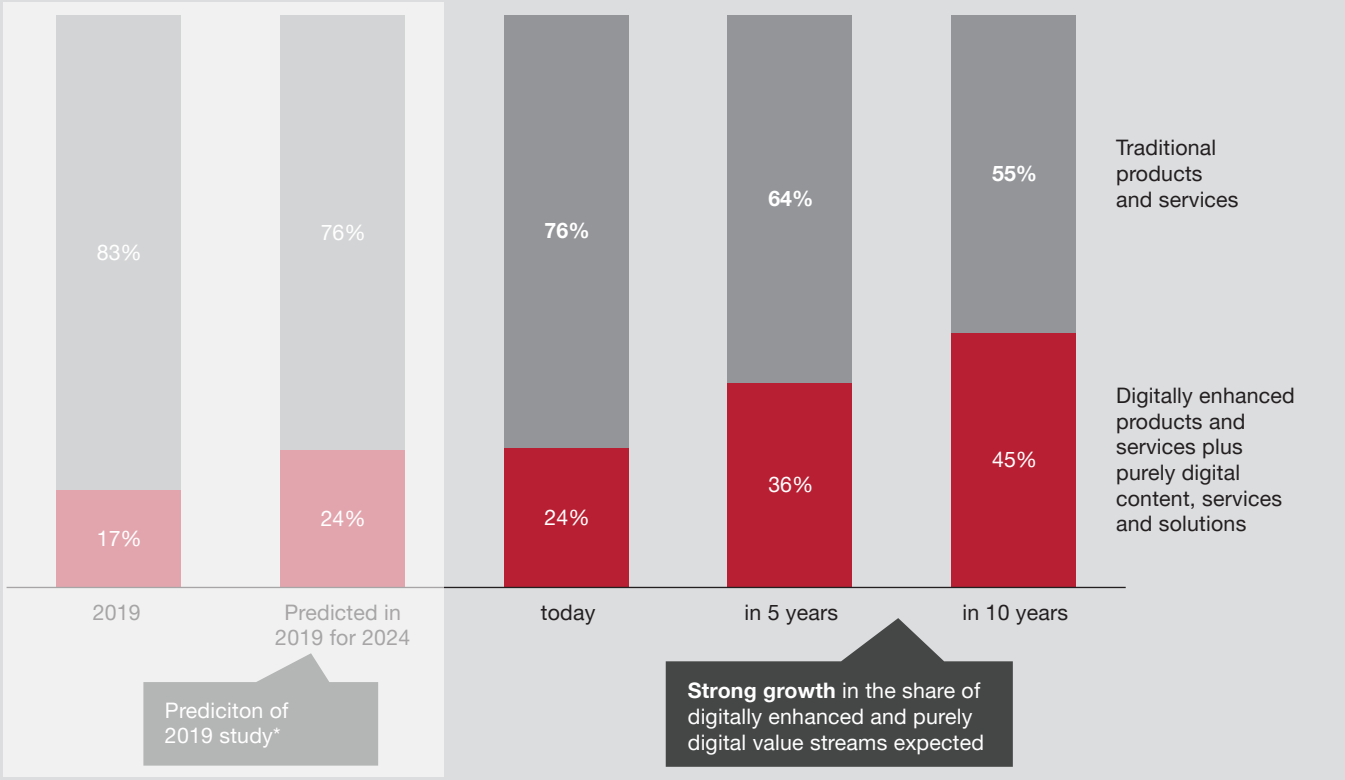
> "The very first step in data monetization is data access and quality, which remains a major hurdle for large energy companies, making the process of monetization burdensome right from the start."
>
> **Flore de Durfort,**
> **CEO at Point Twelve (German SaaS platform to certify green production processes) and former head of data incubation & monetization at E.ON (major German energy supplier)**

Digital business models can unleash new value by complementing the core business

In our 2019 study of digital business maturity among utilities, respondents forecasted that digital business models would account for 24 percent of revenue by 2024 – an accurate prediction as DBMs have reached that proportion this year. Looking ahead five and ten years from now, DBMs are expected to account for 36 percent of revenue by 2028 and for 45 percent by 2033 (*see Exhibit 1*).

To double the share of revenue from digital products and services as expected over the next decade, power companies must transform urgently. That doesn't mean abandoning traditional products and services but rather digitalizing them to establish high-margin and scalable DBMs.

EXHIBIT 1
Expected share of business from DBMs in the future



*2019 Digital Operations study for energy – Power and utilities, PwC Strategy&
Source: Strategy& analysis

The urgency of digital transformation: Utilities as the next Blockbuster?

In 2000, Netflix was a two-year old company mailing DVDs to people who ordered them online. The fledgling business was losing $57 million a year and approached Blockbuster, then a video rental giant with 9,000 stores around the world, about a potential sale. The proposed deal included Netflix's founders setting up an online movie rental business for Blockbuster. Blockbuster's CEO John Antioco turned the deal down. Ten years later, Blockbuster had declared bankruptcy because it never successfully kick-started a digital business, while Netflix has gone on to become a media and entertainment giant.

The survey looked at the relevance – defined as the potential for revenue generation in future – of a range of DBMs, and identified EV charging and smart DBMs such as smart metering and smart grid, as most relevant, because of the synergy potential with the core business. Some 56 percent of respondents rated such synergies as the primary driver of relevance.

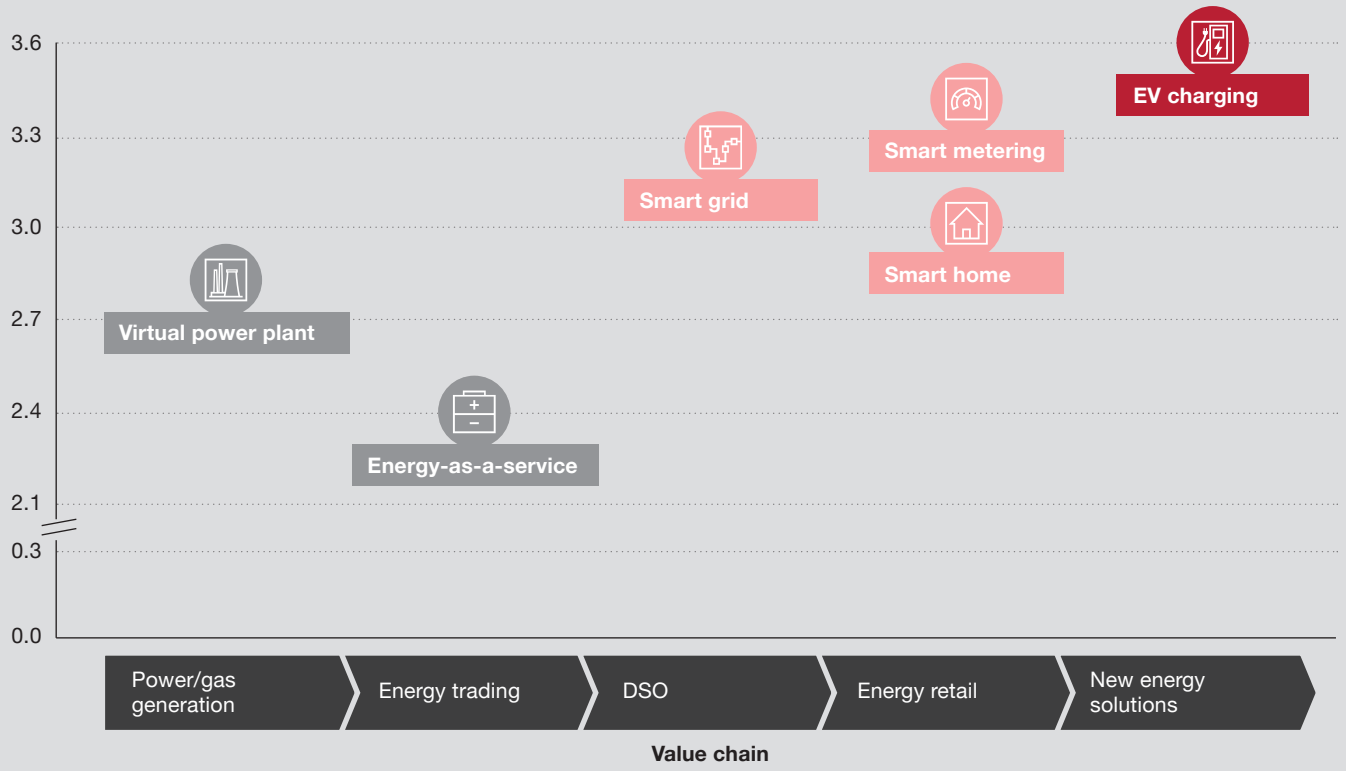
> "The energy company's core business is selling energy products and services. Digital business models may improve the firms' cost efficiency or facilitate more energy sales, and thus provide synergies to the core business. It is, however, important to understand that no digital aspect will replace the core business of selling energy entirely."
>
> **Prof. Dr. Norbert Schwieters,**
> **World Energy Council board member**

The synergy potential of smart meters

An example of synergy potential between DBMs and the core business are smart meters that enable dynamic pricing. General Electric, for instance, offers a demand-side resource and response management solution with which energy companies can incentivize consumers to adapt their behaviour. The goal for the utilities is to achieve more efficient operations resulting in lower prices and cost savings for customers. Smarter demand management also means deferred capital expenditure in generation, transmission and distribution, and helps utilities to increase reliability, with fewer outages and lower ancillary service costs related to renewable energy integration.

Interestingly, the DBMs EV charging and smart DBMs are both located toward the consumer-facing end of the value chain (*see Exhibit 2*), i.e., the DBMs must inherit a clear value add for consumers. The value add from EV charging is obvious – EV charging is key for e-mobility. The consumers' value add from smart DBM s are financial benefits: smart meters and smart home can deliver their full value add if and only if instant pricing provides financial incentives to which households adapt making them thus better off. Lastly, smart grid decreases the energy system's costs (lower redispatch and grid expansion costs) from which grid operators benefit financially and hence households in the longrun too.

EXHIBIT 2
Relevance of DBM along the value chain

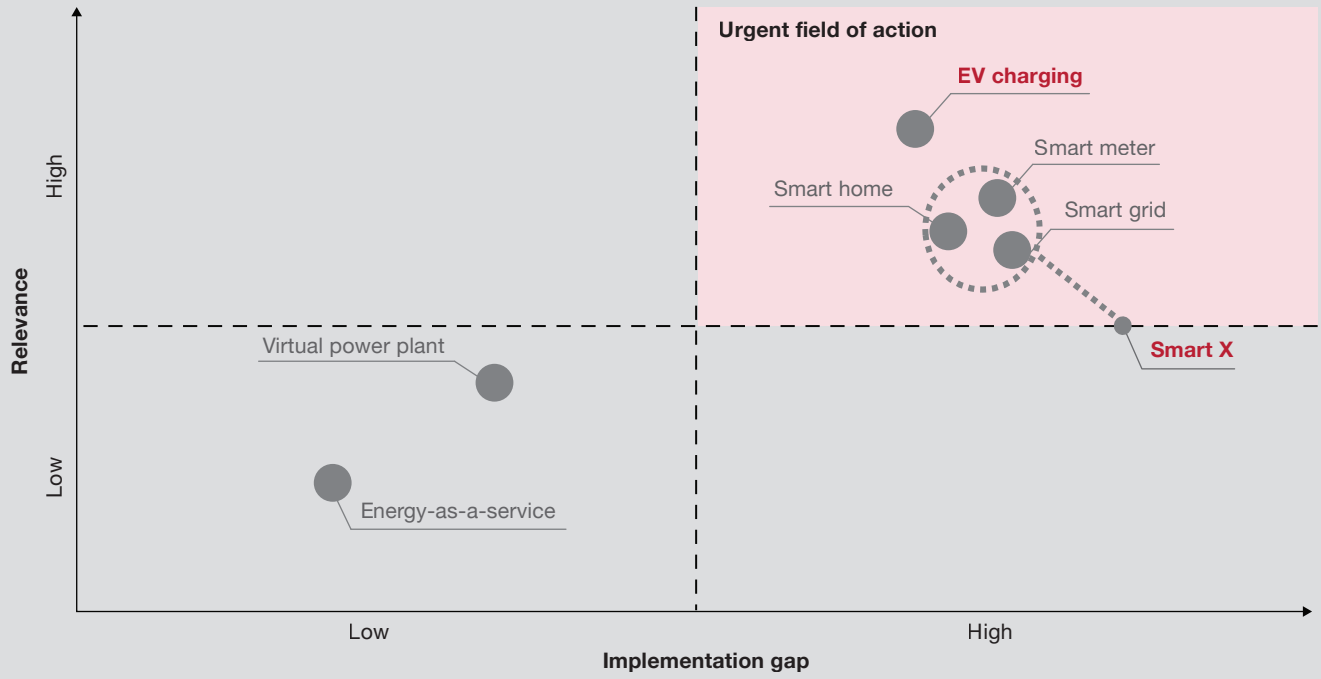


Note: While most DBMs touch on multiple value chain steps, in this case the classification by value chain step was done heuristically
Source: Strategy& analysis

Exploring the implementation gap in digital business models

As *Exhibit 3* below shows, there is currently a gap between the DBM's expected relevance and the current degree of implementation. The size of the gap between the two measures indicates how much companies still must do to build a business model with a profitable income stream in the future.

EXHIBIT 3
The implementation gap



Source: Strategy& analysis

Undoubtedly, DBMs offer an attractive new investment option for utilities, in particular those DBMs with a large implementation gap, which includes the smart DBMs described above (smart home, smart metering and smart grid) as well as EV charging.

Using the data and flexibility that smart DBMs create to offer adaptable pricing can set up valuable business opportunities. One example is that renewable electricity production happens at irregular intervals when the sun shines, with no solar energy produced during the night. However, many EV drivers choose to charge their cars overnight, implying utilities need to buy expensive energy storage to hold and then supply the power generated by solar at night, or invest in further production capacity. Consumers at present have no incentive to change their charging routine, but by offering adaptable electricity prices that are lower during times when renewable production is high (and electricity prices low), consumers can be incentivized financially to charge their car at those times of the day instead. This type of flexibility makes consumers financially better off and helps energy companies win new consumers and save on their energy storage investment cost.

> “Integrating renewable energy is inevitable in transitioning our energy system. This requires a more flexible energy system, i.e., remote control of energy production, transmission, distribution, storage and consumption. A widespread application of such a digital business model is, however, yet to be established in Germany.”
>
> **Constantin Eis,**
> **CEO at LichtBlick SE (major German energy supplier)**

So why do these implementation gaps exist? Our survey shows the reasons fall into two broad categories:

1. Economic uncertainty makes financial payoffs unclear

The world economy has been hit by several large and unforeseeable shocks in recent years. This has hampered investment as establishing a novel DBM becomes much riskier in an uncertain and volatile environment of economic downturns (technical recession in Germany), rising geopolitical tensions (the war in Ukraine), disruptions in the regulatory landscape (the gap between climate change pledges from different states versus actual regulations to tackle emissions), and technological disruption (battery EVs versus hydrogen fuel cell engines as long-term solution, for example). These risk factors make financial payoffs for digital business model investments more uncertain (51 percent of survey respondents agreed), and companies' timelines for digital transformation unclear (45 percent agreed).

> "A changing economic and political environment has certainly contributed to the observed underinvestment in digital business models. To make the digital transformation a real success story, DBMs must be built to be resilient to such external shocks."
>
> **Dr. Marcus Eul,**
> **Managing director and partner at Strategy&**

However, uncertainty is not going away, making business model resilience through adapting fast to significant shifts in the economy, essential. First, a portfolio of innovative services and products will be hit less strongly by economic shocks, and second, building an entrepreneurial and agile culture enable companies to adapt faster to the needs of a dynamic environment.

2. Poor access to capital also contributes to the funding gap

A difficult funding situation is the second factor driving the implementation gap. Some 55 percent of respondents attributed poor access to capital and 46 percent of respondents attributed a lack of internal understanding of DBMs as two major hurdles.

We believe the time has come for companies to raise significant external funding to set up their DBMs if they are serious about these products and services accounting for close to half of revenues in ten years' time. The reality is that the funding requirements are enormous. On average, survey respondents estimated that the annual funding required to fully scale DBMs add up to 12 percent of annual sales. That compares with net margins in the energy industry that are on average well below 10 percent (without considering the recent price shock effects caused by the war in Ukraine) meaning that investments the size of companies' entire annual profits are required for the successful implementation of digital business models. Several levers exist to improve this funding situation.

Funding gap?

55%

attributed poor access to capital

46%

attributed a lack of internal understanding of DBMs

Firstly, utilities can build a portfolio of minority investments to familiarize themselves with the opportunities and challenges related to the new DBM or technology they are considering building. They can then use what they learn to help leadership teams select better projects and focus on the right strategic areas.

How the minority investment approach works at Shell

Shell Ventures, a subsidiary of Royal Dutch Shell, makes minority investments into new technologies and disruptive digital business models that accelerate the energy and mobility transition. This portfolio approach allows Shell to test various DBMs and technologies and identify the most promising. For instance, the company increased its investment into Sonnen to 100% in 2019, expanding its offering of residential smart energy storage and energy services.

Secondly, utilities can look to secure more funding from investors or government grants and subsidies. To win new investors it is key to make the investment opportunity more appealing, i.e., business cases will need to show a clearer route to profitability. Also, government grants are yet readily available, for instance, the EU has identified the lack of investment in digital business models and set up several funding programs in response, including the Digital Europe Programme, the Connecting Europe Facility, InvestEU, Horizon Europe and Creative Europe.

Making government funding work for DBMs

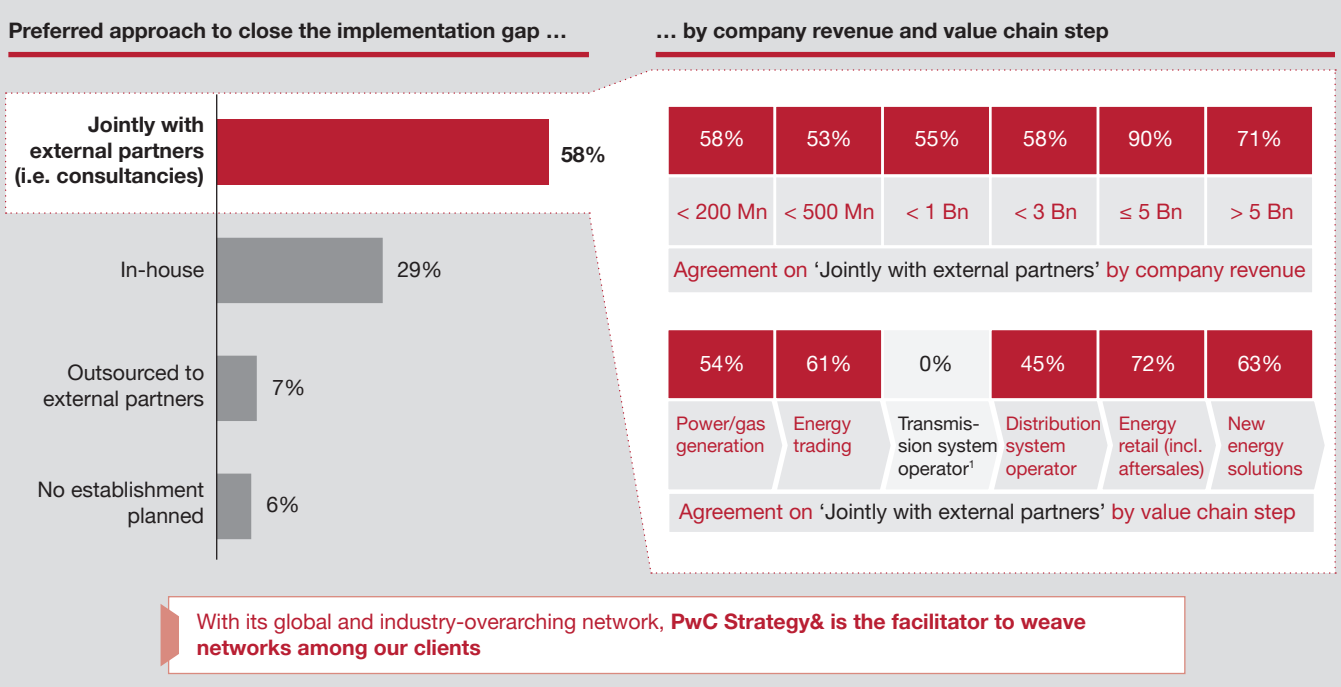
A prominent example of a company receiving low interest government loans is Tesla. Back in 2010, Tesla received a $465 million loan from the U.S. Department of Energy (DOE) as part of the Advanced Technology Vehicles Manufacturing (ATVM) Loan Program. This funding played a significant role in the expansion of Tesla's electric vehicle lineup and the development of its digital and autonomous driving technologies.

Matching relevance with reality: How to bridge the implementation gap

When it comes to closing the implementation gap, the good news is that companies of all sizes and across the entire value chain identify partnerships as the most promising route (*see Exhibit 4*). Some 58 percent of respondents agree that only "jointly with external partners" can the full potential of DBMs be reached.

EXHIBIT 4

Partnerships are seen as the most promising way to close the implementation gap



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1 Only n=1 and thus inadequate number of interview partners from a TSO company interviewed
Source: Strategy& analysis

E.ON is just one of many good examples how to enable DBMs jointly with external partners. The utilities started a partnership in Germany with Google's parent company Alphabet and the technology company Tetraeder in 2018[2], offering its customers a digital assessment of the potential when adding solar panels to their homes. The service considers various data points including weather data, the position of the sun in different seasons, the area and pitch of the roof as well as the shade of surrounding buildings or trees to calculate how much sunlight falls on the roof. E.ON then translates that number into energy and potential cost savings from their solar panels offering. This example shows how partnerships with technology leaders can contribute to digitalizing existing business models.

2 E.ON and Google are launching partnership to expand solar energy, www.eon.com/en/about-us/media/press-release/2017/2017-05-03-e-on-and-google-are-launching-partnership-to-expand-s.html.

> Enormous potential lies in leveraging the know-how of technology leaders and integrating it in an DBM. I believe that existing large players will not develop innovative and digital solutions on their own. They will rather orchestrate the different service providers and to align their unique technologies in new solution."

Kevin Bär,
VP global sales at E.ON One of E.ON Group (German energy supplier)

However, our survey suggests that closing the implementation gap to establish a successful DBM also requires companies to invest in the necessary internal capabilities and technology.

Access to IT experts identified as first priority in capabilities
According to our survey respondents, the most important capability to build is internal IT expertise, by hiring the right skilled workers with state-of-the-art tech backgrounds. Other capabilities including customer understanding, regulatory knowledge or clear strategic focus and steering were viewed as less essential.

Although the utilities sector has faced skills shortages in the past, this time is different because companies are competing with other industries for the same specialized talent. Unless power companies become more attractive as employers, winning the war for talent and implementing successful DBMs will remain a challenge.

> If relevant forecasts are correct, it can be assumed that the demand in practice for qualified business information technology talent will continue to grow as a result of the digitalization of business and administration."

Univ.-Prof. Dr. Armin Heinzl,
Universität Mannheim

We suggest the following approaches to overcome the shortage of skilled workers with IT knowledge:

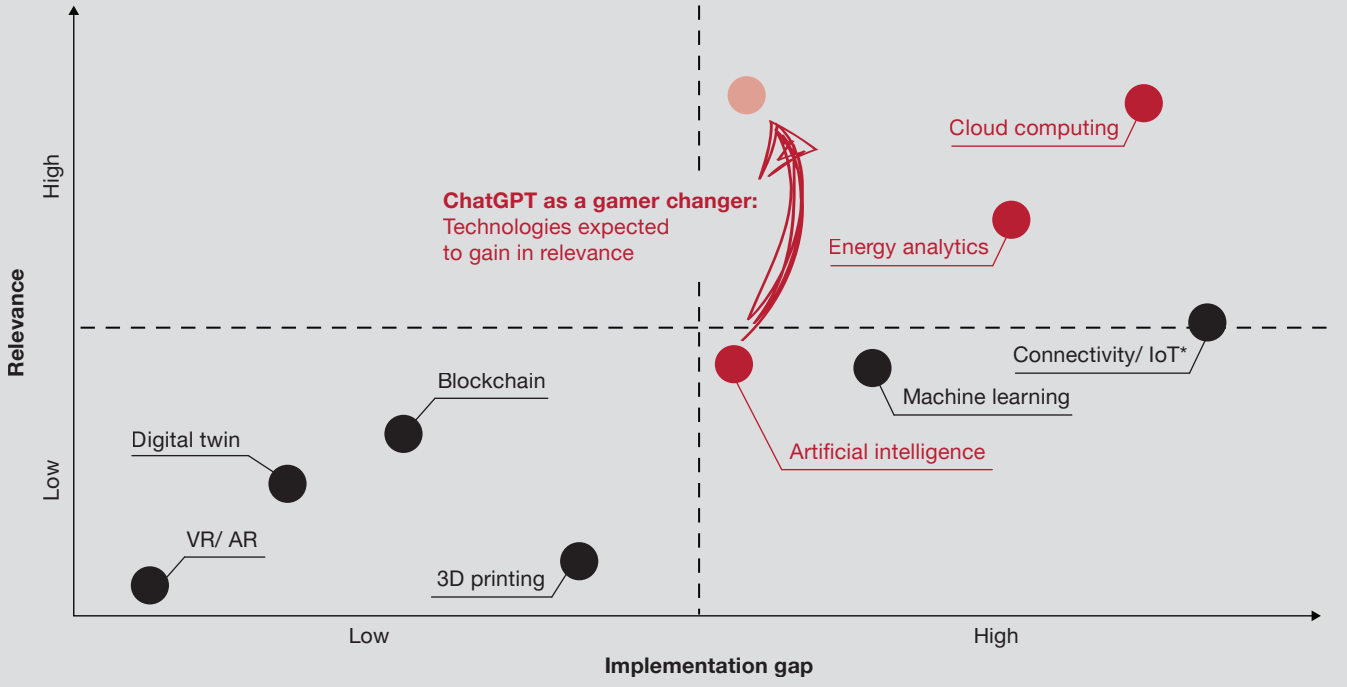
- Appoint a chief digital officer to lead digital transformation efforts.
- Target recruitment of IT experts specialized in digitalization and automation, exploring near- or offshore options to attract top talent from international markets given shortages in western countries including Germany.
- Implement internal schooling and education programs for IT, data analysis and AI skills.
- Establish collaborative partnerships with universities and research labs to recruit talented individuals through internships and research projects.

The key technologies to enable digital business models

The right technologies are the key enablers for DBMs, offering the framework that facilitates the development of innovative ideas, finding new opportunities and exploring new ways of doing business.

EXHIBIT 5

Relevance and degree of implementation per key technology



*IoT: Internet of Things; VR: Virtual reality; AR: Augmented Reality
Source: Strategy& analysis

Our survey shows that utilities lack a thorough understanding of some of the most important technologies, with respondents indicating limited application within their organizations (*see Exhibit 5, previous page*). Specifically, energy analytics (utilizing advanced analytical models to derive new insights from energy data) and cloud computing (providing faster innovation, flexible resources, and economies of scale through internet-based computing services) are deemed highly relevant and crucial for the success of DBMs. However, companies struggle to effectively apply these two technologies in practice as shown by their low degree of implementation. This highlights the urgent need for improvement. The relevance and limited application to date were mentioned by subject matter experts in the interviews we carried out alongside the survey:

> Energy analytics and cloud computing are already among the most important and disruptive technologies in the energy sector. In addition, the recent success of ChatGPT has highlighted the potential of AI, i.e., AI is likely to become the most important technology in the future. However, companies need to learn how to use these technologies in their daily work before they can develop into successful DBMs."
>
> **Jan-Wilm Buschkamp,**
> **Chief information officer at Mainova AG (German energy supplier)**

Energy analytics at work in the real world of smart grids

Dutch grid operators run together the platform GOPACS, which aims to ensure grid stability in the most cost-effective manner. An increasing share of renewable energy generation and greater electricity demand requires the grid to be expanded, but that cannot happen overnight. To buy time, GOPACS applies technology to forecast potential grid congestion and makes use of flexibility provided by energy market participants to prevent the congestion from happening. The energy analytics technology used by GOPACS allows low rebalancing costs and reduces the pressure for grid expansion to happen immediately.

We further want to note that our survey was conducted before ChatGPT started its triumphant march highlighting the potence of generative AI. Potentially, our respondents are thus likely to assess the relevance of AI as much higher today than observed. We see, among other, two main fields of application for generative AI in the energy sector.

1.
Forecasting analytics

Generative AI is a form of artificial intelligence that focuses on creating new content by learning from existing data patterns. It is especially useful for the energy industry, which relies on complex data analysis, pattern recognition, and forecasting. With increasing renewable energy usage and unpredictable weather, traditional forecasting methods are no longer practical. Generative AI becomes thus a valuable solution to tackle these challenges effectively. For example, Gridmatic, a California based company, has been founded on exact this basis in 2017. It is an AI-enabled power marketer that aims to increase profitability of renewable energy generators, optimize revenues from storage and lower costs of energy consumers.

2.
Personalized customer experience

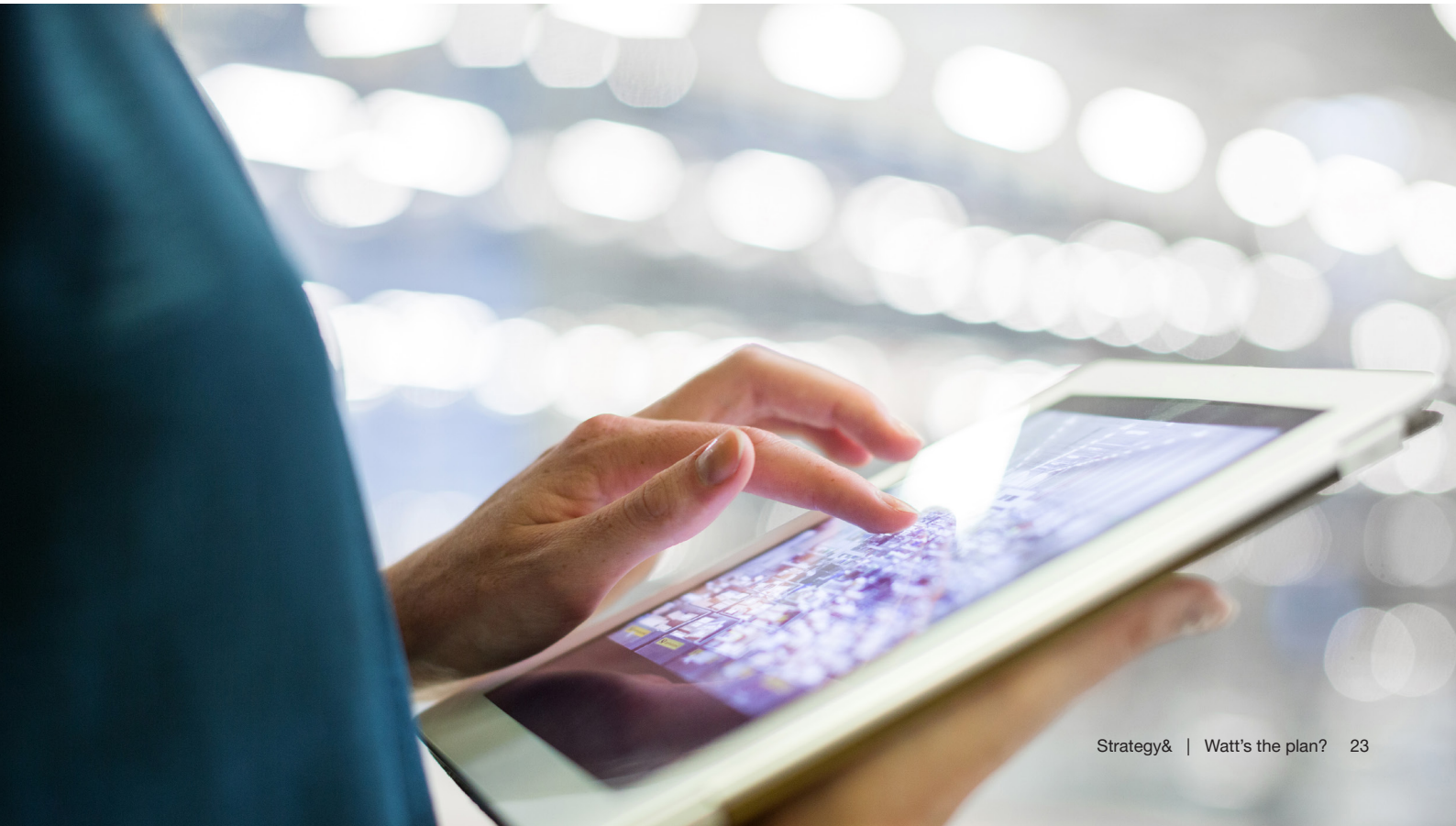
Energy companies are currently lagging behind in utilizing data to enhance customer service. However, with the potential of generative AI, they can revolutionize the customer experience by tailoring content to individual needs. A few examples illustrate this: Firstly, by generating customized energy usage reports, energy companies can aid customers in reducing their consumption. Secondly, by implementing chatbots, they can efficiently address customer billing questions. Lastly, through analysing past purchases and browsing history, generative AI can offer personalized recommendations for products, services, and content. For instance, if a customer has recently purchased a smart thermostat, they might receive valuable recommendations for a solar panel installation or a home energy audit.

On a final note, it is however important to state that leading industry players have already recognized the necessity for this technological transition and, as a matter of fact, have initiated their transitional journey. Anna Jasper-Martens from E.ON emphasizes this as follows:

> “Already now, we at E.ON embrace data analytics and sophisticated deep learning models to augment our core processes and establish new services at scale. The heat transition denotes only one prominent use case that will only be successful if energy companies and municipalities harness the power of digital technologies within the infrastructure planning process.”
>
> **Anna Jasper-Martens,**
> **CEO E.ON Infrastructure Solutions Germany**

Conclusion

In 10 years, digitally enhanced products and purely digital content are expected to make up 45 percent of utilities revenue, close to double the 24 percent proportion today. DBM will provide a complementary value add to the existing core business instead of fully replacing it. The most promising DBMs include EV charging and smart DBMs such as smart homes, metering and grid, where the latter provides flexibility options to the energy system. In addition, smart DBMs are also among the least mature, holding considerable commercial potential for utilities in the future. Our survey respondents agree on the following actions as the most promising way to kick-start DBMs: First, improve your access to external funding by identifying more lucrative investment opportunities through a better understanding of digital business models. Second, collaborate with external partners to leverage their technological knowledge. Third, built up internal IT knowhow to be able to tackle the challenges of the digital transformation. Fourth, put in place the necessary digital capabilities, including cloud computing, energy analytics and AI, that will enable their chosen digital business models to reach their full potential.



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