



Energy-as-a-Service

The lights are on. Is anyone home?

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Executive Summary

Imagine a highly synchronised and sustainable energy platform, where millions of smart physical assets interconnect. The result will be a large array of data-driven energy products and services that incorporate new technologies and efficiency improvements. Multiple entities, from corporations to cities, are making moves to prepare for this future.

There are likely to be more changes in the next ten years than there have been in the previous 100 as the grid is made 'smart'. These developments will play out at national, regional and local levels.

- Deployment of distributed generation and microgeneration
- Adoption of connected technologies
- Expansion of energy efficiency
- Installation of utility-scale storage
- Embracing new market participants
- Harnessing big data and visibility
- Development of local energy markets.

Energy-as-a-Service (EaaS) is a delivery model that combines hardware, software and services. Solutions should combine demand management and energy efficiency services, facilitate the adoption of renewables and other decentralised supply sources, and also optimise the balance between demand and supply. The chief benefit for the consumer is in the simplification of an increasingly multifaceted service offering.

The physical, digital and communications infrastructure required means that a range of players can participate in the Energy-as-a-Service market: utilities; industrial companies; tech companies; oil & gas majors; specialist renewable providers; telcos and start-ups.

Four possible scenarios may emerge, depending on who holds the balance of power, and how widely technological advances take root: the Energy-as-a-Service platform provider; the infrastructure provider; the fallen giant; or the stagnant utility company.

Business models will need to transform, in some cases significantly, to keep pace in the 'new normal'. The same trends that have disrupted retail, transport and consumer electronics are coming to the energy markets.

Companies should identify the opportunities they can exploit, the capabilities they will need to do this, and what market segments have the greatest potential to drive their future growth. They can sequence the shift to Energy-as-a-Service offerings in the following stages: first, digitise core capabilities; next, extend the product and service range; and finally, provide total energy solutions.



Why Energy-as-a-Service?

If you could build a perfect city from scratch, what would the energy system look like?
It would be clean, connected and community-based.

Gone will be the traditional model of centralised generation, where energy flows in one direction to passive, rate-paying consumers. Everyone will be able to generate as well as consume. Welcome to the world of Energy-as-a-Service (EaaS).

Imagine a highly synchronised and sustainable energy platform, where millions of smart physical assets interconnect. A digital layer coordinates and distributes both energy and information in real-time, enabling myriad interactive products and services to be traded.

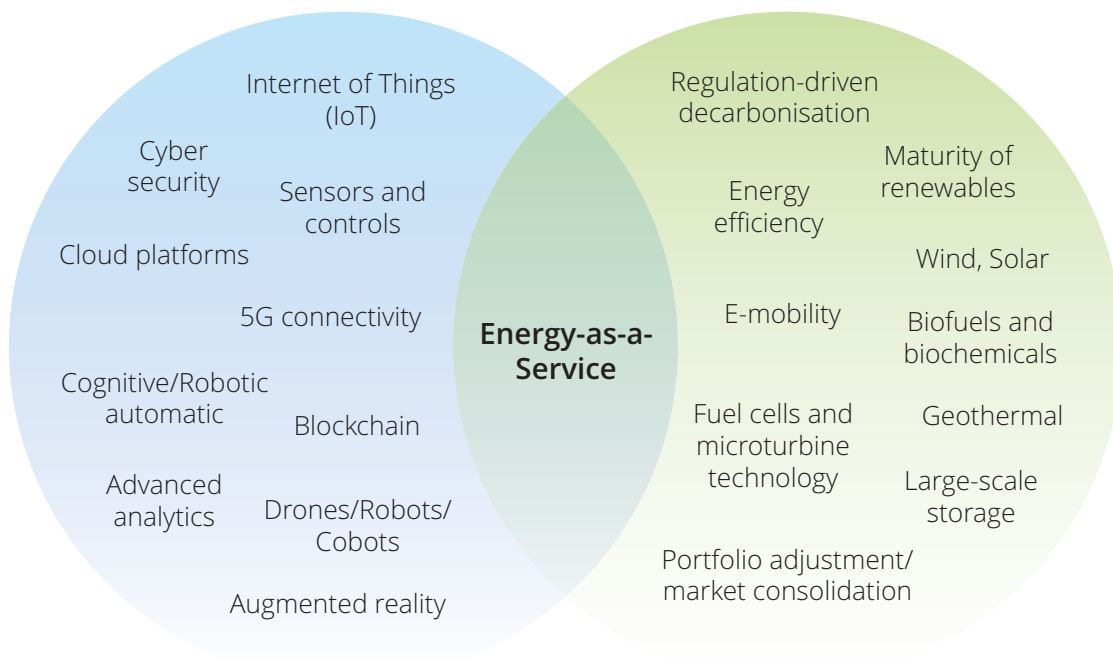
The same convergence that has swept across industries, such as retail, media and manufacturing, is now coming to energy; and the processes that have underpinned generation, distribution and consumption will merge with digital technology and telecommunications. Digital platforms that have transformed how car rides and spare rooms are bought and sold will be adopted for use in energy markets.

The result will be a large array of data-driven energy products and services that incorporate efficiency improvements and new technologies. People will be able to manage their excess supply through peer-to-peer (P2P) markets. Energy will be bundled into customer-centric subscription models and sold as a secondary product embedded in primary products, such as ‘an electric car that has power’ or ‘a home that is warm’.

The evolving energy landscape will become vastly more complex as the cost to produce comes down, the ability to generate moves to micro levels, and products are serviced on digital platforms. End-users will look for an aggregating agent to act as a single source point for all their energy-related needs. This will create opportunities for providers who can deliver a streamlined, cost-effective solution to clients, all for a fixed monthly payment.

A lot has to happen to make this a widespread reality, but multiple entities from corporations to cities are gearing up for such a future. This paper explores what this new world might look like, how it will evolve, and who will be best placed to succeed in it.

Figure A. Tech + Energy = Energy-as-a-Service





Evolution of the electricity grid

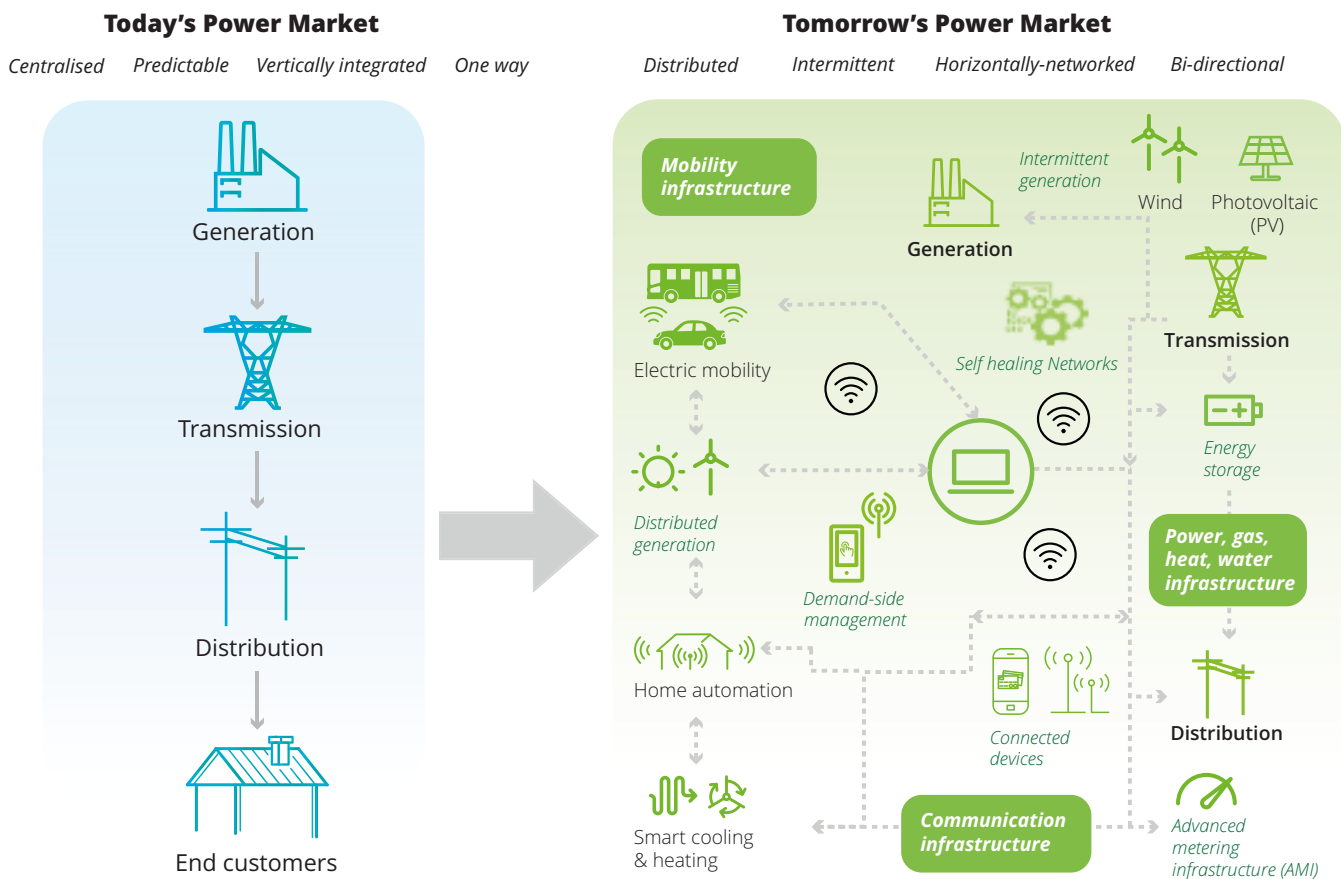
Changes to the way the grid operates will create the conditions for new and very different business models to emerge.

From traditional to technological

Traditionally, power has been generated centrally by highly-regulated vertically-integrated utilities whose main mission has been safe, affordable and reliable power. Sources were mostly fossil fuels, such as coal and gas, but also hydro and nuclear. The flow has been one-way, delivered via the transmission and distribution networks to passive rate-payers.

But there are likely to be more changes in the next ten years than there have been in the previous 100 as the grid is made 'smart'. Traditional power generation, renewable generation, distribution points and users will all integrate into a system that has a high level of automation with a two-way flow of electricity and information, thanks to advanced communication and digital technologies.¹ See Figure B.

Figure B. Changes in the power market



Source: Deloitte

A multi-decade transition

The transformation to an efficient, distributed and flexible energy system that encompasses smart grids, smart buildings and smart transport will be many decades in the making.

We are still in the early days of transition. There already exists a certain level of connectivity, through the deployment of millions of connected devices such as smart meters, demand response thermostats and smart street lights. But the energy system of the future will need to encompass a lot more.



Deploy distributed generation and microgeneration

New investment in distributed energy resources (DER), where energy is generated closer to the point of consumption, surged from US\$46bn in 2004 to US\$279bn in 2017.²

They are predominantly renewable: solar, wind, hydro, biomass, waste-to-energy, fuel cells and geothermal. They can also include small-scale storage and internal combustion generators. They are smaller, modular and more flexible than traditional large-scale centralised generation. When combined with storage, they can serve as micro-grids, either connecting to the low-voltage section of the grid through local distribution networks, or operating independently as self-contained 'island grids'. The improving cost profile, combined with new financing models, means that consumers are opting over time to install these systems in their homes or communities. Their smaller size means less investment, less margin for error, and more scope for 'future-proofing' the technology. Regulatory changes are also helping to create demand, such as the state of California's mandate that all new builds should have solar.³

This burgeoning industry of 'behind-the-meter' onsite generation is one of the fastest growing areas in the energy sector. Investment in behind-the-meter storage is expected to climb from 3.7GW in 2018 to 29GW by 2025.⁴

Yet a power system that includes a greater number of players and relies much more on intermittent renewables will be a lot harder to manage in terms of resilience and reliability.



Adopt connected technologies

Increasing levels of digitisation will help integrate activities and facilitate new ways of buying and selling energy.

More and more devices are embedded with sensors and controls, enabling information to flow continuously between the physical and digital worlds as machines 'talk' to each other. Those tasked with managing or regulating such systems can gain detailed data from these devices to optimise the operation of the entire process.

The smart grid transformation can be seen as one massive IT project.⁵

The advanced communication and distribution technologies that will make grids 'smart' include but are not limited to:

- Private LTE and 5G
- Advanced metering equipment
- Artificial intelligence (AI): analytics and machine learning
- A big data platform with cloud computing
- An asset performance management solution that includes distributed energy resources
- Cybersecurity
- Robotics and visualisation technologies
- Blockchain
- Edge capabilities such as bi-directional connectors for energy and information, remote management, data storage and computing.

See *Deloitte's Digital Innovation: Creating the Utility of the Future* for more details.



Expand energy efficiency

Energy efficiency programmes that use smart technologies provide a significant opportunity for achieving decarbonisation goals. Energy efficiency is one of the main policy pillars in the European Union's fourth energy package, launched in 2017.⁶ Particular emphasis is on improving energy performance in buildings, which accounts for 40 per cent of final energy consumption in Europe and 36 per cent of greenhouse gas emissions. To meet the Paris Agreement targets, energy consumption by buildings will have to fall by 75 per cent.

The digitisation of buildings is not yet far advanced, compared to assets like cars and factories, but it is set to grow extensively. The future market for Internet of Things-connected products for smart buildings and homes is estimated at US\$100bn.⁷



Install utility-scale storage

Developments in the market for stationary storage will be a game-changer for development of the grid. With the increasing use of renewables there is much greater load variability and potential for grid instability. Large-scale storage offsets this, through load levelling, frequency regulation and renewables integration. It is also used for voltage support and price arbitrage. And it is often more cost-effective to support substations than build new ones.

Large-scale storage, which has been provided predominantly by pumped hydro, is set to incorporate many more stationary batteries. The total amount of grid-scale storage globally was about 170GW in 2017. Batteries made up just 4GW, but this is set to grow to around 100GW by 2030, due largely to falling costs. Technological improvements, higher battery density and economies of scale are resulting in much lower prices, and this should make storage comparable in cost to gas-fired peaker plants by 2030.



Embrace new market participants

More decentralised energy resources will mean that more individuals, networked groups and energy communities will be capable of generating and sharing their own energy. With increased transparency, choice and flexibility, consumers will be able to participate actively in energy markets, by generating, storing and selling, as well as consuming electricity.



Harness big data and visibility

The new technologies will create real-time data flows that enable participants, from generators down to consumers, to make sense of what is happening. Big data will enable system operators to balance energy flows. For example, they can use weather information to forecast changes in wind and solar generation, by location. Power generators can analyse resource use to improve asset management. Suppliers can make better predictions of consumer behaviour and preferences. And consumers can opt for more environmentally-friendly energy sources, or investigate a range of sources to get the best prices, buying energy when rates are cheaper, then storing for future use when rates are higher.



Develop local energy markets

The integration of a much wider array of distributed resources, and the growth in technologies that enable real-time views of supply and demand, will enable prosumers to offer generation, demand and storage anywhere, not just back to the grid, via secure trading platforms. More flexibility and speed will be needed to match supply with demand at an appropriate price point. The current half-hourly energy trading system seen in many markets, designed for traditional large-scale generation, will need to transmit information at much shorter intervals, such as every five minutes or every minute.

The rise of many-to-many markets

As energy is increasingly produced and consumed in local, decentralised markets, it will start to resemble other peer-to-peer markets—think eBay, Airbnb or Funding Circle. Technology is helping to bypass top-down supply, and create platforms that can manage and monetise spare capacity in the system, through the leasing and trading of assets and outputs.

Spare capacity currently exists in many locations in the energy infrastructure, from generation created by rooftop PV and on-site generation, through to demand side management. Eventually it will also include electric vehicle (EV) storage, when vehicle-to-grid becomes widespread. The ability to match supply and demand means that grid operators can do more with less, so capacity effectively expands. Less energy travelling shorter distances will also create capacity in high-voltage transmission lines.

It takes a village

These developments will play out at national, regional and local levels. A number of cities, precincts and regions are seeking to produce, supply and manage the local delivery of decentralised energy to a 'whole site' development. Examples include a peer-to-peer platform in the Brooklyn Microgrid in the US,⁸ Horizon Power's DER pilot in the Pilbara region of Australia,⁹ Samsø Island's total renewable self-sufficiency in Denmark,¹⁰ and Simris in Sweden, where a local energy system is pilot-funded by the European Union.¹¹

Community solar or smaller community-based energy networks are part of a growing trend, because renewable micro-grids can be cleaner, more affordable and more reliable than a centralised grid, particularly in more remote areas.

Electricity networks are perhaps the most appropriate platform on which to start building a smart city, connecting to every house, street, public area and, eventually, means of transport. The economy is digitising, and almost everything digital is electric. Electricity infrastructure can also connect smart features in other systems: smart street lights can also house EV chargers, ANPR or video cameras, wifi/5G and sensors. In the US alone, over 60 cities are involved in using their electricity networks to build smart cities.¹² A Deloitte report, *Renewables (em)power smart cities*, has studied how some cities are creating a renewable platform as a springboard for larger smart city implementations. The challenge will be how to get electricity companies to work together with corporations and citizens to create such cities.

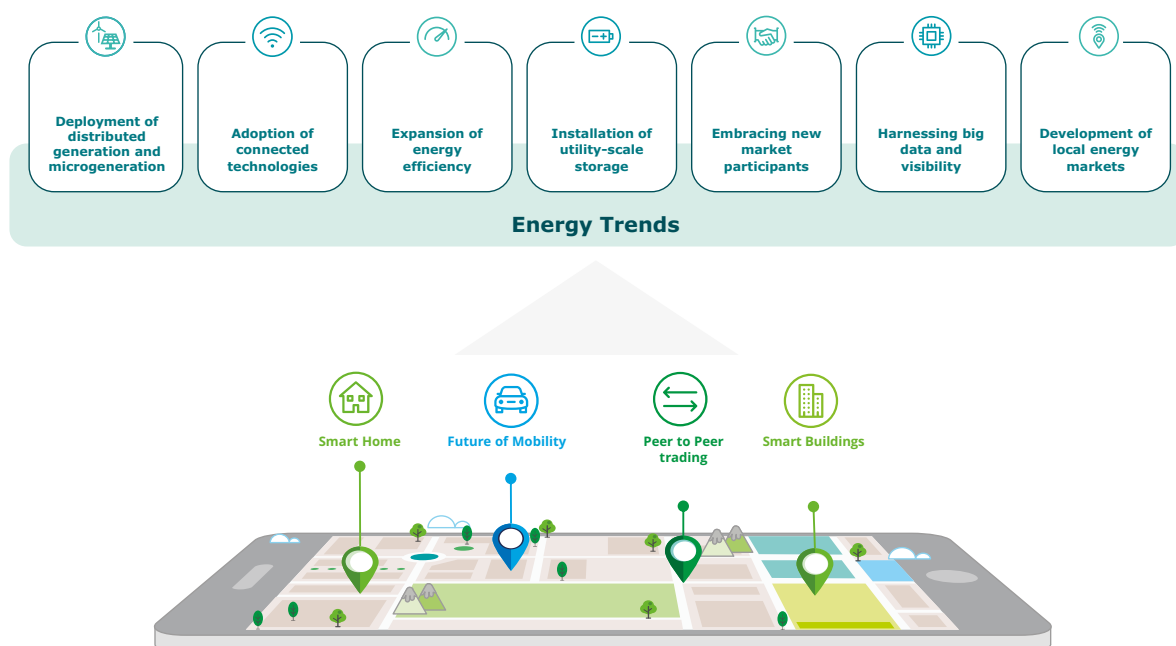
The inherent complexity of a system that needs to integrate growing amounts of distributed energy resources on the transmission and distribution side, and facilitate the many-to-many markets on the retail side, will create an opportunity for an overall orchestrator. At grid level, this could be a neutral facilitator of open and competitive markets where third parties can buy/sell from the system. At a neighbourhood level, it could be an aggregator that clusters a number of smart buildings or campuses into a virtual power plant, links to the distribution system operator (DSO), and provides layers of load balancing and control. And at a retail level it could be a service provider that helps a commercial or industrial client meet its objectives and requirements around energy supply, energy efficiency, backup or resiliency needs, and renewable or carbon reduction goals—all for a fixed monthly payment.

A word on central generation

Historically the grid was built out from the 'bottom-up'. Local electrical and gas companies started off in cities and over time were connected through high voltage transmission lines and high pressure pipelines. This 'centralisation' served three purposes. It removed polluting power stations from city environments; it enabled large-scale energy resources to be utilised, such as hydro plants and gas storage, even if located far from demand centres; and high voltage transmission lines enabled regions or countries to be interconnected, to trade power as and when needed.

The regional decentralised energy systems that are now emerging will require coordination. The incorporation of intermittent energy sources will make the system more fragile; but increasing digitisation in the economy and society means that a reliable electricity supply will be vitally important.

Thus, a need will probably remain for a national or regional system operators in the public domain. System operators (often, a utility) have visibility over the entire network, to balance supply and demand. They would also ensure electricity security, which is considered a public good.





X-as-a-Service comes to energy

Energy-as-a-Service (EaaS) is an innovative business model for providing bundled energy services, propelled by technological and financial developments.

What is X-as-a-Service?

X-as-a-Service is a delivery model for diverse solutions that combine hardware, software and services. Value is generated by bundling into a single offering the various elements that are usually sold separately.¹³ There are several distinctive features.



It is sold on a subscription basis

The customer pays for an all-inclusive package, and not per unit consumed. Corporate customers benefit from predictable subscription payments rather than making 'lumpy' asset purchases, or incurring capital expenditure.



It is output-based

The customer pays for the output of the asset (when it works), not for the asset itself, nor for the parts, repairs and servicing required to maintain it. The customer pays only for what it consumes, and the service (or equipment) provider is motivated to reduce downtime and provide assets that perform well. The best known example of performance-based contracting is the Power by the Hour service that Rolls-Royce pioneered for its engines. This arrangement aligns the incentives of buyer and seller.



Service providers fund the upfront costs

All project costs, including equipment, construction, operations, monitoring and maintenance, are the responsibility of the service provider. Examples of this type of contract are the Philips/WMATA lighting-as-a-service in Washington DC, and US Department of Defense contracts for facilities maintenance, modernisation and energy supply.¹⁴



It is data-driven

Advances in digital technologies enable a level of monitoring and operational performance that was not previously possible. Thanks to sensors and other smart assets, the service provider can collect a wide range of data across multiple parameters, and monitor in real-time and 24 hours a day. Information flows continuously between the physical and digital world. Products can be tracked from source to customer, or while they are in use, enabling fast responses to internal and external changes. Figure C shows some examples.

Figure C. Examples of X-as-a-Service contract types

Software as a Service (SaaS) is a software delivery model in which software is licensed on a subscription basis and is centrally hosted. SaaS has become a common delivery model for many business applications.

Lighting as a Service (LaaS) is a service delivery model in which a lighting service is charged on a subscription basis rather than via a one-time payment. This business model has become more common in commercial and city-wide installations of LED lights, specifically in retrofitting buildings and outdoor facilities, with the aim of reducing installation costs. Lighting vendors have used a LaaS strategy to sell value-added services, such as Internet-connected lighting and energy management.

Mobility-as-a-Service (MaaS) describes a shift away from personally-owned modes of transportation and towards mobility solutions that are consumed as a service. This is enabled by combining services from public and private transportation providers through a unified gateway that creates and manages the trip, which users can pay for with a single account. Users can pay per trip or a monthly fee for a limited distance. The key concept behind MaaS is to offer travellers mobility solutions based on their travel needs.

Source: Deloitte

EaaS makes use of traditional arrangements such as energy performance contracts (EPCs), energy supply contracts (ESCs) and power purchase agreements (PPAs), and employs alternative new models that lower or eliminate upfront costs around funding, owning and operating capital-intensive energy generation and storage systems. Solutions range at one end from grid-level aggregation and management, to home or campus energy management, EV charging packages and peer-to-peer energy trading at the other end.

In the beginning, there was ESCO

Energy has always been sold as a service. Consumers don't buy electrons: they buy heating, cooling, lighting, cooking and freezing services that can be provided by equipment that uses electricity. Electricity consumption in effect is the consumption of energy services.

With the drive towards energy efficiency in recent years, energy service companies (ESCOs) have been providing solutions that cover both supply and demand management. It is a big market globally, growing by 11 per cent in 2017 to US\$28.6bn.¹⁵

The primary purpose has been to reduce energy costs of buildings, through measures such as energy audits; project design and implementation; maintenance and overhaul; retrofits for energy

efficiency; monitoring and evaluation of savings; and energy and equipment supply. The premise of the service is based on energy performance contracting (EPC), where improvements to physical plant and energy use are funded through cost reductions. As a specialist provider, the ESCO implements a project and uses the income from the cost savings or energy produced to recover its investment and any project expenses.

The ESCO takes on the technical risks by guaranteeing specified performance improvements. In effect the ESCO does not receive payment unless the project delivers the expected energy savings or services. Any equipment procured, such as backup generators, rooftop solar, combined heat and power systems, or lighting control systems, is owned by the customer.

Innovative financing methods can help customers pay for the upfront investment, through loans, capital leases or bond issuance. In some cases, projects create special purpose vehicles to avoid holding assets on their balance sheets. EPC arrangements can benefit cash-poor yet creditworthy customers that lack the energy engineering skills, capital and other resources to make their own arrangements.¹⁶ Most deployments are in large buildings, and the biggest customers tend to be government facilities, universities/schools and hospitals, and for street lighting.¹⁷

Figure D. ESCO versus EaaS

	ESCO	EaaS
Capital investment by customer	Sometimes	No
Ownership of equipment by customer	Often yes	Often no
Off-balance sheet financing	No	Yes
Performance risk borne by customer	Sometimes	No
Flexibility to add retrofit during contract period	Difficult	Yes
Scalability	No	Yes
Term of contract	10-20 years	5-20 years

Source: ACEEE 'Energy as a Service', 2019 and Deloitte

The evolution into Energy-as-a-Service

Energy-as-a-Service is different from ESCO offerings in several respects. Currently its target customers are owners of commercial and industrial buildings. The service provider is responsible for all the capital investment in the project, and owns and manages the equipment on behalf of the customer. In EaaS, customers are not committed to a specific piece or type of technology as all upgrades over the course of the contract are funded by the provider. Figure D summarises the main differences.

With the emergence of renewable energy generation and energy efficiency deployments a range of specialist financial products and investors has emerged to cater to this growing market, such as Sustainable Development Capital LLC in the UK, Hannon Armstrong, Sparkfund in the US, and SUSI Partners in Switzerland.




The solution: Supply + demand + balancing

EaaS offers demand management and energy efficiency services, facilitates adoption of renewables and other decentralised supply sources, and also optimises the balance between demand and supply. This requires a higher level of digital technologies and analytics than with ESCO contracts. The ability to link multiple sites in a bundled service package means that EaaS can also work on a much larger scale.

EaaS can include on- and off-site energy supply solutions, including PPAs, and energy storage and management. It will also involve strategic guidance across procurement, financing, operations and maintenance of the customer's entire energy portfolio. On the demand side there will be traditional energy efficiency services, and load-balancing to link the distributed resources and demand response.

As transactive energy markets develop, offerings will include platforms that facilitate P2P trading, wholesale contracts, renewable energy certificate (REC) tracking, and broader distributed payment management. See Figure E.

Figure E. Energy-as-a-Service offerings

 Application	 Service	 Technology	Examples
Energy Supply	Ancillary Services	Platform	Distributed energy resource interconnection portal, transactive energy
	Energy Storage	Batteries Power-to-anything (P2X)	Microgrid, residential and commercial energy storage
Energy Transition Enabler	Distributed Generation	Renewables	Solar, wind, fuel cell, combined heat and power (CHP), etc.
	Energy Load Balancing	Front-end algorithm	Monitoring and load management services
Energy (Demand) Optimisation	Energy Savings	Smart meter	Demand response, building energy management, advanced metering services, energy efficiency
	External Supply Optimisation	Software app	P2P trading, real-time pricing

Source: Deloitte

Benefits for the customer

The chief benefit is in the simplification of an increasingly multifaceted service offering. All aspects of ownership, software, analytics, and operations & maintenance are kept ‘behind the curtain’. It is also tailored to customers’ specific needs.

Energy management is not a core competency for many organisations. Microgrids and sophisticated tools to manage distributed energy resources are costly and complex. Many firms that are keen to benefit from such equipment may not necessarily want to own the assets themselves. With an EaaS contract, customers can avoid the need to stay on top of the technology by selecting vendors that provide design, installation, maintenance and performance management services. The responsibility shifts to the service provider. Figure F illustrates how a contract works.

The EaaS market builds on ESCO services, but includes a wider range of energy supply options, and integrates and manages them across multiple sites through digital technologies. Navigant estimates that commercial and industrial sectors will be the early adopters in this market, estimated to be worth US\$221bn by 2026.¹⁸ See Figure G.

Figure G. Global commercial and industrial EaaS market by value

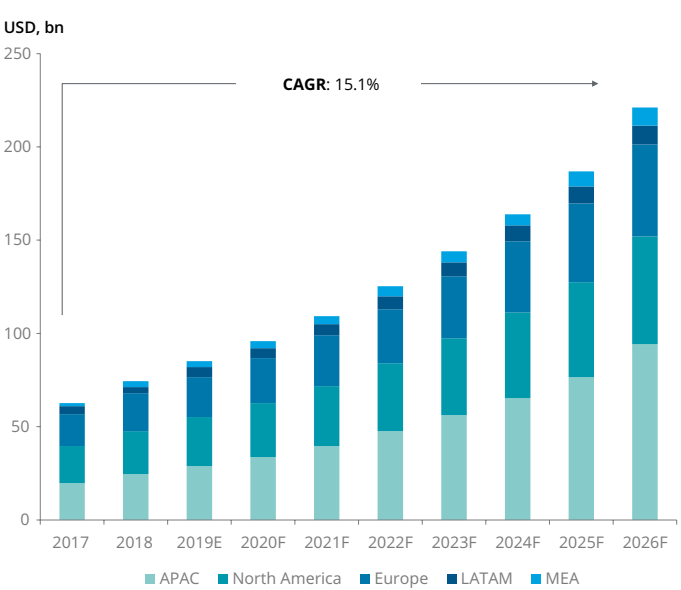
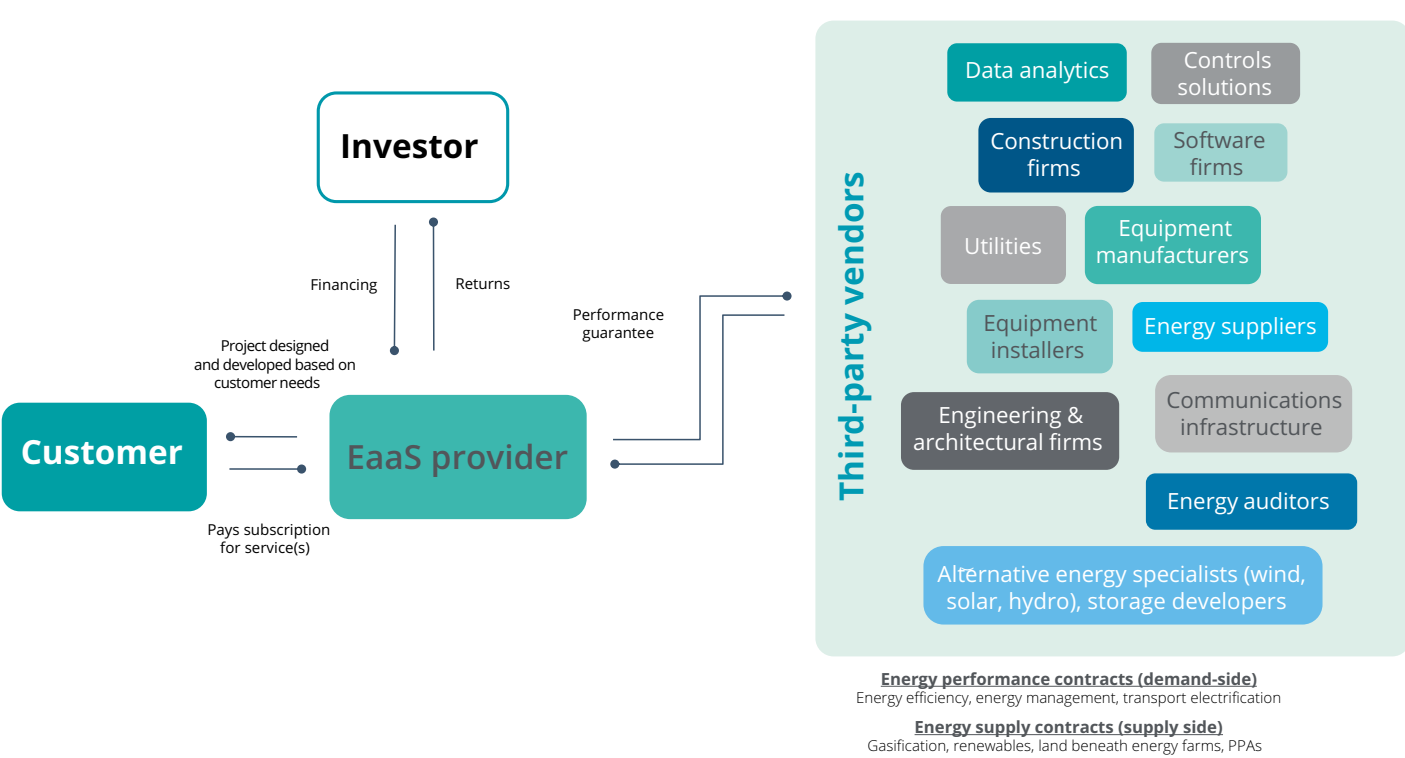


Figure F. How an Energy-as-a-Service contract works



Source: ACEEE, Deloitte



Players and potential outcomes

Companies will need to determine what capabilities they have, what they need, what alliances they should form, and what their role should be.

The physical, digital and communications infrastructure required means that a range of players can participate in the EaaS market. To do so, they must bring together the following capabilities: technology, data, energy systems, wire and non-wire infrastructure, devices, and commercial understanding of output-based or performance contracting.

Major players: A mix of incumbents and new

Large international control equipment companies and electricity companies are already developing EaaS propositions; and telecommunications companies, technology companies and oil and gas majors, among others, are capitalising on their specific strengths to offer services in energy platforms. Before long, larger renewable developers are likely to join in as well.

The market is at such an early stage of development that companies looking to offer EaaS will need to form partnerships and collaborate to provide a full range of capabilities. Over time, competition is likely to intensify in specific segments; and as providers develop expertise in their segment, we will see horizontal and vertical consolidation of players, through mergers and acquisitions. Figure H lists some of the current and expected players in EaaS solutions.



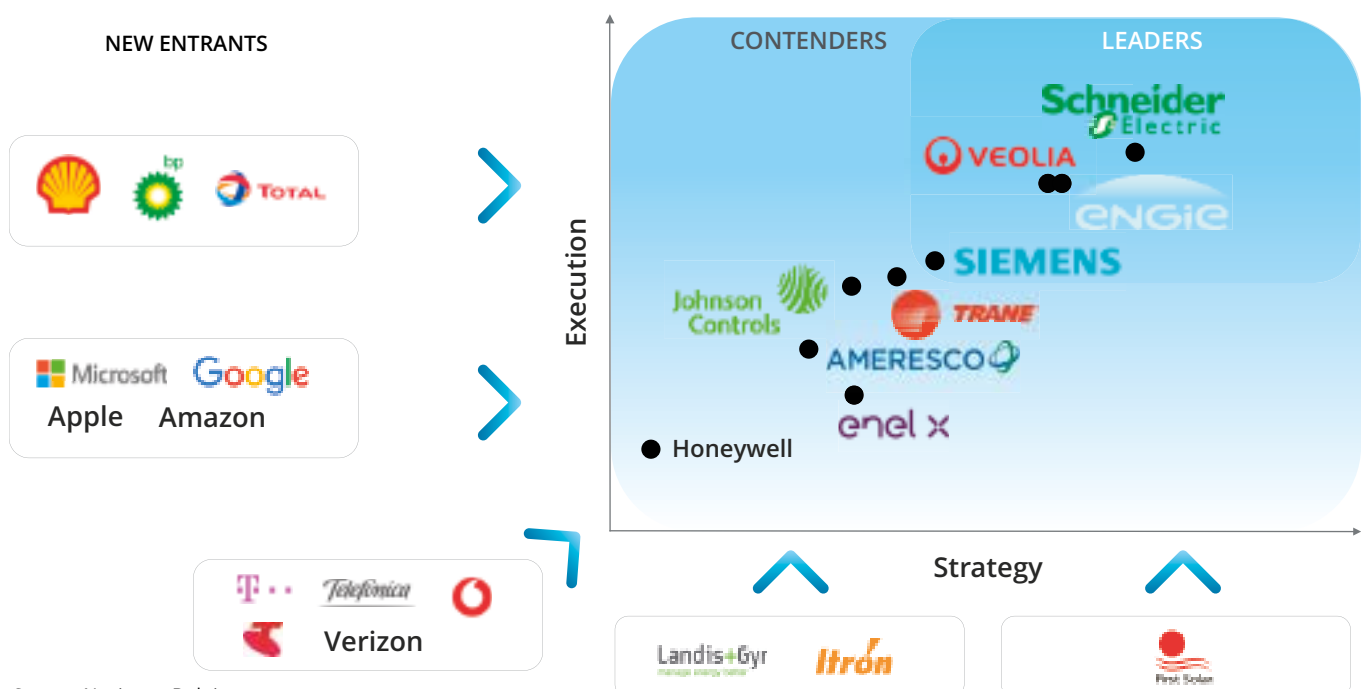
Utilities

Utilities have a natural advantage in this space: long experience of owning and operating the essential physical assets. They now face pressure to adapt their business models and develop strong capabilities in digital technologies, offer cleaner and greener energy options, and work with a range of partners to construct and deliver winning customer propositions. These new models will require agile and innovative approaches.

French utility Engie has been expanding its service offering thanks to a series of acquisitions: commercial storage with Green Charge Networks; PPA facilitator OpTerra Energy Services; electric vehicle charging network EVBox; solar developer SoCore Energy; and energy services company Ecova.¹⁹

Utilities recognise the need to manage change successfully. Failure to adapt adequately to digital and distributed energy resources, or to improve their connection to energy consumers, may erode their advantages over time as new, nimbler competitors enter the market.

Figure H. Players in EaaS solutions



Source: Navigant, Deloitte



Industrial companies

Large industrial manufacturers with strong businesses in power electronics, energy management systems, energy storage systems or advanced metering and control devices are also in EaaS. They include major ESCOs such as Johnson Controls, Honeywell, Trane, Siemens, and Schneider Electric. Their ability to link discrete systems through automation gives them a powerful advantage. Other niche providers are moving into the business. AMI vendors Landis+Gyr and Itron are partnering with a range of companies to offer behind-the-meter energy monitoring and control devices, and are building out their data analytics capabilities to support these efforts.²⁰ Landis+Gyr has also been selling Smart Grid as a Service (SGaaS) to clients, including big utilities.²¹



Tech companies

Many of the big tech companies have begun to offer services in specific segments. Their familiarity with the communications and IT layers, together with their ability to move quickly, higher risk appetite and deep pockets, means that they can become serious contenders, even if they are not yet noticeably active. By purchasing or partnering with other companies, they could put together a range of propositions.

Google has already made a number of moves into smart devices and energy. Its Nest brand sells smart home products, such as thermostats, smoke detectors, and security systems.²² It recently partnered with Leap to sell energy back to the grid.²³ Google Energy (now part of Google Environment) produces and sells energy and in 2010 was granted permission by the US government to trade energy at market rates.²⁴ And its Deep Mind AI is being used to optimise the delivery of power from wind farms.²⁵



Oil & gas majors

The big integrated oil & gas majors are moving into electricity generation as they seek out new lines of business to offset the expected slowdown in demand for their oil and gas businesses. Like the tech companies, they have deep pockets, and can apply their capabilities and extensive retail infrastructure to the provision of mobile power, especially around transport. By acquiring a number of smaller specialist players, the big oil & gas firms could also construct a broader service offering.

Shell has already announced its intention to become the world's largest electricity company by the 2030s.²⁶ To that end, it has made a number of acquisitions: it purchased UK independent supplier First Utility and New Motion, one of Europe's largest electric vehicle charging networks, at the end of 2017,²⁷ and German residential solar battery maker Sonnen and demand aggregator LimeJump at the start of 2019.²⁸



Specialist DER providers

Solar developers such as SunPower and SunRun are growing their capabilities in putting together packages for residential and business clients. As solar and storage are combined for utility-scale generation, the larger providers might look to develop alternative business lines.

Distributed energy resources will eventually be so prevalent as to become commoditised. Margins on specific technologies (rooftop, solar, storage) will decline, so building a sustainable business in any specific sector will become difficult except for companies that operate at scale. Ownership of the assets will be dispersed among customers, companies and communities, so service providers that can develop and manage large projects will be best placed to capitalise on this growing market.



Telcos

Telcos see an opportunity in the emerging smart landscape to leverage their existing relationships with customers, and their capabilities in data collection and processing. Many are bundling their mobile, broadband and ICT services into IoT packages using wifi, cloud, antenna and blockchain. Deutsche Telekom²⁹ and Telstra³⁰ have developed energy-focused offerings. Verizon has developed a cloud-based energy platform, Grid Wide Utility Solutions.³¹ Others, such as Telia,³² Telefonica³³ and Vodafone³⁴ are actively piloting and partnering in the home automation and smart meter markets.



Start-ups

The rapid innovation that has helped drive the development of Energy-as-a-Service is attributable in no small part to the legions of start-ups active in this space. For example, aggregation platforms not only collect the distributed supply of a multitude of prosumers; they also help balance loads and monitor and optimise voltage and frequency within the grid.

As the technologies mature, many of the most prominent start-ups will become acquisition targets. Software is in demand from more established hardware manufacturers with well-established products, that are seeking newer technology and platforms that connect into a more sophisticated service. For example, aggregator LimeJump was sold to Shell; REStore is now part of Centrica Business Solutions; and EnerNOC is now Enel X.

Four scenarios for the future

The future development of the Energy-as-a-Service market, in terms of speed and scope, will depend on the interplay of a number of factors: technological, economic and environmental developments; consumer and societal shifts; and political and regulatory responses.

Figure I sets out four possible scenarios that may emerge, depending on who holds the balance of power, and how widely technological advances take root.



The Energy-as-a-Service platform provider

Incumbents have the upper hand in the market, thanks to developing deep capabilities in all digital technologies (including cloud, AI, data analytics, blockchain and robotics) and distributed energy resources. They use their strengths in managing intricate energy systems to offer a range of bespoke, flexible solutions to customers. They set the standards for product integration across the industrial, commercial, residential, transport and trading sectors for energy. Their detailed knowledge of customers' preferences and energy portfolios enables them to tailor additional services to meet demand.



Stagnant utility company

Here, incumbents effectively 'capture' government policy-making and regulatory regimes to block changes to business models, by preventing or slowing access for new entrants, or new services to the market.



The fallen giant

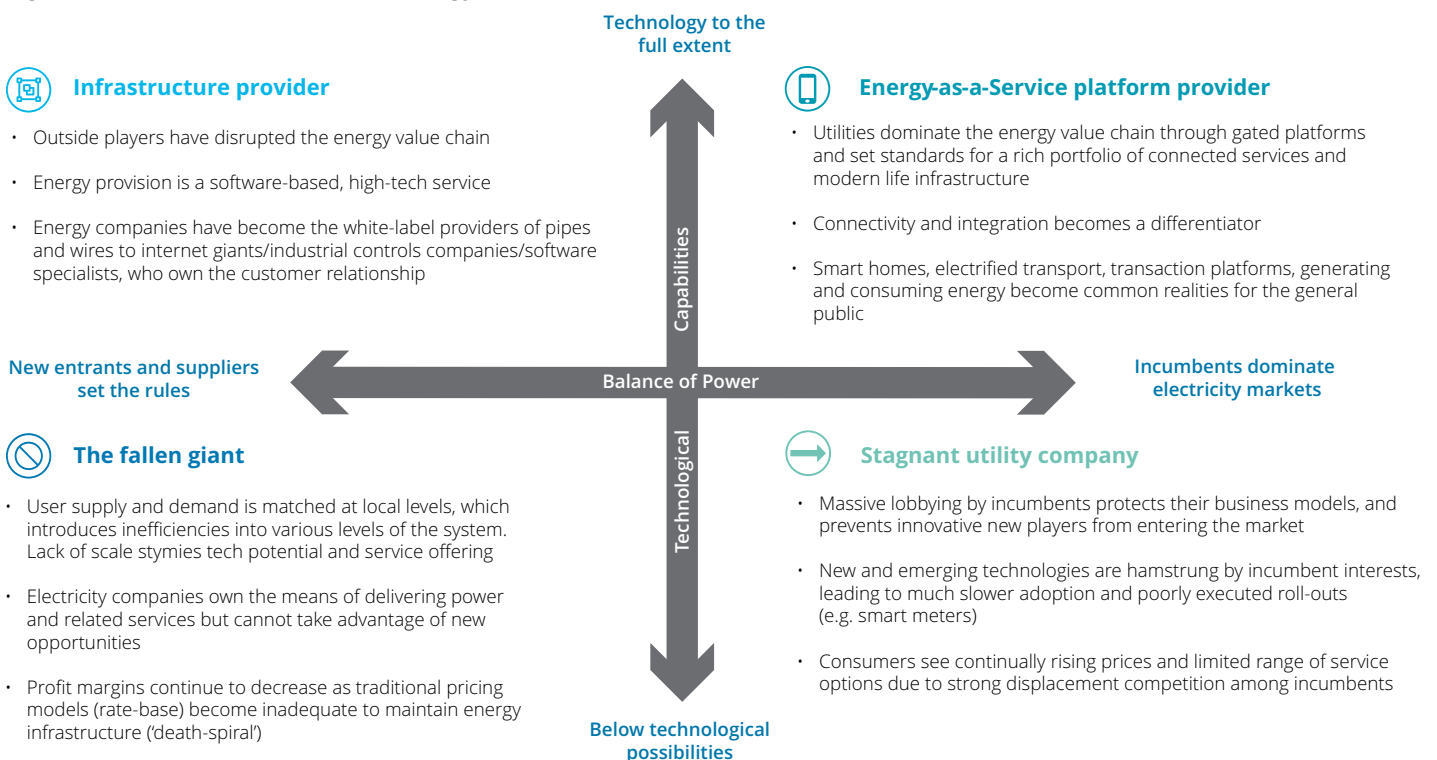
Consumers switch in larger numbers to behind-the-meter solutions. Energy is generated and traded locally, with community-level aggregation, resulting in inefficiencies at various levels of the system. The lack of scale inhibits the spread of technology and creates a so-called 'death spiral' for incumbents, where declining customer numbers mean falling revenues that are inadequate to maintain the infrastructure, much less prepare it for a higher level of services. Energy companies are reduced to providing a bare minimum of power services.



Infrastructure provider

In this fourth scenario, new entrants (large industrial conglomerates, oil & gas majors, tech companies, etc.) disrupt the value chain. Digital and communications technologies are essential for providing a wide-ranging menu of integrated services. Incumbents are reduced to providing basic transmission and distribution services, and some billing.

Figure I: Potential scenarios in the energy future



Source: Deloitte



Getting to EaaS

The transformation of a company's energy offerings should follow external market developments and expansion of internal capability.

Three global trends and macro-level shifts are affecting all players in the energy markets: decarbonisation and the need to produce energy from cleaner and greener sources; decentralisation, involving advances in energy technologies that are smaller in scale, modular and cost-effective at micro levels; and digitisation that makes 'intelligent' connections between people, places and assets, amplified by the spread of automation and artificial intelligence.

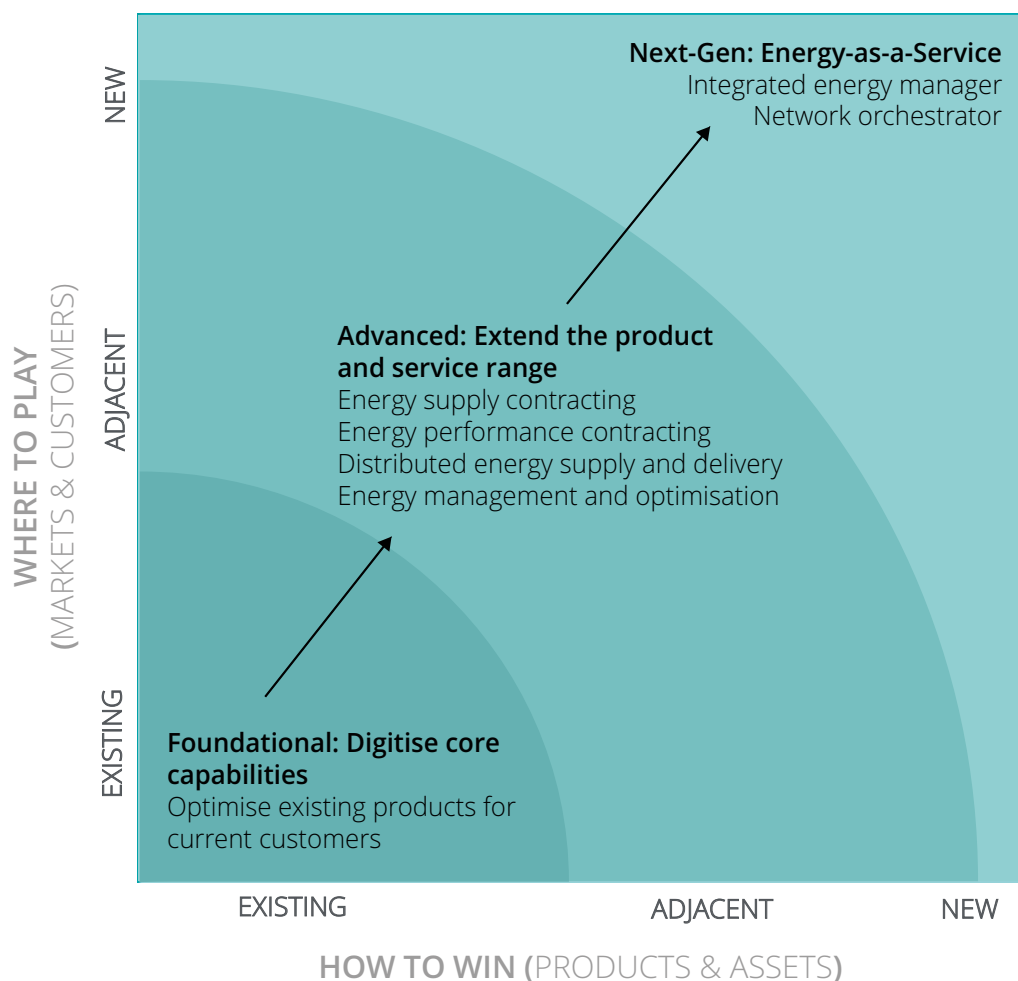
Business models will need to change, in some cases quite significantly, to keep pace in the 'new normal'. So how can companies prepare themselves for this *Future of Energy*? Figure J maps out the transition over time.

Foundational: Digitise core capabilities

Companies will need sophisticated digital capabilities to deliver EaaS, so the first steps should be to develop them. Essential building blocks are process automation, asset analytics and field mobility applications.

Companies should expand into a limited number of new business lines that track broader market developments. This can include smart grid investments, transactive energy exchanges, and embedded digital technologies in all physical assets.

Figure J. Evolution towards Energy-as-a-Service



Source: Deloitte

Analysing the data generated by the digital transformation will be essential to managing EaaS successfully. On the network side, data and software platforms can aggregate DERs and orchestrate their usage at the grid edge. On the retail side, the ability to deliver a complete customer service—a thorough audit, monitoring and understanding of customer behaviours and energy use over time, and pricing the service appropriately—will be key.

Advanced: Extend the product and service range

In the next phase of evolution, companies should reinvent themselves as platform players, getting better at using data and applying it at speed. Depending on which part of the market they are operating in—generation, distribution or retail—the next steps should be to branch out into a wider range of services. As value shifts away from centralised energy generation and delivery, this should include distribution platforms that help integrate into the grid the growing amounts of behind-the-meter distributed energy resources. Platforms should enable energy and transaction management, operations and maintenance, and optimisation of all appliances and devices.

External ecosystems of suppliers and partners will be required to deliver the extended range of value-added services and products. Companies should begin to expand their portfolio of offerings to include energy supply, large-scale storage, demand management and energy efficiency initiatives, as well as overall balancing with the grid.

Next-Gen: Provide total energy solutions

At this point in the company's evolution, a large proportion of revenue should be derived from EaaS offerings. By now smart devices will be embedded in public infrastructure, buildings and transport. Universal communications will enable instantaneous exchange of data, and multi-sided markets will exist to buy and sell energy. Transport will be largely electrified, with mobile power supply and demand.

The most value-added opportunities will be in new or combined services that foster customer loyalty and realise high margins due to the tailored, end-to-end nature of the solutions they provide.



CONCLUSION

All these developments may seem very 'space-age' and far away, but they are already happening. Smart buildings are being constructed and groupings of them are developing into smart places—automated, integrated and sustainable precincts—that manage supply and demand not just for energy, but for a range of systems in one networked whole. Over time, these will evolve into smart cities and regions.

The energy infrastructure in the future will be very different from today, with new players, new products, and new customer preferences. EaaS service providers will take information on energy supply, demand and prices, and overlay it with other data points, such as weather conditions, building occupancy, and current traffic conditions, to manage smart places as a dynamic portfolio of products and services.

The same trends that have disrupted retail, transport and consumer electronics are coming to energy markets: digital technologies driving disintermediation, and the rise of many-to-many markets trading over peer-to-peer platforms.

Companies should identify the opportunities they can exploit, the capabilities they will need to do this, and what market segments have the greatest potential to drive their future growth.

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