Joule Assets Europe

Energy as a Service Disruption - White Paper

Optimeyes Energy Ltd presents the fundamentals and reasons why Energy as a Service Solutions are disrupting the Energy Sector, based on real case studies and on the NEO technology platform developed during the last 2 years.

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Executive Summary

The traditional utility model, based on the sale of electricity and gas to end clients at a marginal profit, is no longer viable. Already today, with the growth of distributed solutions from home energy management systems to local solar or wind generation, the investment returns on centralized generation units or in electricity retail markets are no longer secure and dozens of traditional and even innovative retailers have failed recently in UK and internationally because they could not balance their contracted variable commodity costs with ongoing client revenues.

New technologies, such as batteries, low-cost solar and building and system controls, are enabling a wide range of new, customer-oriented business models, which embrace distributed generation and are prepared for the markets of the future. These models include peer-to-peer trading, energy centres, and corporate power purchase agreements among others.

However, each of these models provides only a partial solution, for example, a customer may now earn from their own generation units while still being left exposed to market variations and required engage with multiple parties – each of which charges them a separate fee. The earnings of the customer are therefore reduced, while they remain with a range of responsibilities and various levels of market exposure.

Therefore, these models are eventually most appropriate for customers who have a defined interest in different forms of generation or enjoy the engineering aspects of building controls, but for the vast majority of business and home owners, the likes of peer-to-peer trading will remain too demanding to be an interesting service model for them.

For these, energy-as-a-service is a convenient, low effort and beneficial solution. At this disruptive model the customer pays a flat monthly fee covering all their energy needs, ranging from heating and cooling to EV charging, and will earn full benefits from the renewable-generated energy or battery technologies they own – ALL delivered through a single provider and a single contract. Meanwhile, the provider will manage the full portfolio of technologies on the customers' site and any connected sites, to the full advantage of the customer. This includes reducing peak time consumption using local storage systems, bidding the customer's load into the flexibility frequency reserve markets, managing their consumption to maximize the use of their PV, or allowing them to benefit from a local peer-to-peer trading system, or to optimize their electric vehicle charging, etc.

The core of this change is shifting from selling energy as a commodity – a material resource, to selling it as a service - an experience. These are the disruptive solutions of the future, leaving behind the old, fossils based, centralized business models, paving the way for cleaner, consumer centric and decentralized solutions powered by the intelligent combined use of renewables, and information technologies, enabling new, cleaner and customer centric business models.

Contents

Introduction

There is a paradigm shift taking place within the energy industry – indeed the old business models based on the centralized resources and the sale of energy as a commodity are no longer viable without ever increasing level of state support in the form of capacity markets and direct subsidies.

Indeed, this is not a European phenomenon but a global phenomenon. According to the IMF[1] over $5.2 trillion was spent globally on fossil fuel subsidies in 2017 *alone*. This essentially means that the world's governments have its most valuable resources on life support, with the United States and Europe as major contributors. And yet today, despite this fact, distributed and renewable resources can out-compete fossil fuel-based generation, even in markets where renewable subsidies are largely phased out or never existed. This is enabled through a combination of falling costs and improved energy and information technologies that combined created the "perfect storm" to replace the centralized utility business model.

With every market disruption, there are equal parts of increased risk and opportunity. Successful investors and business executives are those that can see change coming and have the courage to take advantage of the opportunities.

This paper aims to provide some insight into the new, future oriented business models paving the way for the success of the energy transition. It reviews the current market disfunction and analyses the basis for the current seismic changes overtaking the electricity markets. It will then introduce a selection of future proof business models which are already viable today and which will only grow going forward. In all of these, the shift in focus is away from electricity or gas as commodities to be sold, toward energy as a service – where the customer's experience is core.

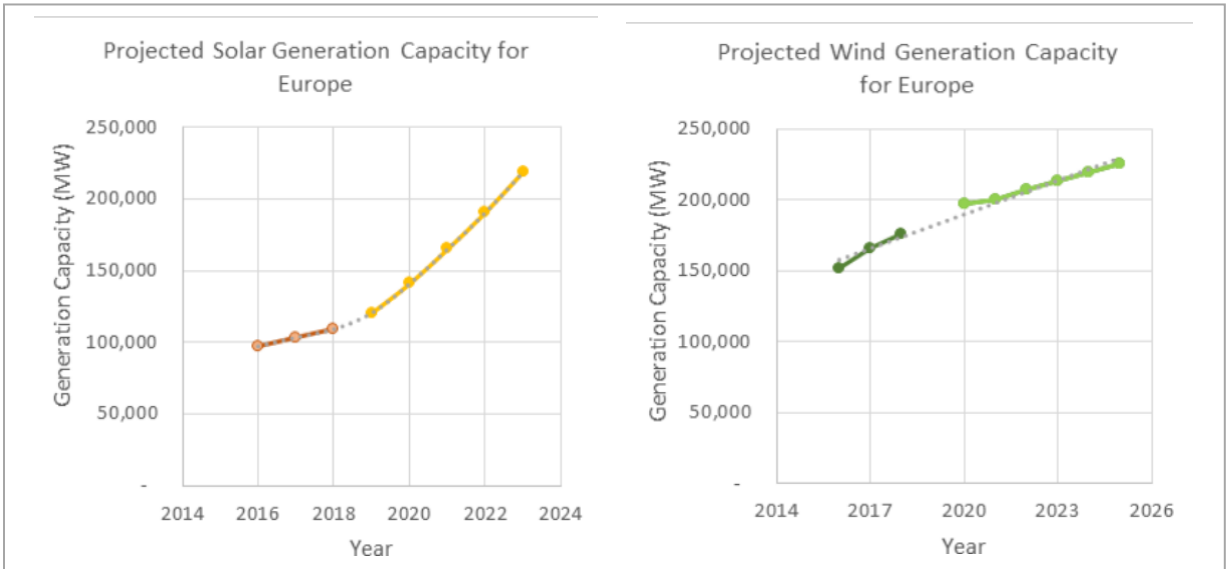
[1] https://www.forbes.com/sites/jamesellsmoor/2019/06/15/united-states-spend-ten-times-more-on-fossil-fuel-subsidies-than-education/

Section 1: Market trends – a slow death of the centralized model

This chapter reviews the current trends within the energy markets challenging the industry's traditional business model.

1.1 The shaking the ground beneath: renewables and distributed generation.

Europe as has set binding targets of achieving 35% renewable generation by 2025 and Member States (including the UK) have made their plans accordingly. Indeed, renewables are well supported by national governments in national budgets and planning has been carried out accordingly. On top of this, renewables are well supported by the investment community and the markets are awash in funds looking to capitalize on one of the few real growth industries in the European and UK markets. As can be seen from figures 1 and 2, the transition to a low carbon, distributed market is well established.



Data Sources: ENTSO-E 2013 -2018 Factsheets, SolarPower Europe Global Market Outlook for Solar Power 2019- 2023, Wind Europe - Wind Energy Outlook 2017

Figure 1: Projected Solar and Wind Generation Capacity in Europe

This is a positive and critical development in the battle over climate change and in the public support for a cleaner more consumer-oriented energy industry. However, it has had a significant and largely unforeseen impact on the viability of many utilities. And this impact will only become more decisive as the current plans are implemented. It is therefore important to understand how and why the only viable energy investments of the future will look significantly different than the energy investments of the past.

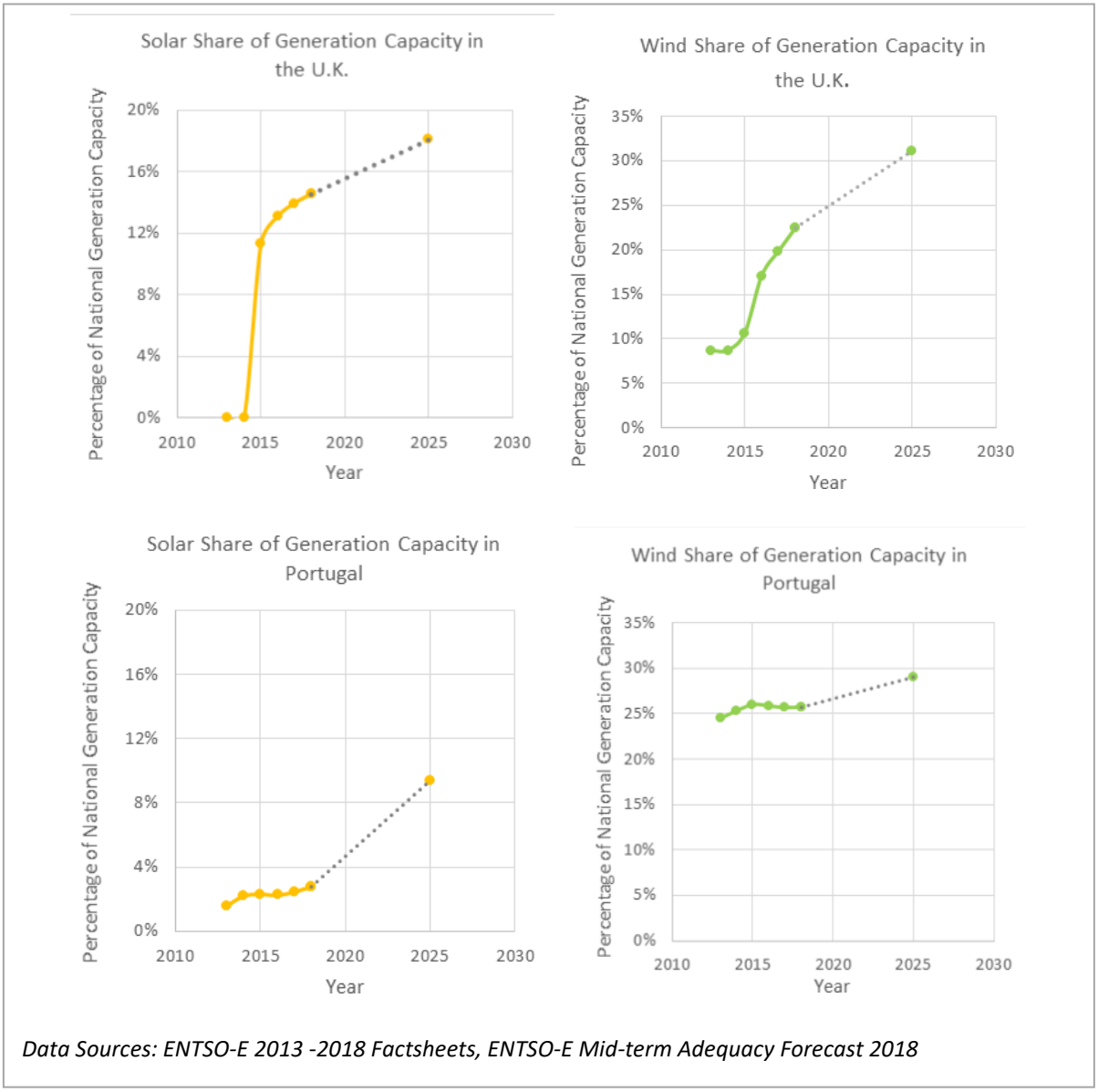


Figure 2: Projected Shares of Solar and Wind Generation Capacity in the U.K. and Portugal

The death of the centralized electricity system: The old centralized model was based on the construction of centralized generation units, with a payback time of 25 to 45 years, which provided a secure source of revenue to their utility owners and investors throughout this period and beyond. Long term returns could be made due to the relatively stable prices in the wholesale electricity markets. Prices remained stable over many years due to the fact that only certain forms of generation were available, all of whom had to purchase some form of fuel (gas, coal, uranium) in order to generate. The market prices would only ever descend to a certain limit, because no utility owner was going to undercut the value of their own generation assets and there was little real competition in any case in the vast majority of European Member States. Besides, a relatively small portion of electricity was ever actually traded through any national

market – the majority of MWs were bought and sold through internal negotiations and prices were and are unknown.

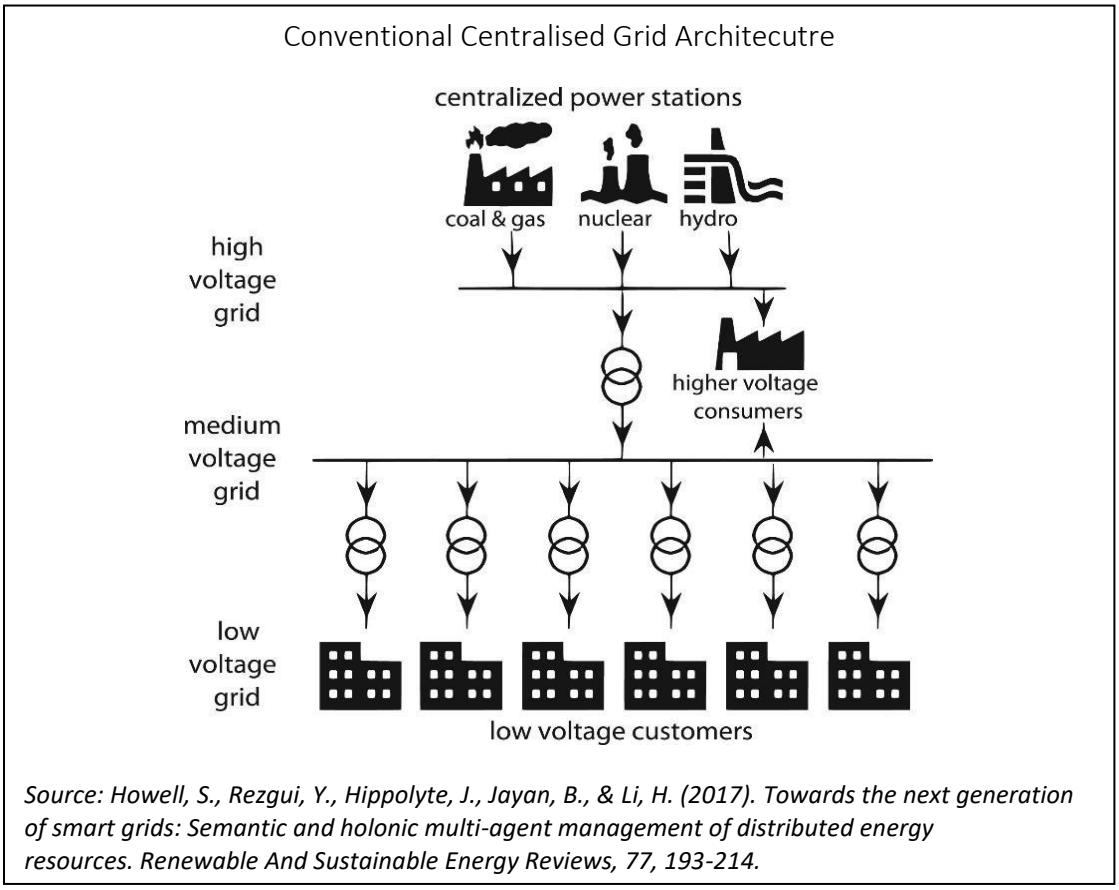


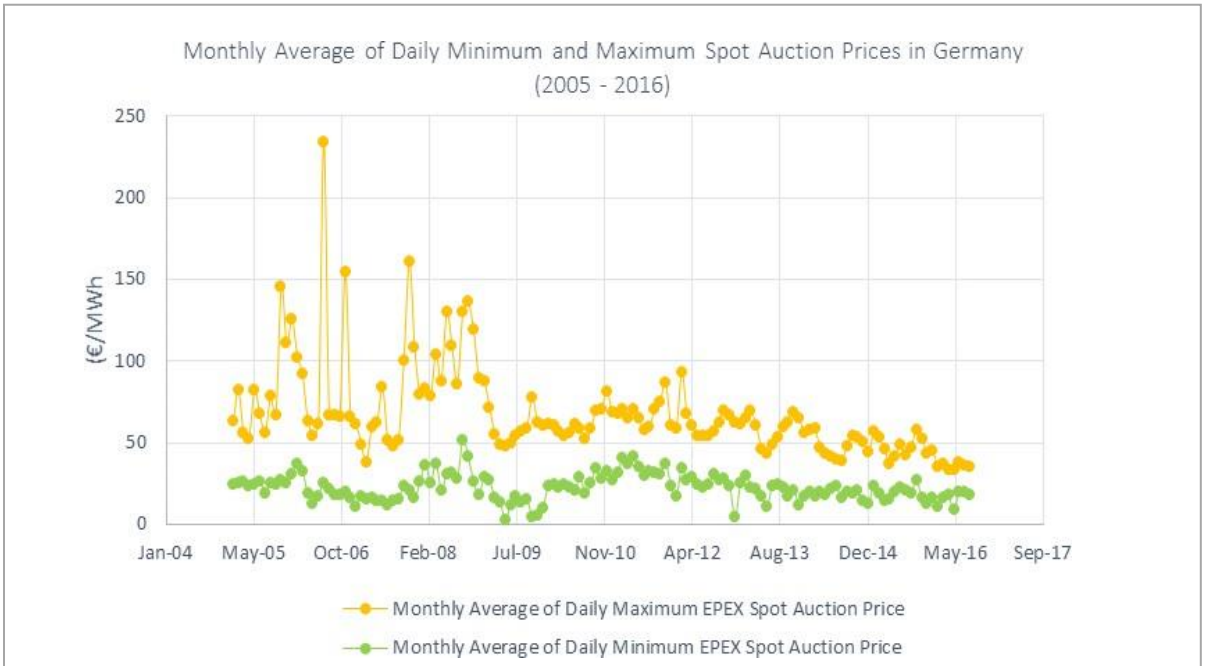
Figure 3: Schematic of Conventional Centralised Grid Architecture

At the same time, the margins of the client-facing sell-side of the business were low – sometimes less than £20 annually per household. The retail arm of utilities therefore had few resources by which to provide added value services to any but the largest industrial clients – no matter how dedicated the individual staff or how consumer-oriented the corporate culture might have been. The same is of course true for any new entrant retailer coming into the country. They will not own any generation assets and, in their case as well, their margins will be kept low per customer assuming all they provide is electricity bought at the same price as everyone else on the wholesale markets.

Therefore, the real return on investment and the financial security of the industry more generally was never in the retail arm of business or the actual sale of electricity to clients, but always the returns from centralized generation units, which was secured by a relatively steady wholesale market price.

This held true until a significant portion of a new form of generation, wind and solar units in particular, began to compete. This development permanently altered the nature and business model of the entire electricity system.

This is due to the impact that even a modest amount of renewable generation has on the trading price of a wholesale energy market. It undermines the price security. This can best be seen in Germany, which was one of the first Member States to make the transition toward significant solar capacity nationally. As a result of this (combined with the decision to phase out the country's nuclear fleet), RWE lost 80% of its value in less than a year, while E.ON was forced to sell off its entire generation fleet as bad assets and re-focus on its grid business and end customer services.

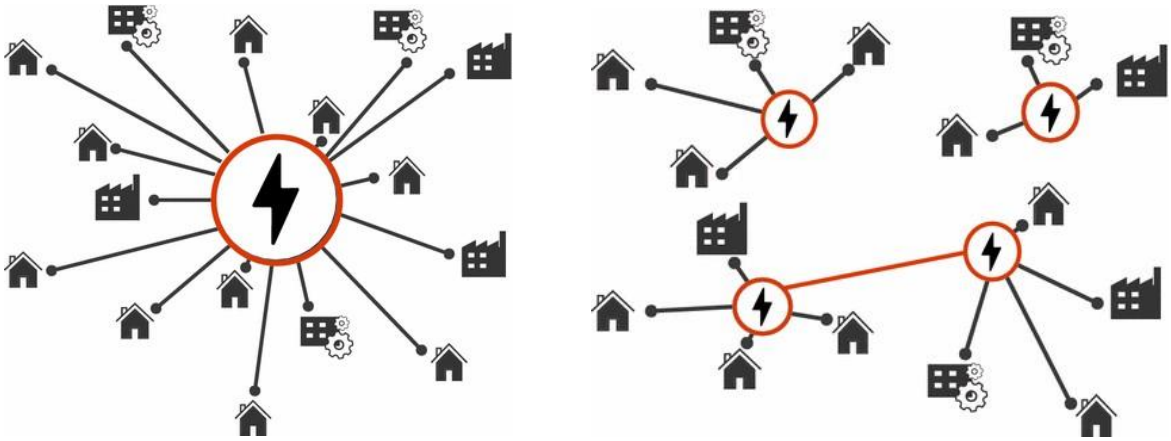


Source: EPEX Spot Market Auction Data Germany/Austria

Figure 4: German Wholesale Electricity Prices 2005 – 2016

The reason for the industry disruption caused by significant renewable capacity from wind and solar is that renewables can be bid into the markets at virtually any price – once the plant is built, they require no set commodity cost – no set commodity fee. Wind and sunshine are free. While coal, gas etc. all must be purchased as fuel and have personnel on hand to run the power plant, wind or solar units may be expensive to build, but they are close to free to run. On top of this, as in the case of fossil fuel plants, renewables also benefit from government subsidies – even though these have been reduced in recent years and will continue to shrink as the technologies come down in price. This makes solar and wind capacity highly competitive bidders in any market – and this undermines the market's clearing prices BELOW what gas and nuclear can tolerate, with indeed the only remaining competition being lignite coal (the most polluting form of coal available).

The utility's model of building large centralized units against a relatively stable commodity price ceased to be possible in the early 2000s. Centrica's CEO Iain Conn lost his position due to his difficulty in selling Centrica's bad generation assets before they had lost a significant portion of their market value. These errors are expensive for investors and management alike. GE's power generation unit has had to cut significant jobs in Europe precisely because they failed to understand the impact that renewables would have on the bankability of their gas and coal fired units. The utility lobby asking for the establishment of subsidized capacity markets – where new generation centralized plants will be supported longer term is a result of the price destabilization.



Centralised Energy System

Decentralised Energy System

Source: Vezzoli C. et al. (2018) Distributed/Decentralised Renewable Energy Systems. In: Designing Sustainable Energy for All. Green Energy and Technology. Springer, Cham

Figure 5: Schematics of Centralised and Decentralised Energy Systems

Added to this, new challenges to the centralized model will arise in the future. To name only one example, Demand Response is a programme where consumers' loads are aggregated and sold into various electricity markets at competitive prices. The client's consumption flexibility is achieved through building and appliance controls. Today, there is not yet sufficient load in the wholesales markets to impact national clearing prices, yet this is growing, and relatively small amounts of capacity will have a critical impact on clearing prices. This is due to the fact that Demand Response customers lower or increase their consumption directly in reaction to price spikes or valleys in the wholesale market. This flattens the price and means that the trading overall gets more predictable and cheaper. And once the technologies are ubiquitous – only 500MW participating in the wholesale market (less than is already available today in France for example) will lower the value of the markets by hundreds of millions a year.

In summary, the sale of electricity as a commodity is no longer a safe investment. The impact can already be seen in the investment patterns. Reliance on selling kWh to customers, without added value services, is no longer future proof or viable, as margins are too thin and the value of the markets is undermined too much to allow utilities providers to compete on price alone. It has become a race to the bottom (with many generation assets stranded on the way down).

Section 2: The Regulatory Changes as market enablers

Industrial, consumer and environmental pressure all pushed regulators to open markets to distributed resources, such as solar panels, demand response and mini-grids. The European regulatory framework has been set at the European Commission level and captured within the Energy Efficiency Directive, the Energy Performance in Buildings Directive, the updated Electricity Markets Directive and the Renewable Energy Directive, among others.

All of the above aim to create a foundational structure which delivers competitive, consumer-centred and low carbon energy production, delivery and consumption, throughout Europe. Today these directives form the basis of the national regulation reviewed below. Indeed, these regulations are in response to the requirements and objectives created jointly by Member States at the European level. For the purpose of this paper, we focus on Portugal and the UK, however the regulatory evolution is European wide, though progress remains uneven between Member States.

Though literally hundreds of critical technical changes to regulation could be listed (the Network Codes alone included over one-thousand pages of legally binding articles – many addressing customer connection and trading rights), there are a few key enabling themes, which support the transition from the old energy-as-a-commodity toward the energy-as-a-service model.

The basis for this transition is a shift in the rights and role of the end-customer in the energy markets overall. This has developed from viewing the customer as a passive, solely receiving entity, totally outside the energy system itself, to an active participant in the industry – with the right to control both their consumption and their production and with the right to be paid a fair market price for doing so.

The motivation for the regulatory changes is driven by consumer rights: The European Union privatized the electricity and gas markets in the early 1990s, and by 2010 – almost 20 years later for some countries, the results were judged unsatisfactory. Electricity costs had risen, few services had been added and indeed in some Member States, such as Sweden, Finland, Italy and Germany, utilities suffered lower customer satisfaction ratings than almost any other sector or the economy.

This was not the intended impact – competition was meant to improve services at the very least, even if it could not be guaranteed to lower costs. But it hadn't.

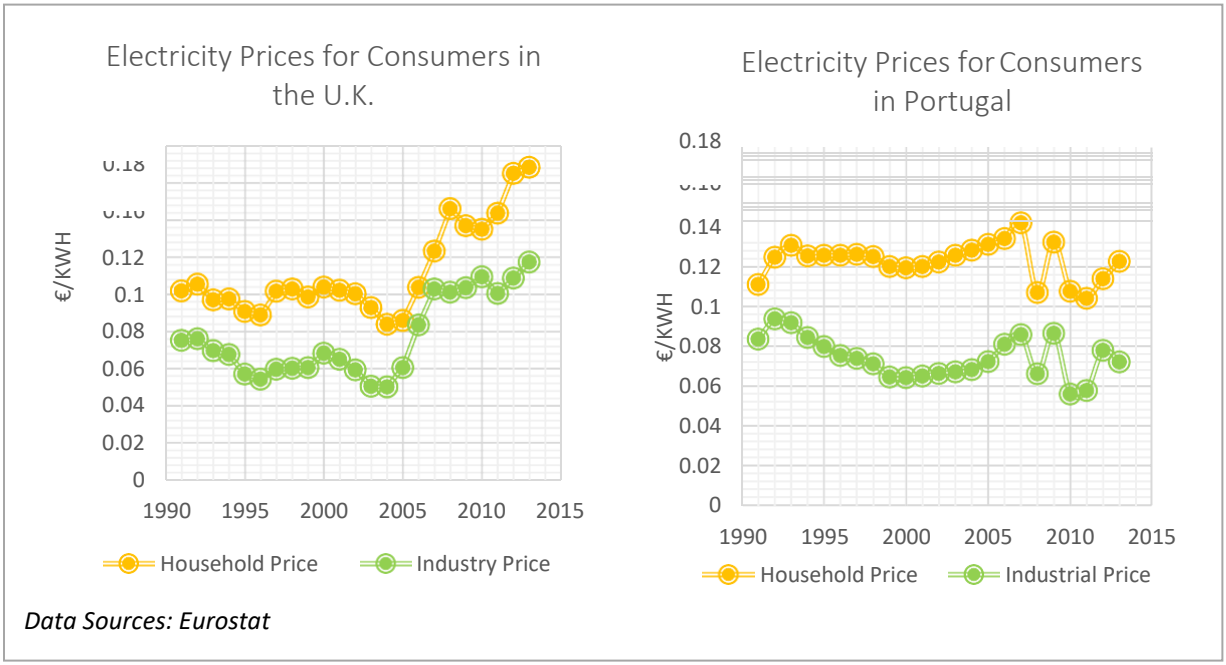


Figure 6: Electricity Prices for Consumers in the UK and Portugal 1991 – 2013

At the same time, industry groups and individual businesses began to lobby national governments and the European Commission actively to open the markets to consumers – in order to allow them to participate and earn both from their ability to shift consumption through demand response programmes and/or generate locally. These 'new' business models were enabled by the descending costs of technologies, such as building control technologies and the public subsidies of solar PV (batteries and EVs were not yet a competitive reality). The message from industry groups, such as the Smart Energy Demand Coalition (SEDC, now SmartEn), EPIA (now Solar Power Europe), Digital Europe and many others, clarified that not only would the European energy transition depend on the active participation and positive engagement of European consumers, but that the privatization of the energy industry itself could not be justified without an improvement in services.

This sustained push on the part of many parties, resulted in a revolution not only in individual regulations but in the very standards against which regulation and market structures were measured by government. A regulation could not be maintained if it was shown to be strongly prejudicial against the consumers' right to participate in the markets, either through the sales of the own consumption flexibility (Demand Response) or with the use of the PV panels, back-up generation etc.

A dramatic example of this was the loss of the European Commission and the UK government in the General Court of the European Union due to the legal challenge brought by Tempus Energy in 2014 and won in 2018 (Tempus at the time, was a company with under a £1 million turnover

annually). Tempus argued successfully, that the UK capacity market design was prejudicial against customer participation through Demand Response and that the European Commission had failed to carry out an adequate review for bias, prior to its approval of the design. The Court found that the Commission *"failed properly to assess the role of DSR (Demand Side Response) within the capacity market". (…) "The Court notes, first of all, that it was for the Commission to satisfy itself that the aid scheme was designed to allow DSR to participate alongside generation, because their respective capacities provide an effective solution to the capacity adequacy problem. In that context, the aid measures should be open and provide adequate incentives to the relevant operators.[2]"*

The ruling is significant, in that it indicates the extent to which the European regulatory path is now set - and the extent to which investors and industry must adjust.

Europe has reached the point of no return. The breakup of the old monolithic system is a given. Consumers have the right to participate in the markets, renewables and consumer load are competing and competing successfully. And any new market designs which overtly block this participation is no longer defensible. In the case above – the European Commission itself, and the UK Government both lost against a company that employed less than 20 people. Regulations are required, even by the highest court in the Union, to protect the rights of consumers to be active participants in the markets and use their consumption or their generation units in direct and equal competition to the utilities centralized generators.

The future is distributed. The future is based on business models in which the customer is the centre point of the activity.

2.1 Key Areas of Regulatory Change

Self-consumption

Self-consumption is the right of the household or business owner to consume the electricity they generate on their own property themselves, rather than being required to feed all of it into the grid – bypassing the owner's property. The first regulations in many Member States created structures through which customers were allowed to own the solar panels but not to control their usage. Rather they were paid a set fee per kWh that was fed into the network.

Owners were well paid for their kWhs and the solar panel market exploded in Europe. However, as government support was reduced and feed-in tariffs came down, it became clear that other business models would be necessary in order to allow the continued growth of the industry. If a customer is required to feed all of the electricity they generate into the grid – they cannot

[2] https://theenergyst.com/tempus-wins-european-court-case-capacity-market-bias-towards-generation-dsr/

reduce their dependency on that grid, or on their electricity retailer, nor can they benefit from, for example buying storage units or optimizing their overall systems with building controls.

Self-consumption is now possible in most European markets, including both the UK and Portugal, which in turn is the foundation for several business models, including Demand Response, Power Purchase Agreements, building optimization, mini-grids and many other services. The shift from the feed-in tariff model to self-consumption is therefore enabling the rollout of a wide range of business models today, as well as the sale of key technologies, such as batteries and building controls.

Demand Side Response (DSR)

In the UK customers now have the right to bid their load into a range of electricity markets by participating in Demand Side Response programmes. In practice, this means that if a customer shifts when they use/generate electricity and this shift in consumption/production is measured and verified by an aggregator, they now are able to bid the kWhs or MWhs shifted into an electricity market.

UK opened a certain number of markets to consumers – meaning that their load will be accepted and paid for. In the UK, consumer load participates in the Balancing Market mechanism, the frequency reserves, and can now even access the Capacity Market. They are still barred from the wholesale markets and many specifics of the regulations are still in need of improvement (the motivation for the successful Tempus court challenge). However, the markets are officially open and will remain so. Indeed, the recent August 12th UK blackout during which some one-million UK customers lost power, was blamed on insufficient demand side resources (demand side load, distributed diesel generators and batteries in this case) having been contracted to act as reserves by the UK transmission system operator, National Grid[3].

As recently as 2012 both the regulators, OFGEM, and the grid operator, National Grid, were claiming that distributed resources were unlikely to ever to be truly useful for security. On August 12th 2019 it was two large power plants that failed – tripping the entire system, throwing consumers and a large portion of the national transport system into disfunction – and it was the distributed resources who were seen as the secure go-to option for the defence of national security of supply. This is a truly amazing turn around for an industry centralized for over a century.

In Portugal and other European markets, Demand Response is still at testing phase but in practice little load currently participates in the pilots. This is largely due to the centralized nature of the markets and eventually the lack of awareness concerning the potential of this programmes. The UK DSR Market has been followed by different countries and companies as one of the most advanced and its learnings may be adapted and replicated internationally.

[3] https://www.theguardian.com/business/2019/aug/12/what-are-the-questions-are-raised-by-the-uks-recent-blackout

Peer-to-Peer Trading

Peer-to-peer trading allows consumers to trade the electricity they generate through their own resources or communally with others. This allows communities of consumers to cooperate and control the usage of their generated energy as well as how they would best like to earn or make use of it. Peer-to-peer trading can be supported by blockchain technology and is one of the key building blocks of mini-grids, community-owned retailers and other community-focused programs. For example, for a mini-grid to be possible, customers must be able to generate or store electricity and sell this to each other, they must also have the right to control and operate a limited portion of the grid, as well as to own and trade electricity with each other.

Size of the UK Market Opportunity

	Addressable Market	Brokers' Share of Addressable Market
Monetary Value	£10.7 billion	£3.75 billion
TWh/a	107.13	37.5

None of this was legal in Europe 5 years ago. Communities of small to medium consumers have not had the right to trade electricity with each or control their own grid, separately from the nations grid and bi-passing electricity retailers. However, the combined pressure from technology providers lobbying for the ability to sell their batteries, building controls etc. effectively in Member States, together with the regulatory shift in priorities towards consumer empowerment, have changed this.

In the UK and Portugal, peer-to-peer trading (and mini-grids) are now possible. Indeed, the Portuguese legislation was put in place only in July 2019 and is one of the most advanced in Europe in this sector, enabling the use of the local distribution grid in decentralised models.

Consumers groups may now own, operate and trade electric capacity with each other (this means that a community of some 50-200 homes and shops could all work together as also a group of industrial sites). In the UK, the maximum capacity for a jointly owned mini-grid without the need of a retail license is currently 1MW. Within these mini-grids, consumers will often jointly own a solar farm and battery storage. They may also decide to create their own EV charging network, they may decide to automate their community buildings and also to trade any energy that they generate through individually owned PV panels and batteries with each other. With the growing trend toward independence and community action – particularly the need groups of people feel today to break away from industrialized, polluting solutions to their everyday problems, mini-grids and community owned energy retail is becoming increasing popular. The recent changes in regulation will only serve to increase this number.

Conclusion: Many other concrete examples of regulatory structures enabling the establishment of consumer-centred business models based on distributed generation could be shown.

However, of these the right of the consumer to control the use and value of their own consumption and generation through Demand Response and Self Consumption as well as their right to trade this value both in the markets and with each other through Peer-to-Peer trading are key. And none of these were possible as little as 10 years ago. This combined with the ever increasing public and private investment in renewable generation is a clear indication of the direction of the electricity industry.

Section 3: Future oriented business models, viable today

As the old, centralized business models have lost their viability and do no longer provide secure investments, new dynamic models have come centre stage. These are based on distributed solutions, consumer-centred and service-oriented. Below is an overview of a few of these, based on known and increasingly price competitive technologies, such as solar panels, battery storage, building controls, electric vehicles and blockchain-based trading.

3.1 Business Model Types

In order to support a like for like description, each model is first described in short. Then its key business drivers are described: who is the provider, the potential market size, the extent to which it optimizes the customers site and the ease of engagement for the customer. A cost benefit analysis has not been included as this is company specific and could not be performed accurately. Suffice to say that all of these models are successfully deployed today at a limited rate and their viability and market acceptance is only improving.

Power Purchase Agreements (Local PPA or Remote/Corporate PPA)

A PPA allows a business to purchase its electricity at a given price from a specific generation asset, through a long-term contract, allowing them to bi-pass their electricity retailer for at least a portion of their energy requirements if not all of them. This generation may be located on their own premises connected directly via private wire behind the meter or elsewhere remotely, at a solar or wind farm, transported through the electricity grid at agreed and regulated costs.

Corporations often use a PPA with a renewable generator, as a means of lowering their company's carbon footprint. This also has the added benefit of providing investment security for the construction of new-build renewable generation. These generators may be also renewable local heat for Care Homes from biomass, remote or local solar-farms, but they may also be waste-to energy units, industrial combined heat and power sites, wind, hydro or multiple technology sites. No matter the technology, the PPA provides investment security for a new build or existing generation unit and cost control as well as the ability to lower the company's carbon footprint for the client.

Key facts:
Provider: Contractor, or sales person for generator.
In addition to this, most corporations will also need to maintain a contract with their retailer and distribution provider.
Basis for business model: The model is based on the idea that customers just want to be able to purchase energy directly from a generator (usually renewables) without having to own and run this unit outright. This gives them the benefits of purchasing renewable energy without direct, immediate ownership and without the retailer as their middle man.

Size of market: The potential market size is large. In theory any commercial, industrial customer or social housing unit could make use of this opportunity. As long as they are in a position to sign a 20-year contract or are able to sell this contract on.
Maximization site energy optimization: Partial or nothing.
The site itself is not necessarily included in a Corporate PPA, though generation may indeed be on-site. The storage and consumption flexibility potential on-site are not used necessarily, nor are opportunities within the neighbouring community.
Complexity of engagement for client: Engagement is simple.

Case Study: Energy Efficiency Program for KFC UK Chain – Local and Remote PPAs

With two sites as pilot locations and a budget of £120,000 per site, Optimeyes proposed an energy efficiency package that included options for Solar PV/Micro-CHP/Battery technologies combined with LED upgrades, the installation of EV chargers and a BMS. The final recommendation for each site was dependent on site-specific conditions and tailored to obtain the best integrated project at each location.

With a Local PPA in place, the client is set to accumulate more than £150,000 of savings over the 12-15 year project lifespan. In addition to the two sites selected for the pilot, there are another 5,000 sites with the potential to replicate these projects and savings. Due to the limitation of rooftop space also solar carports are being considered to enhance the total solar that can be generated. The balance of energy not generated locally would be potentially be provided through a Solar Corporate/Remote PPA to all restaurants, inclusively the ones without roof space.

Project Summary

CAPEX	*Technologies*	*Project Lifespan*	*Total Savings*
£120,000	Solar PV/Micro-CHP/Battery LED upgrades, EV chargers, BMS	12- 15 years	£150,000

This business model lowers the complexity of making use of /owning renewable generation resources but does not lower the complexity of energy management itself. The client will now have an added service provider, in addition to their retailer and distribution providers.

Case Study: Renewable Power and Heat for Care Homes – Local Heat and Power PPA
As part of a renewable heat pilot project for The Fir Tree House Nursing Home in Sutton, UK, Optimeyes proposed a technical solution comprised of a biomass micro-CHP and solar PV system. The proposed solution had potential for integration of an electrical battery with remote EMS.
Fir Tree opted for the Optimeyes financing model that was made up of 50% equity and 50% debt at 7%. The incorporation of applicable grants like the Feed-In-Tariff program and Domestic Renewable Heat Incentive (RHI) brought the capital expenditure of the project to £50,000. With a private PPA for electricity and heat, the total net profit for the project is anticipated to be £75,000 over a seven-year period with an IRR of 12%.

Project Summary

CAPEX	*Technologies*	*Project Lifespan*	*Net Profit*	*IRR*
£50,000	Solar PV, Micro-CHP	7 years	£75,000	12%

Energy Centres

Energy centres are on-site generation centres which provide all or a significant portion of a site's energy requirements. Energy Centres make sense for large multi-purpose commercial or industrial sites – where there are multiple buildings but one owner.

Key facts:
Provider: One or multiple contractors
The client will also still be dependent on an outside retailer and distribution system operators and may need to engage with multiple contractors and an aggregator as well for the energy centre itself.
Business model: Energy centres offer long term energy contract at a competitive price with on-site control.
A contractor should design and install multi technology generation units on-site and set up power purchase agreements and financing to provide the customer's site with an optimized energy supply at a lower cost than the equivalent quality and supply would cost from the market.
Size of market: Limited.
The core customer group is limited to large consumers (multi use residential and commercial sites for example) with an ability to sign long-term contracts and sufficient consumption on-site or with agreements with neighbours to guarantee offtake of generated energy, be it heat or electricity.
Maximization site energy optimization: partially to fully optimized

Many energy centres exclude managing the actual buildings, therefore though the generation and storage potential of a site is likely to be optimal, the consumption may be beyond scope.
Complexity of engagement for client. Complex.
The customer must be comfortable understanding technology and price risk, even with a well-designed energy centre. They must also trust the contractor(s) and be comfortable signing a 20–25 year contract.

Case Study: Sutton Point Energy Centre

CNM Estates commissioned an Energy Centre to supply electricity and heat to three of its property developments housing hospitality, commercial and residential tenants in Sutton. The Energy Centre hosts a CHP system, boilers and solar PV array with an EMS.

To finance the Centre, CNM opted for the Optimeyes model of 30% equity and 70% debt at 5%. Incorporation of applicable grants like the Feed-In-Tariff program and Domestic Renewable Heat Incentive (RHI) brought the capital expenditure of the project to £1,200,000. With a PPA for electricity and heat, the total net profit for the project is anticipated to be £5,000,000 over a twenty period with an IRR of 28%.

Additional opportunities for the Energy Centre include participation in Demand Response and integration of battery storage for flexibility services. These opportunities have the potential to add components to the project's revenue stack and increase its overall value.

Project Summary

CAPEX	*Technologies*	*Project Lifespan*	*Net Profit*	*IRR*
£1,200,000	CHP system, Boilers, Solar PV, EMS	20 years	£5,000,000	28%

Mini-Grids

Mini-grids are a set of electricity generators and possibly energy storage systems, interconnected to a distribution network that supplies electricity to a localized group of customers. These small-scale electricity generation systems, consisting of multiple small and locally owned units (up to a maximum of MW, defined by each country) will serve a limited number of consumers via a distribution grid that can operate in isolation from national electricity transmission networks.

Customers participate by subscribing to or becoming a partial owner in the system. Indeed, an important aspect of mini-grids is that all members of a community can participate, not only those who own a home or have the money for solar panels, an electric vehicle… but anyone in the community. This has the potential to democratize the development of distributed solutions as well as vastly expands the size of the available market. As a result, the market size is the same size as the household and small commercial loads.

Case Study: Housing Association Community Energy

The Severn Vale Housing Association in Gloucestershire, UK produces their own electricity on site through a "behind-the-meter" solar PV and electrical battery system. To finance the project, the Severn Vale Housing Association opted for the Optimeyes model that was made up of 70% equity and 30% debt at 5%. Following the capital of expenditure £12,000, the Housing Association established a private PPA for the electricity it generates, resulting in an IRR of 14% and net profit of £19,200 over a twenty period.

While already participating in the Feed-In-Tariff program, there is potential for involvement in Demand Response and the Domestic Renewable Heat Incentive.

Project Summary

CAPEX	*Technologies*	*Project Lifespan*	*Net Profit*	*IRR*
£12,000	Solar PV, Battery	20 years	£19,200	14%

Key facts:
Provider: Multiple types, community run non-profits, aggregator or contractor.
They will be required to engage with multiple technology and controls professionals for the establishment of the mini-grid itself.
Business model: To allow a community of users to become independent or semi-independent from the national energy system at a competitive price and using local, communally owned generation resources. Customers are able to engage with minimal or no upfront investment and without the need to install technology (though this is an option) or engage in a long-term contract.
Size of market: Large, once available.
In theory the strength of the mini-grid business model is that anyone in a given community can participate with a very low entry threshold. However, in reality the business model is limited to communities benefitting from educated, local and environmentally minded leadership in some form.
Maximization site energy optimization: Potentially high
As a mini-grid is based on local, professionally guided action, the potential for optimization is high, though complexity differs significantly between actual min-grids.
Complexity of engagement for client: simple for the individual, complex to establish
For the individual participant, engaging with a mini-grid model once it is running will be simple. However, establishing a mini-community owned energy system is complex.

Energy-as-service

Energy-as-a-service looks to take the main benefits of each of the models described and combine them into a single offering, maximizing the benefits of each.
Energy-as-a-service is a model which allows a customer, residential, commercial or industrial to literally have energy provided to them as a service at a fixed fee, rather than at a unit cost. This offering is enabled by the contractor optimizing the customers site, this could be done for example, through only installing energy management controls, installing more efficient equipment such as heating or cooling units and perhaps also on-site solar. However, once a sufficient number of clients are enrolled in fact many will only require basic building controls as the pool of client load can be used to optimize each other. It is also possible to aggregate a range of clients together in order to optimize the aggregated pool and lower the energy costs of all. In addition all energy that cannot be generated locally can be also be provided using remote/corporate PPAs, that will allow the long-term contracting costs to be predictable and aligned with the flat fee revenues.

Case Study: NEO Energy as Service Platform and Business Model

The NEO Energy-as-a-Service solution being developed by Optimeyes Energy (www.optimeyesenergy.me) in collaboration with Resilience Energy , Joule Assets and Puredrive Energy will be launched at WebSummit in Lisbon on 6th November 2019 in its version 1.0, enabling already some of the assets to be managed using the AI driven R-platform from Resilience Energy and the unique VPP storage controls from Pure Drive Energy batteries.

NEO introduces a New Energy Operating system that will enable the integration and optimization in real time with AI algorithms and Blockchain protocols of local and remote energy assets to serve one specific customer, either in one home, one city or one multi-site business.

NEO is also a disruptive Business Model for a Next generation Energy Operator, with decentralised assets and remote assets being managed under a flat fee that will enable business customers to predict their energy costs in advance and benefit from the incredible technological advances that will be available during the next years, taking control of their long term plans

The NEO Solution: a disruptive solution needed for a disruptive business model
Optimeyes Energy is raising up to £5 million to develop the next releases of the platform as also to extend the pilots already executed in UK for other countries like Portugal and Brazil. The expectation is that the platform could be widely available next Autumn 2020.

Key facts:
Provider: Single provider taking over all roles regarding energy
Business model: provide the customer energy at a known cost without hassle after installation of required technologies.
Size of market: Large. In theory all industrial and commercial consumers and most residential customers could benefit from energy as a service.
Maximization site energy optimization: Maximized.
The basis of the model is that in order to provide all the clients energy needs at a known fixed cost the site must be optimized, and some aspects controlled by the service provider.
Complexity of engagement for client: Simple post installation.
As mentioned above, once the aggregated pool of clients allows for cross optimization of the clients' consumption flexibility and production potential,

Business Model	Provider	Size of market	Site optimization	Complexity for client	Future proof business
PPAs	Multiple	Medium	Medium	**Simple**	**Future proof**
Energy Centres	Multiple	Limited	Medium	Complex	**Future proof**
Mini-grids	Multiple	**Large**	Medium	Complex	**Future proof**
Energy-as-a-service	**Single**	**Large**	**Optimal**	**Simple**	**Future proof**

Conclusions

The phase-in of customer-oriented business models poised for the evolving energy market has started. Today, conventional utility models are no longer viable and investment returns on centralized generation units or electricity retails markets are increasingly insecure.

With the abandonment of traditional fossil fuel driven business models, the paradigm shift from selling electricity as a commodity to selling it as a service is inevitable. Turning toward distributed generation that harnesses technologies like batteries, low-cost solar and building controls has opened the door to a cleaner, more consumer-centric and decentralized energy market.

As it stands, business models such as peer-to-peer trading or corporate power purchase agreements, are most suitable for customers who have a specialized interest or expertise. For most businesses and homeowners, participating in these business models or managing the integration of new technologies can prove too demanding or onerous.

Putting the everyday customer at the focal point of activity allows the development of convenient, low effort solutions for consumers. Instead of a customer who wants to earn from self-generation needing several transactions with different parties to secure one stream of revenue, the customer can pay a flat monthly fee to a single provider to cover all their energy needs. In this model, the customer no longer holds the same exposure to market fluctuations as a single provider can manage a portfolio of customer or site-specific solutions and technologies. This could involve bidding the customer's load into the frequency markets, managing their consumption to maximize the use of their PV, or allowing them to benefit from a local peer-to-peer trading system, etc.

Offering energy-as-a-service is a solution that enables all customers to benefit from the evolving energy system and marketplace. This paradigm calls for greater benefits to consumers from the adoption of new technologies and customized energy solutions. These actions are leading the transition to a cleaner, fairer and decentralized energy system powered by the intelligent use of renewables, and information technologies.

New technology platforms and new business models will appear in the next months to implement the Energy-as-a-Service promise. The current utilities may not be the most prepared to deliver such a model since it is fundamentally different from their core business and could undermine the value of their centralized generation assets and reduce even further their retail utility margins.

For each customer that decides to reduce grid consumption, all others that stay there will have to pay a little more for the same assets and will be more incentivized also to reduce exposure. Energy is a sector where long standing relationships and trust are key to success and so, innovative startup may partner with other energy established players, like Energy
Brokers, ESCOs (Energy Service Companies),etc to accelerate their market penetration and success. EaaS needs the "right" combination of technologies, delivery and customer trust to succeed.