BRYAN, GARNIER & CO

Playing Catchup

HOW DIGITALIZATION WILL IMPACT EUROPEAN UTILITIES

SMART ENERGY WHITE PAPER JANUARY 2018

Contents

The 2000s were dominated by vigorous M&A activity in the utilities sector. This was thrown into reverse by the financial crisis, the rise of renewables and a slump in European electricity prices.

The electricity industry is faced today with seismic transformations in the form of declining traditional baseloads (coal and nuclear), rising intermittent renewables (wind, solar), digitization of the supply chain, increasing residential and utility-scale energy storage, and energy sharing communities.

Major utilities across Europe have reviewed their business models in response. However, while some utilities in Northern Europe, e.g. France and Germany, have implemented strategic changes, they have fallen behind their southern European counterparts, who anticipated the renewables revolution and its implications.

One of the most significant of these implications is the digitalization of energy markets, which holds out potential for rapid change in the sector, and creates an opportunity for the big tech companies who see the chance to leverage their huge expertise in data.

In response, incumbent utilities are scrambling to acquire expertise. At the same time, they need to prepare for the different demand profile that the rapid rise in electric vehicles will bring, and to leverage the potential of demand response technology, which will play a crucial role in this new landscape.

Looking further ahead, the potential for decentralized and peer-to-peer markets is set to further disrupt a sector already in the throes of major change. For the big incumbent players, this doesn't have to be a negative story. There is huge opportunity in this new market for utilities that can catch up with the structural and technical developments in time.

1: Historical business models under pressure

Until the very end of the 2000s, virtually all European utilities groups were involved in a wave of major acquisitions, driven by ongoing confidence in structurally high electricity prices (see Fig.1).

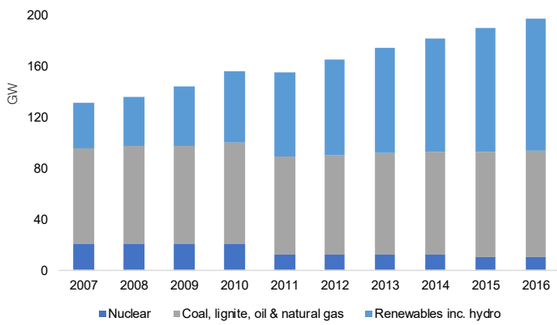
FIG. 1: NON-EXHAUSTIVE LIST OF BIG DEALS IN THE EUROPEAN UTILITIES SECTOR (2000 - 2010)

Year	Target	Buyer	Amount (USD m)
2010	International Power	GDF Suez	35,932
2009	Italgas Hellas	Snam	3,937
2009	Essent	RWE	9,791
2008	British Energy	EDF	14,114
2008	Union Fenosa	Gas Natural	8,561
2007	Energy East	Iberdrola	8,096
2007	ASM	A2A	5,790
2006	Scottish Power	Iberdrola	27,234
2006	Suez	GDF Suez	49,863
2006	KeySpan	National Grid	11,283
2005	Electrabel	Suez	13,551
2002	Italgas Hellas	Eni	3,406
2002	Lattice Group	National Grid	17,697
2002	Eurogen	Edipower	3,359
2001	American Water	RWE	7,495
2001	Powergen	E.ON	14,929
2000	Thames Water	RWE	9,768
2000	Niagara Mohawk Holdings	National Grid	8,336

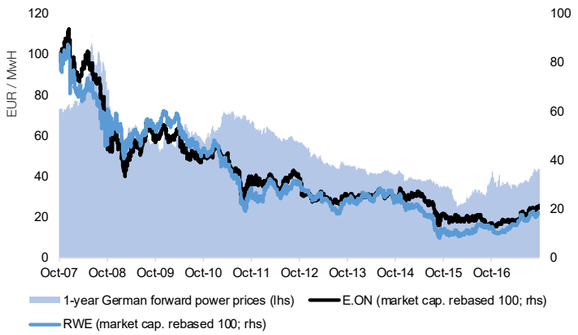
Source: Bloomberg; Bryan, Garnier & Co

FIG. 2: HISTORICAL BUSINESS MODELS UNDER PRESSURE

CHANGE IN THE ELECTRICITY MIX IN GERMANY SINCE 2007



STRONG CORRELATION BETWEEN GERMAN UTILITIES' MARKET CAPS AND FORWARD ELECTRICITY PRICES



Source: Thomson Reuters, AGEE, BMWi

Since then the situation has reversed, with electricity demand slowing following the 2008/2009 financial crisis, the proliferation of renewable energy installations - fuelled by subsidies - and a slump in electricity prices in Europe (Fig. 2). Acquisitions hit a record low in the 2012-2015 period, particularly deals between the sector's industrial players, which now represent only one fifth of the total number of deals made.

The crisis in the sector, together with severe value destruction during the wave of acquisitions, prompted European utilities groups to review their business models, a move that, despite coming too late, led to the implementation of significant changes.

The German utilities groups were no doubt the hardest hit by the dramatic drop in prices in the electricity market, the huge influx of renewable installations in the network and the government's announcement that all nuclear plants would be stopped after 2022.

At the end of 2016, **RWE** spun off its "clean" subsidiary, innogy, which has refocused on network activities, renewable energy production and energy supply. In a similar approach involving splitting its sluggish conventional activities from its growth businesses and other regulated activities, **E.ON** spun off its subsidiary Uniper, retaining the infrastructure, renewable energy production and retail activities.

In France, **Engie** launched a vast programme of asset disposals (EUR15bn by 2018), also with the aim of refocusing on regulated, contracted activities and reducing its exposures to commodity prices (disposal of thermal facilities exposed to market prices, and of exploration and production activities). EDF also plans to sell off nearly EUR10bn in assets by the end of the decade (it has already sold assets for over EUR8.0bn, including half its stake in RTE for around EUR4bn to CDC and CNP Assurances).

Despite these new smaller and more flexible structures and an unconvincing M&A track record, the beginning of 2017 brought a resurgence of speculation on potential consolidation in the sector. Finnish utility **Fortum** has launched an EUR8bn take-over offer on German company **Uniper** which was c.47% owned by E.ON. In the environmental services segment, **Suez** bought **GE Water** on the basis of an enterprise value of around EUR3.2bn. **EDF Energies Nouvelles** announced the more moderately-sized acquisition of **Futuren**, which specializes in wind energy production.

Other major moves in the segment include **Total's** acquisition of 23% of **Eren**, one of the largest independent renewables players in the sector, for around EUR240m. With this acquisition, Total is now fully integrated along the value chain with **SunPower** (solar panels manufacturer), Eren (power producer), **Saft** (batteries manufacturer), **Lampiris** (power and gas suppliers) and **GreenFlex** (Energy Efficiency).

Time to catch up

Due to a clear lack of flexibility, utilities in France (GDF-Suez then Engie, EDF) and Germany (E.ON and RWE) have fallen significantly behind in terms of adapting their business models and shifting their thermal/nuclear energy mix to a model based on renewables and energy services. Their constraints have been political (especially for EDF); social, including strong trade-union influence that creates difficulties regarding any self-help measures; and external factors, such as the 2008/2009 financial crisis and the ensuing slowdown in energy demand, and Fukushima nuclear disaster, which prompted the German government to end nuclear energy production.

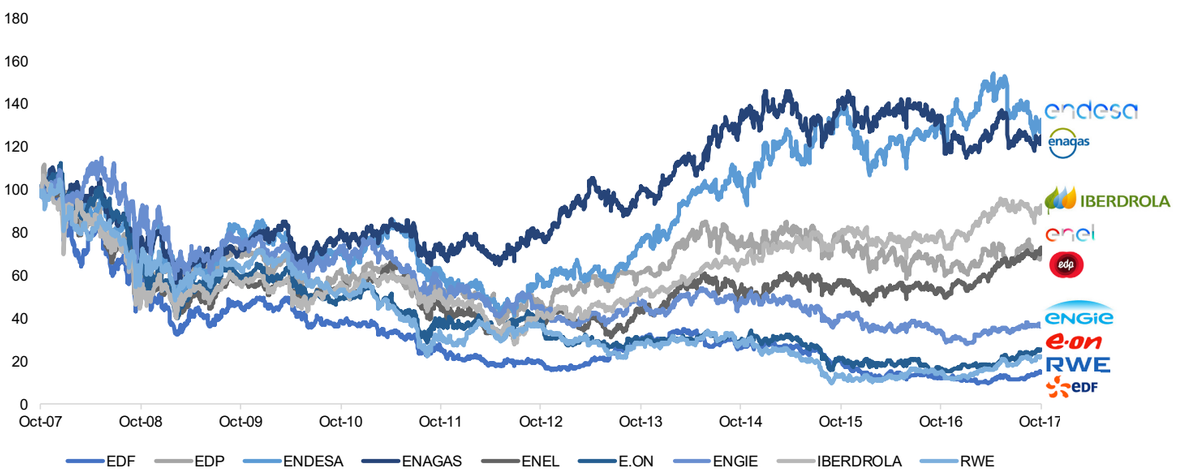
This situation compares unfavourably with the (rapid) transformation that took place among southern Europe's utilities, such as **Iberdrola**, **EDP**, **Enel** and **Endesa**. These companies all successfully anticipated the renewables revolution, supported by government policies, and adapted their business models to new challenges such as the disruption of the merit order, greater intermittency and rapid learning curve bringing faster cost reduction, etc.

Since 2007, southern Europe's utilities have significantly outperformed their French and German peers, with their stock market performance rising +3.1% on average over the period compared with -73.4% and -75.1% respectively (Fig. 3).

Similar dynamics have played out in other European markets such as UK, the Nordics, Netherlands etc. – in fact, in these markets, utilities such as **Centrica**, **Eneco**, Fortum etc. have shown a greater openness to digital innovation in terms of organizational structure, acquisitions and investments. Centrica, for example, is progressively moving towards a more capex-light business model as shown by its dedicated Business Solutions entity and by the recent acquisition of demand response leader REstore.

They are all trying to catch up with smart meters pioneer Enel which recently launched **Enel X**, a dedicated branch to e-solutions grouping together e-mobility, e-home, e-city and e-business solutions.

FIG. 3: STOCK MARKET PERFORMANCES (BASE 100)



Source: Bryan, Garnier & Co; Bitfury

It is now crucial for these "new" companies – Engie without its E&P activities and part of its thermal assets; E.ON without the conventional activities of Uniper; and **Innogy**, floated on the stock market by parent company RWE – to make sure they don't miss the boat in terms of sector digitalization, which will bring e-mobility, smart homes, demand response solutions and advances in storage solutions (Fig. 4).

FIG. 4: FROM ONE REVOLUTION TO THE NEXT

Source: Bryan, Garnier & Co

2: Digitalization: shaping a new ecosystem

THE RACE TO BE FIRST MOVER

Over the last few years and with a growing sense of urgency, many European utilities have been focusing on the need to take their business digital. This is in response to the pressure on business models discussed earlier, coupled with the desire to build an ecosystem that accommodates both conventional activities (production, infrastructure, energy supply) and the new challenges brought on by technological advances in mobility, storage, data analysis and management.

Perhaps, above all, it is driven by the widespread development of renewable energy over the past decade, and the intermittent nature of this type of generation.

Improvements in grid and infrastructure intelligence are not only necessary to adapt to the new market reality: they are also conscious differentiation strategies.

Another crucial factor is the need to be one of the first movers before US tech giants, **"GAFA" – (Google, Apple, Facebook, Amazon)** establish themselves in the energy space. The colossal quantity of data available in the sector – e.g. local production, consumption, e-mobility, flow monitoring – presents a wealth of opportunities to use, analyze and monetize information, which is a speciality of the GAFAs.

In the medium to long term, we expect to see clear convergence and inevitable competition between GAFA's interests and those of the conventional utilities in the energy sector. In practice, this has been happening since 2014 when Google acquired smart home specialist **Nest**.

The emergence of new players in the growing IoT and Connected Homes market is a force to be reckoned with, making consumers more aware and pro-active in managing their energy needs. Nest is already competing with utilities' own products such as Centrica's **Hive** solution in the UK, as well as with independent players, such as the German **Tado** or French **Netatmo**.

In 2016, Engie and innogy implemented "3D" strategies: decarbonization, decentralization and digitalization (Fig. 5). These three themes will dominate their strategies and generate synergies with all utilities' existing businesses:

- e-mobility (development and installation of charging points for electric vehicles, development of new pricing models relating to electric vehicles)
- Big Data (predictive maintenance for existing facilities, energy management software)
- the Internet of Things (smart cities and smart homes).

PARALLELS WITH THE TELECOMS INDUSTRY

The transformation we are seeing in the utility sector today has parallels with that undertaken by the telecoms industry in the late 1990s. At that time, telcos needed to offset the commoditization of bandwidth by generating recurring revenues from their B2B and B2C client base through technology-based services such as server and data hosting, and SaaS (then known as Application Service Providers, or ASPs). This led to the creation of new divisions such as **BT Global Services** or **Orange Business Services**.

Today, utilities are facing similar challenges and are pushing to provide differentiated digital services, usually through the creation of dedicated units such as **Centrica Business Services, Enel E-solutions, Engie Fab** etc. The parallels suggest that the new e-businesses are here to stay in some form or other, and that the pace of change will only increase.

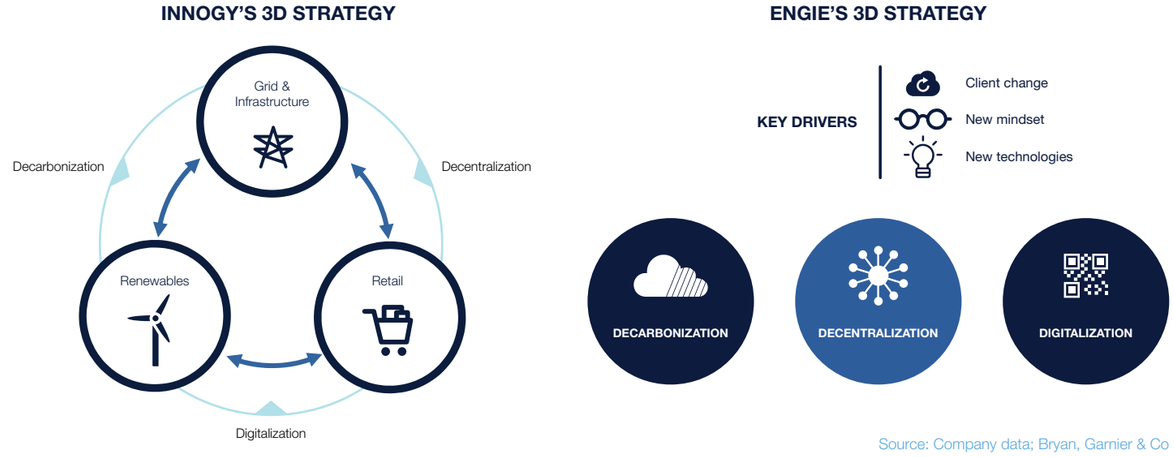
Further, as utility businesses increasingly start to resemble the digital services provided by telcos, we may start to see a convergence between these industries. In the UK and in other highly deregulated markets, telcos, supermarkets and even media brands offer their own branded telecom and energy supply services. French telco Orange announced only recently that they are looking to provide energy services in Europe, and others may follow, widening consumer choice and creating competitive challenges for utilities.

Words can quickly be put into action and most sector players have already launched sweeping programmes of targeted acquisitions – usually of small or mid-sized companies – specializing in digital activities, storage, e-mobility or energy efficiency.

Fig. 6 lists the main acquisitions made in Europe in this segment since 2016. The sums involved, as well as the key metrics, are rarely disclosed, so the valuation multiples underlying these deals are not yet known.

In the future, we believe that three sub-segments of the digital energy sector will inevitably emerge among Europe's utilities (Refer to Fig. 7 on page 9).

FIG. 5: ENGIE AND INNOGY: TWIN STRATEGIES



Source: Company data; Bryan, Garnier & Co

FIG. 6: MAIN ACQUISITIONS BY EUROPEAN UTILITIES IN THE DIGITAL ARENA IN 2016 AND 2017

Date	Buyer	Target acquired	Type of deal	Main activity
Jan 2018	Engie	Electro Power Systems	Acquisition (pending)	Energy storage solutions and mircogrids
Nov 2017	Centrica	REstore	Acquisition	Demand response and energy management
Oct 2017	E.ON	Cuculus	Acq. of minority stake	IoT platform
Oct 2017	Shell	The New Motion	Acquisition	Electric vehicle charging
Oct 2017	ENGIE	Fenix International	Acquisition	Solar Home Systems
Oct 2017	Enel	Emotorwerks	Acquisition	Energy and e-mobility solutions
Sep 2017	Total	GreenFlex	Acquisition	Energy efficiency services
Jun 2017	Enel	EnerNOC	Acquisition	Demand Response
May 2017	Total	PitPoint BV	Acquisition	Natural gas for vehicles (NGV)
May 2017	Centrica	IO-Tahoe LLC	Acquisition	Data discovery software solutions
Apr 2017	Total	Xee	Acq. of minority stake	Collection, processing and mgt. of data from smart cars
Mar 2017	Engie	EVBox	Acquisition	Supplier of charging solutions for electric vehicles
Mar 2017	Engie	Keepmoat	Acquisition	Energy efficiency upgrade services for local authorities
Jan 2017	Enel	Demand Energy Networks	Acquisition	Intelligent software and energy storage systems
Dec 2016	Fortum	Info24	Acquisition	IoT solutions specialist
Nov 2016	Engie	Opus One Solutions	Acq. of minority stake	Operating system for distribution networks
Oct 2016	Engie	Siradel	Acquisition	3D town modelling, software publisher
Sep 2016	Engie	Heliatek	Acq. of minority stake	Production of organic photovoltaic films
Sep 2016	Engie	Symbio FCell	Acq. of minority stake	Hydrogen mobility
Sep 2016	EDF	Groom Energy Solutions	Acquisition	Energy efficiency support and solutions
Sep 2016	Total	AutoGrid	Acq. of minority stake	Software to balance flows in distribution networks
Aug 2016	innogy	Belectric	Acquisition	Solar PV and battery systems
Jul 2016	Total	United Wind	Acq. of minority stake	Decentralized wind power generation
May 2016	Engie	Green Charge Networks	Acquisition	Battery storage
May 2016	Total	Saft	Acquisition	Battery design and production
Apr 2016	Centrica	Neas Energy	Acquisition	Energy management and revenue optimization services
Mar 2016	Engie	C3 Resources	Acquisition	Digital energy management
Feb 2016	Engie	OpTerra Energy Services	Acquisition	Energy efficiency

Source: Bryan, Garnier & Co. Highlighted above, the main acquisitions made over the last two years. For the purpose of this table, we consider Total to be a utility, especially given that it has set up a renewable energies and storage solutions division.

FIG. 7: SUB-SEGMENTS OF THE DIGITAL ENERGY SECTOR

ELECTRIC VEHICLES AND STORAGE:

The arrival of electric vehicles and the related development of storage solutions.

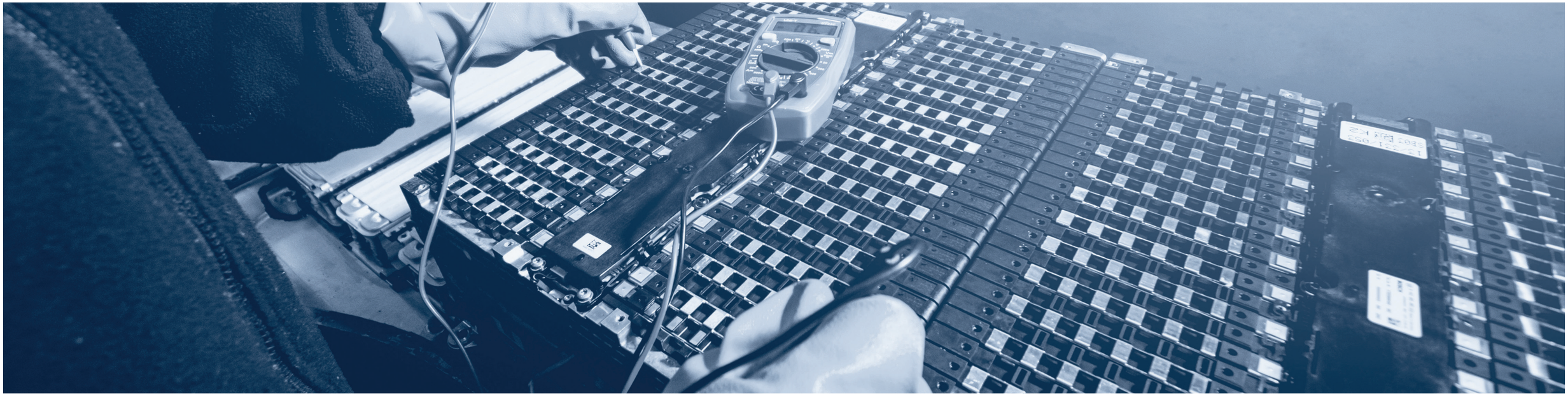
DEMAND RESPONSE:

Demand response initiatives and their implications in terms of energy management software (EMS).

VIRTUAL POWER PLANTS AND ENERGY TRADING:

Virtual Power Plants, as electricity production models are decentralized with peer-to-peer energy trading and the “prosumer” concept.

It is difficult to establish boundaries between these sub-segments, given that they are so deeply intertwined and interconnected.



Markets boosted by the plunge in battery prices

Battery prices have plummeted. The cost of lithium-ion batteries fell by 65-70% between 2010 and 2015, from around USD1,000/KWh to around USD300/KWh. Sector players believe that a price of around USD100/KWh by 2025 is a realistic and achievable target. This has driven – and should continue to drive – both the e-mobility market and electricity production solutions, coupled with storage systems, especially PV plus storage.

At present, electric vehicles (EVs) represent only a small fraction of new registrations which, in 2016, stood at around 1% in France and 0.5% in Germany. However, this percentage is set to climb steeply in the coming decades, driven by innovation and government policies such as purchase subsidies and dedicated lanes on the roads.

Based on our estimates (BG Auto & BG Utilities), EVs could represent around 17% of total vehicles in use in France and around 9% of those in Germany by 2030.

Moreover, we believe that on average, EVs could account for 30% of new vehicle registrations in France and 20% in Germany over the 2025-2030 period (Fig. 8). Some European countries, such as Norway and the Netherlands, have higher projected EV penetrations.

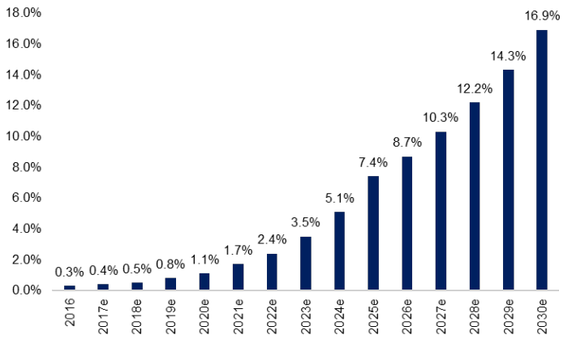
Based on the three assumptions below, we believe that EVs could increase electricity consumption in France and Germany by respectively 2.5% and 2.0% by 2030.

- A traditional EV, equipped with a 25-45kWh battery that enables it to drive 200-300km, uses 12kWh/100km on average. So, a million EVs averaging 15,000km a year would use around 1.8TWh.
- At present, new registrations of electric vehicles represent 0.5%-1% of total new registrations in France and Germany.
- We assume that underlying electricity consumption in France and Germany (excluding additional demand from EVs) will see annual average growth of 0.25% out to 2030 (Fig. 9).

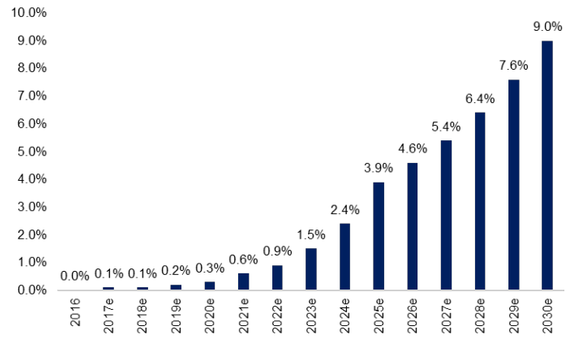
This anticipated rise in electricity consumption due to the growing number of electric vehicles in use explains why Europe's utilities are specializing in electric vehicle charging infrastructure. Engie acquired Dutch company **EVBox** at the beginning of the year, innogy is building infrastructure via organic growth,

FIG. 8: ANTICIPATED INCREASE IN ELECTRIC VEHICLES IN FRANCE AND GERMANY TO 2030

PROJECTED EV ADOPTION, FRANCE



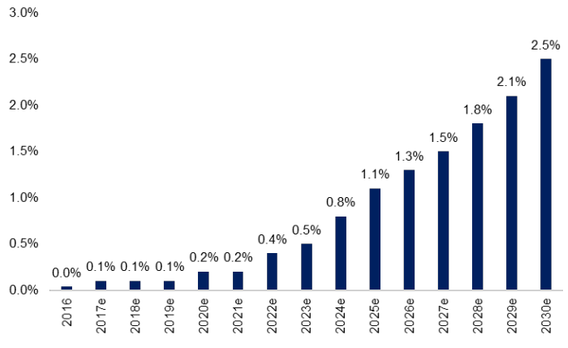
PROJECTED EV ADOPTION, GERMANY



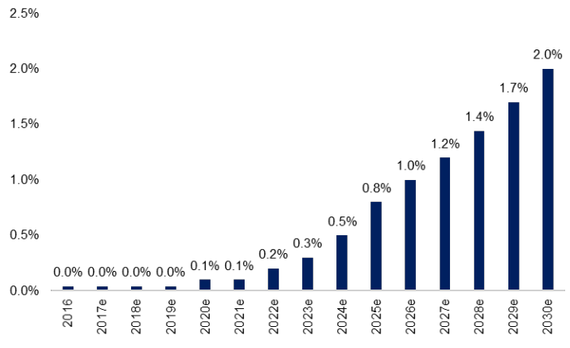
Source: Bryan, Garnier & Co

FIG. 9: EVs COULD BOOST ELECTRICITY CONSUMPTION IN FRANCE AND GERMANY BY 2%-2.5% BY 2030

EVs AS A % OF CONSUMPTION, FRANCE



EVs AS A % OF CONSUMPTION, GERMANY

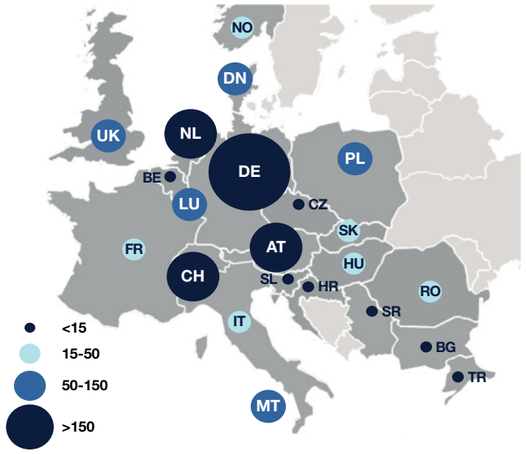


Source: Bryan, Garnier & Co

EDF is using its **Sodetrel** subsidiary and E.ON is leveraging a recently signed partnership with Danish company **CLEVER**. (Figs. 10 & 11). More recently, oil and gas major **Shell** bought Dutch-based company **The New Motion** which is the owner of one of Europe's largest charging networks. It also partnered with **IONITY**, a joint venture between car-makers including **BMW**, **Daimler, Ford** and **Volkswagen**, to deploy ultra-fast chargers on Europe's highways.

FIG. 10: INNOGY IS PRESENT ACROSS EUROPE IN ELECTRIC VEHICLE CHARGING STATIONS…

BROAD COVERAGE OF CHARGING POINTS THROUGHOUT EUROPE WITH A FOCUS ON GERMANY
innogy charging points as of 31 December 2015



Key statistics (2017)
> Overall > 5,400 charging points in > 20 countries
> 470,000 charging transactions
> 4.5GWh electricity charged
> More than 130 (municipal) utility and 50 B2B partner in Germany

Current business model

Provision of state-of-the-art hardware	Operation of own and partner-owned infrastructure	Full back-end solution including access, billing, utilization monitoring etc.

Source: Company Data

FIG. 11: …WHILE ENGIE AND SHELL HAVE SNAPPED UP SEGMENT LEADERS

14 MAR 2017 Engie announces the acquisition of EV-Box. The Netherlands-based company is one of the worlds leading electric vehicle charging services providers with over 40,000 charging stations in service.

12 OCT 2017 Shell announces the acquisition of The New Motion, a Netherlands-based provider of tens of thousands of private and public EV charging points as well as a payment card.

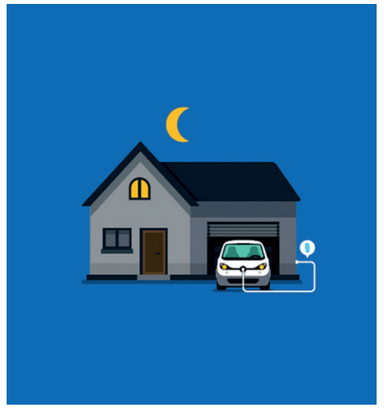
Source: Company Data

The forecast rise in demand also explains why these same utilities are keen to develop cross-selling of products and services between charging stations, as well as new pricing practices. Through its Elec' Car offer, Engie enables users to charge their vehicles during the night at off-peak times for 50% less than the usual peak-time rate, aiming to smooth charging times throughout the day (Fig. 12). By 2030, if the forecast seven million EVs in France were to be charged at the same time in slow-charging mode, this would need over 20GW of simultaneous capacity.

FIG. 12: DEVELOPMENT OF NEW PRICING POLICIES AIMED AT SMOOTHING NATIONAL ELECTRICITY CONSUMPTION

04 OCT 2016 Engie launches Elec'Car, the first electricity tariff for electric vehicle owners in France.

At the 2016 Paris Motor Show, Engie is launching "Elec'Car", a green electricity offer at a competitive price, exclusively for owners of electric or plug-in hybrid vehicles in France. It enables customers to save money by recharging their electric vehicles at home during off-peak hours.



06 OCT 2017 E-On launches the Fixed 1 Year Electric Vehicle tariff in the UK.

This a special dual rate tariff offering a competitive day rate and a night rate that is 33% below the day rate for use when many hybrid and EV owners choose to charge their cars. E,On provides an Economy 7 programmed smart meter free of charge as a necessary part of the tariff.

Source: Company Data

This theoretical 20GW could pose a serious risk to grid stability, notably in the event of new closures or mothballing of peaking power stations or winter temperatures below the seasonal average. The winter peak in France usually stands at around 85-90GW. Stress situations, such as that recorded at the beginning of 2012, have caused consumption peaks of over 100GW, 10-15GW above the usual level.

The anticipated surge in EVs would go hand-in-hand with major developments in storage systems, which could benefit renewables and limit their intermittency. We nevertheless believe that this potential stress on the grid will create the need for increased grid intelligence using demand response solutions and energy management software.

Demand response and EMS will create a smarter grid

WHAT IS DEMAND RESPONSE?

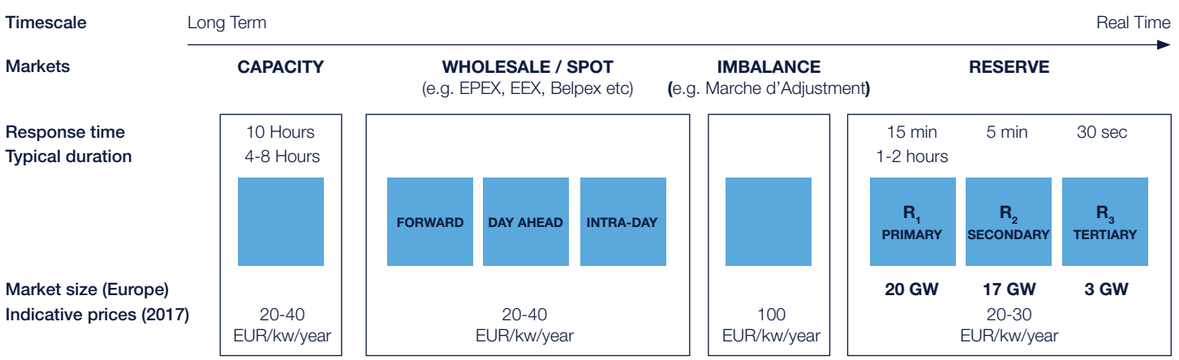
Demand response means adjusting energy consumption rather than production (Fig. 13). Based on demand curtailment, it is geared mainly towards industrial consumers whose electricity consumption can account for 10%-60% of their costs, depending on the sector. New technologies can extend demand response beyond a handful of the largest energy users to a wider base of energy intensive industries. These users are better placed to quickly ease stress on the national grid, because the time taken for a request to translate into a reduction in load can be from seconds to minutes, creating an immediate response to alleviate potential stress. In 2013, Siemens highlighted that demand response initiatives had reduced consumption peaks by around 8% in the interconnected market in the north east of the United States (Michigan, Pennsylvania, Maryland, New Jersey and North Carolina).

In return for reducing their load, industrial players involved are generously compensated for the MW they agree not to use on demand. Specifically, the grid operator pays an aggregator to deliver demand response capacity. The aggregator then pays the users that have agreed to make this capacity available when requested. This is typically compensated based on MW made available on demand, even if they are not actually used.

FIG. 13: DEMAND RESPONSE BUSINESS MODEL

Source: Bryan, Garnier & Co

FIG. 13B: STRUCTURE OF ELECTRICITY MARKETS



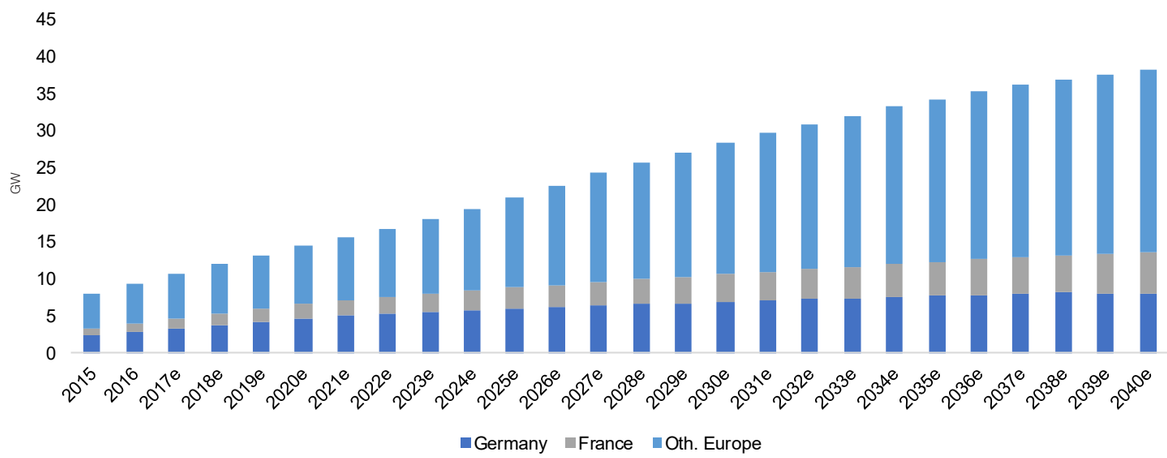
In our view, demand response measures confirm the growing role of software in the energy world. Software is being used in wider applications, including cost reduction through predictive maintenance; using weather forecasting to estimate renewable energy production, helping control the intermittency issue; and fostering a smarter grid where aggregators can liaise with industrial users to minimize demand response times, and where it is generally easier to manage consumption and flows. Although Europe's demand response markets have not yet attained the volumes seen in the US, (particularly in its PJM capacity market), demand response solutions are gradually becoming more mainstream through tender procedures. Additionally, Europe has tended to be more innovative in opening up higher value markets requiring faster response times than the traditional capacity markets, such as the primary and tertiary reserve markets.

In December last year, French grid operator and EDF subsidiary **RTE** announced the results of its demand response tender. Thirteen operators have been selected and are working to make balancing loads available for a total volume of 750MW to 1.4GW for 2017. The capacity can be activated up to 40 times over the year and during all peak hours throughout the day, i.e. up to 10 hours a day, for a price of up to EUR20,700 per MW (source: RTE).

In 2015, global flexible capacity from demand response initiatives stood at around 40GW, around 1% of total capacity worldwide, based on the latest data from **Bloomberg New Energy Finance** (BNEF). Around two-thirds of this capacity is in the US market. BNEF expects demand response capacity to grow around 7.5% per year over the 2015-2040 period, reaching around 245GW in 2040, which is in line with our view. In France, BNEF expects to see linear growth in demand response capacity, reaching around 8GW in 2040 (Fig. 14).

This figure is consistent with current data for the PJM market, where according to PJM and BNEF), demand response capacity is close to 5% of consumption peaks on average, fluctuating between 3% and 6.5% since 2008/2009. As mentioned above, France's consumption peak is around 90GW on average, to which we can add a further 20GW relating to electric vehicles: the 8GW of demand response capacity would therefore represent around 7% of the average French electricity consumption peak.

FIG. 14: ANTICIPATED TREND IN DEMAND RESPONSE LOAD REDUCTION CAPACITY IN EUROPE (2015-2040E)



Source: Bloomberg New Energy Finance (BNEF); Bryan, Garnier & Co

WHICH PLAYERS ARE CURRENTLY OPERATING IN THE MARKET?

We have identified around 10 European players active in the demand response market (Fig. 15). According to BNEF, **REstore** and **Energy Pool** have the largest portfolios (around 1.5GW of flexible capacity).

Over the last few years, Europe's utilities have made a stream of acquisitions in the sector. Engie took a stake in UK-based **Kiwi Power** in 2015 and **Alpiq** acquired **Flexitricity** a year earlier. Last year, **Vinci**, via its subsidiary **Vinci Energies,** acquired **Smart Grid Energy** (SGE), a French start-up specializing in demand response solutions. This year, Centrica acquired REstore, while **Statkraft** invested in **Limejump**.

FIG. 15: KEY DEMAND RESPONSE PLAYERS IN EUROPE

Company	Country	Estimated sales	Flexible MW in the portfolio*
REstore (Centrica)	Belgium	EUR10-15m	1,700MW
Energy Pool (Schneider Electric)	France	EUR30m	1,500MW
Actility	France	EUR15-20m	500MW
Voltalis	France	n/a	500MW
Kiwi Power	UK	n/a	400MW
Flexitricity	UK	n/a	300MW
Smart Grid Energy	France	EUR10m	300MW
Enerdigit	France	< EUR5m	n/a
Entelios (Agder Energy)	Germany	n/a	n/a
Eqinov	France	< €10m	n/a

Source: Bryan, Garnier & Co* Bloomberg New Energy Finance estimates

Towards decentralized production and peer-to-peer energy trading

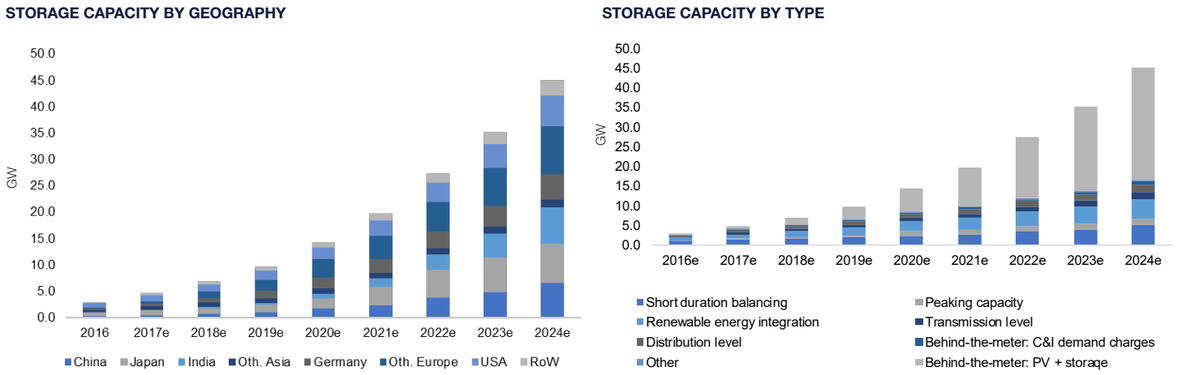
In the future, demand curtailment practices and a more "software-driven" sector are likely to be accompanied by decentralized production models. The increasing use of storage systems could encourage the development of new alternative micro-grids where consumers are also producers, or "prosumers".

In 2016, EDF entered the residential self-consumption arena with the launch of its **"Mon Soleil et moi"** solution, encompassing the sale, installation, use and maintenance of photovoltaic solar panels and home batteries. The same year, E.ON launched **Aura**, a local solar production and storage system followed in 2017 by **Solar Cloud**, which enables producers to store their electricity in a virtual account for later use. More recently, in March 2017, Engie launched a self-consumption solution called **My Power**, which includes PV panel installation and a smart device enabling customers to use around 90% of the electricity they produce. Developments in companies' retail businesses are trending towards self-consumption, but also towards the "smart home" segment, which is likely to see cut-throat competition in a few years' time as utilities, tech companies, electronics specialists and potentially telecoms players all enter the market.

In general, storage capacity is expected to increase sharply in the coming years, driven mainly by a rapid reduction in associated costs. Currently at 4-5GW (worldwide), this capacity could increase 10-fold by 2024 according to BNEF. Particularly strong growth is expected in Asia (+50% CAGR in China and +80% in India over the 2017-2024 period) and Europe (+40% CAGR in Germany and +34% in the UK over the 2017-2024 period) (Fig. 16).

These growth trends are likely to be fuelled mainly by the residential solar market in Europe and Asia, where growth in energy storage applications could exceed 60% over the next 10 years.

FIG. 16: STRONG GROWTH EXPECTED IN STORAGE CAPACITY, DRIVEN BY THE RESIDENTIAL SOLAR MARKET

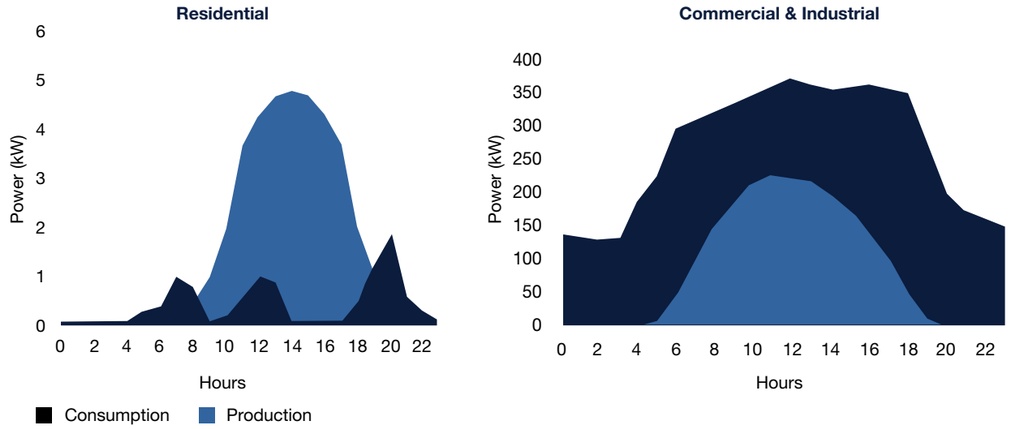


Source: Bloomberg New Energy Finance (BNEF); Bryan, Garnier & Co

Applications for commercial and industrial (C&I) players are likely to remain more marginal, other than in North America, where BNEF estimates they could reach around 10% of local storage capacity.
We believe this is a cautious view, for three reasons:

- The large size of industrial sites could favour the installation of larger-scale solar roof panels
- The consumption profile of industrial players could be better suited to the production profile for solar energy (Fig. 17)
- Commercial and industrial (C&I) players are increasingly focusing on renewables, notably in the US, where corporate PPAs are now commonplace.

FIG. 17: THE CONSUMPTION PROFILES OF CONSUMER AND INDUSTRIAL PLAYERS ARE WELL-SUITED TO SELF-CONSUMPTION PRACTICES (E.G. HYPERMARKETS)

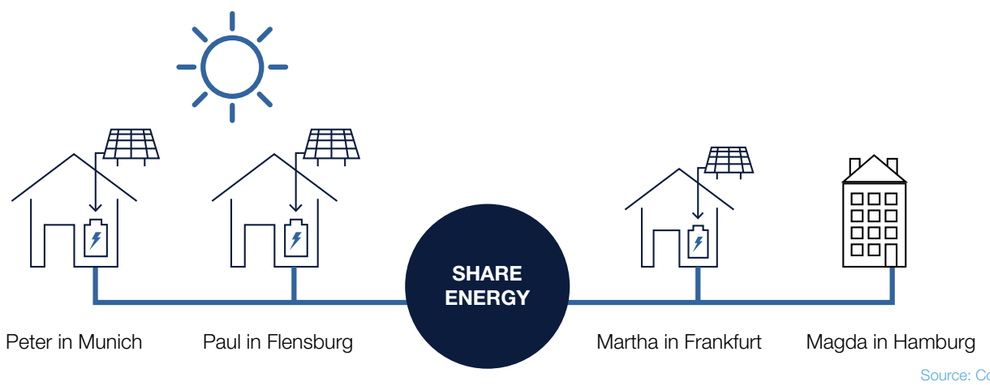


Source: GreenYellow, the renewable energy subsidiary of French retail group Casino

Looking further ahead, we could also see the development of peer-to-peer energy trading, where a decentralized producer sells part of its production surplus through a virtual platform – such as the one launched by Germany's **Sonnen** as part of its **SonnenCommunity** concept (Fig 18) – to consumers located near the production centre.

This approach enables suppliers to meet immediate consumption needs locally and helps to gradually reduce congestion in the national grid. Some such initiatives have already been launched, notably in the US, where they are used together with blockchain technology in order to guarantee that transactions between individuals are secure and to avoid the need for intermediaries. Energy trading communities represent a significant threat to established power producers that have historically thrived on the centralized generation model and are, as such, a call for these players to adapt and evolve.

FIG. 18: AN EXAMPLE OF ENERGY TRADING COMMUNITIES: SONNENCOMMUNITY



Source: Company Data

3: Conclusion

In the long term, we believe that sector digitalization should improve the growth profile of Europe's utilities. We've seen that Southern Europe has already caught the renewables wave and that France and Germany need to catch up. In the UK, Netherlands and the Nordics, we have seen a cautious embrace of new digitalization technologies. The US is already ahead in many areas, such as demand response in the capacity market, and peer to peer trading, its hungry tech giants are eyeing the data rich energy sector with great interest. The key digitalization trends – BigData, IoT, EVs, management of supply and demand and storage solutions – are also paving the way to a decentralized market, in which established players are taking their first steps.

However, we do not believe that decentralized production practices – "behind the meter" – will become predominant yet. Instead, we see them being used alongside traditional models with the aim of reducing congestion in national grids, which will be affected by the growing use of EVs and increasingly intermittent production capacity as growing renewables impact peak capacity.

In our view, Engie, E.ON, Enel, Centrica and innogy seem to be particularly well placed with respect to these digital and innovation themes, with developments in new mobility practices, smart grid applications and self-consumption models, especially in the residential sector. We believe that these initiatives will continue in the coming months and years via new acquisitions and new partnerships. An example is E.ON's recently announced partnership with Google, in which it aims to optimize its solar installations using Google's expertise in data analysis and processing. More extensive organic development is also likely.

EDF has been less active on the acquisition front, although it has acquired equity stakes and invested in **Actility** (via the **Electranova** fund in 2012), **Enlighted** and **Forsee Power**. However, its R&D budget exceeds that of its direct competitors by far (Fig. 19).

FIG: 19: R&D SPENDING IN 2016

innogy	EUR149m
E.ON	EUR14m
EDF	EUR572m
Engie	EUR191m
EnBW	EUR37m
Iberdrola	EUR211m
Fortum	EUR52m
Vattenfall	EUR53m

Source: Company Data; Bryan, Garnier & Co

Fig. 19 presents the various initiatives launched by prominent utility sector players. The chart includes acquisitions (Belectric for innogy and EVBox for Engie), minority stakes **(Total/Xee)**, and organic development (self-consumption practices at Engie or EDF). It is not intended to be exhaustive, but aims to highlight the proliferation of digital initiatives across the sector and the fact that major utilities, especially in Northern Europe, have firmly grasped the challenges involved in the revolution that's starting in their industry.

For Europe's utilities, digitalization is more opportunity than threat – provided they can move fast enough.

FIG. 20: DIGITAL INITIATIVES BY MAJOR UTILITIES

ENGIE Fab
mypower energy for living
Vertuoz
ENGIE
IoT
EVBOX
blu.e
OPTERRA ENERGY SERVICES
ecova
KiWiPOWER demand management
GreenCharge
Retroficiency

lemonbeat
RWE
innogy
ecova
KIWIGRID CONNECTING ENERGY
BHC ENERGY
powerhouse
DESIGNETZ VERBUNDEN MIT KREATIVER ENERGIE
FRESH ENERGY
BELECTRIC
bit.B brings insights to business

GAS, RENEWABLES AND POWER

TOTAL
eren GROUPE
Xee
Lampiris
KONARKA
GreenFlex
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saft

E.ON Connecting Energies
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E.ON Aura
e·on
CLEVER
IMS Connected car solutions for life.
matrix
better place

centrica Business Solutions
HIVE
centrica
Panoramic POWER
NEAS ENERGY
REstore
alertme
ENER-G

enel X
enel
ENERNOC
BESS
DEMAND energy

sowee
Linky
EDF
enervee
Imtech
store & forecast GROUPE EDF
Soleilenligne Suivi de votre production solaire
EDF renewable energy
futuren

Logos above the highlighted utility are in-house initiatives. Logos below the utility are investments, acquisitions and partnerships.

FIG. 21: ACQUISITION OF RESTORE BY CENTRICA

REstore

Acquired by

centrica

€70,000,000

November 2017

Sole Advisor to the sellers:

BRYAN, GARNIER & CO

SUMMARY OF RESTORE

Europe's leading demand response and VPP player with advanced software for energy management. Winner of several reference awards Algorithm-based optimal monetization of flexible capacity for commercial and industrial customers, built on a deep IP portfolio Capabilities extending beyond demand side reduction to storage management and energy IoT.

TRANSACTION HIGHLIGHTS

Tightly managed competitive process with sale at benchmark multiple and on favourable terms achieved within six months of going to market.

"We selected Bryan, Garnier & Co based on their track record, network and ability to realize upside potential on transactions. Bryan, Garnier & Co played a fantastic role in our search for the ideal strategic partner. They were able to combine their established experience and relationships in energy with an ability to demonstrate how transformative our software technology and intellectual property could be for the industry."

Jan-Willem Rombouts, co-CEO, REstore

BRYAN, GARNIER & CO

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Corporate Transactions: Smart Energy

Bryan, Garnier & Co leverage in-depth sector expertise to create fruitful and long lasting relationships between investors and European growth companies.

REstore	tado°	coronis SYSTEMS	voltalia	McPhy energy
Acquired by centrica	Private Placement INV/E/N CAPITAL CEZ GROUP SIEMENS	Acquired by elster	Initial Public Offering Euronext Paris Private Placement CORIS une société april	Initial Public Offering €32,000,000 Secondary Placement €8,000,000
€70,000,000	€45,000,000	Undisclosed	€115,000,000	
Smart grid technology	Consumer IoT	Sale Advisor	Joint Lead Manager and Bookrunner	IPO Lead Manager & Bookrunner and Placement Sole Manager
Advisor to the Sellers	Sale Manager			

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