DISTRIBUTED INTELLIGENCE: EMBEDDING THE CONSUMER IN THE ENERGY EQUATION AND POWERING THE FUTURE

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Managing the rapidly diversifying energy landscape has never been more challenging than today. Look no further than the current energy price crisis to see why – utilities are battling not only against the elements, but also an aging infrastructure that does not yet permit us to fully wean off fossil fuels or take advantage of more consumer-centric approaches.

The simple truth is that renewable energy sources are much less reliable in the face of extremes than gas and coal, as the year 2021 has shown us. In September, UK wholesale energy prices surged to a record-breaking £2,500 per megawatt hour due to a long period of low wind speeds. The same phenomenon was responsible for another spike in November, a spike of £2,000 MWh between peak hours. Both times, the National Grid was forced to call on coal-powered plants to make up for the dip in power generation. And this is just low wind. Strong gales, floods, earthquakes and serious natural disasters all pose a threat to the grid. Indeed, a recent Itron Resourcefulness Report, found utility executives consider the impact of disasters (88%) and integrating renewables (86%) two of the biggest concerns about the energy grid today.

This volatility ultimately translates into power outages, frustrations and higher energy prices for the consumer – a backwards outcome, considering the fact that the role of consumers in energy management is fast-changing.

CONSUMERS ARE BECOMING ACTIVE PARTICIPANTS IN ENERGY GENERATION

Consumers are now taking their fair share of renewable energy generation, most commonly through installing solar panels on their roofs. It is then perhaps not surprising that solar PV is expected to be responsible for over half of all new renewable energy generation in 2022. Where new trends emerge is how these consumers are encouraged to share what they generate.

Today, one in six utilities use customer-generated power, and the use cases are growing. Adding to this, there are now various government schemes that incentivise consumers to help stabilise the grid. For example, the UK government' Smart Export Guarantee pays households to feed excess solar energy back in to the National Grid at a time of need. And it's not just solar PV – UK households are filing a record number of applications for batteries, potentially tripling the UK's battery storage capacity (1.3GW to 4.5GW) by the end of 2022 and giving the grid a chance return to the equilibrium 50GHZ during peaks and troughs.

Besides solar panels and batteries, one of the most significant ways consumers can help stabilise the grid is through their electric vehicles (EVs). Modern electricity monitoring and metering technology will turn EVs from a thing you drive, to a thing you can derive energy from. But before we get there, we must first overcome the challenge of integrating EVs into the grid at scale – a concern for 85 percent of utilities.

THE EV CONUNDRUM

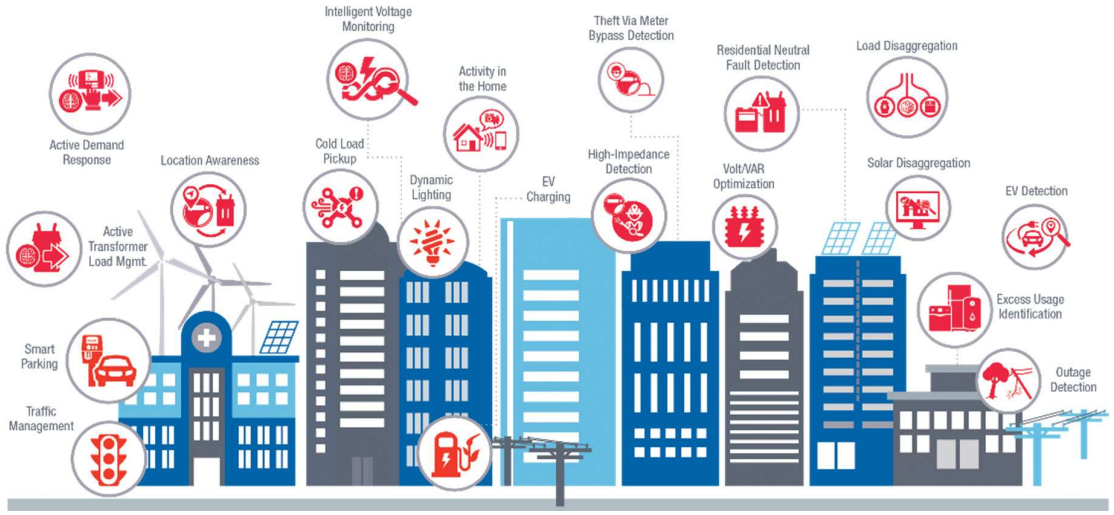
We know even boiling kettles during the World Cup final can wreak havoc on the grid. At the end of the famous 1990 World Cup Final, millions of Brits reached for their kettles, generating a whopping 2,800MW surge in electricity demand. Even today, the National Grid must prepare for half-time kettle-boiling and light switching. Now imagine what happens when five commuters in a cul de sac all plug in their EVs at the same time after a day of work – day after day, including on match days!

Luckily, new EV trials are providing a window into future energy cooperation. In the recent government-backed Smart Metering Innovation for Load flexibility (SMILY) field trial, the latest generation of SMETS2 meters were put to the test to help utilities take control of EV charging schedules, harmonising them to the most optimal times from the grid's point of view.

As one of the participating organisations, we were able to see first-hand how modern smart metering technology was able to incentivise and produce collaboration between users and utilities to keep the grid balanced. By the end of the trial, 76 percent of participants became comfortable with their energy supplier remotely controlling the charging of their EVs (at the start this was 60 percent) and the same rate expressed interest in learning about the impact of their EVs.

WHERE DO WE GO FROM HERE?

There is a clear shift in consumer attitudes that utilities need to pay attention to and take advantage of. With the growth of consumer appetite for insight – be that on how energy



There are infinite possibilities created by edge computing and distributed intelligence that can support the future direction of the utility business model.

is spent or how they can monetise their energy generation – comes the demand of action and innovation.

The proliferation of technologies has already resulted in a complex low voltage network that provides charging for EVs and hybrids, solar and smarter meters dotted alongside the edge of the energy network. As we see the demand for smarter energy management solutions rise, power generation will increasingly move from a centralised to a distributed model. This, combined with the complexity of the network means that, in order to keep the grid stabilised, command and control of the electric grid will also have to become more decentralised, and more capable at the service point and at the distributed generation plants.

There is no escaping the fact that utilities will now have to re-imagine their business models and move energy management solutions closer to the where problems occur. As the industry moves towards a reformed business model of data-driven and performance-based initiatives, a new technological framework comprised of distributed intelligence and edge computing will emerge.

THE PROMISE OF DISTRIBUTED INTELLIGENCE

Distributed intelligence applies analysis, decision making and action where it is best utilised for the most valuable outcome. It enables utilities to manage rapidly changing conditions locally, providing significant improvements to outage detection and analysis, distribution connectivity modelling, fault detection, theft detection, transformer load management, renewables integration, EV integration and multiple innovative consumer services.

At the heart of this reformed model is two-way communication. In the current infrastructure, a transformer can communicate supply to an EV charging point, but the charger cannot feed supply back via the same route, nor can its energy be used to power the local environment such as the home or other buildings. Under distributed intelligence, sensors, meters and IoT equipment can all communicate with each other to compare information and status. Devices can then create a bee-hive effect where one device can tell another device that something is occurring, and the other device can validate and pass that information on to a third device. This real-time peer-to-peer communication enables the network to self-correct faster, for example by controlling high loads locally or keeping the lights on during natural disasters.

Beyond improving grid efficiency, reliability and safety, distributed intelligence is also a business imperative, since customers will reward utilities that can provide fast or preventive action with their loyalty. With the complexity of the information provided, and the broad nature of the solution, having an open and vibrant ecosystem of solution providers will create more opportunity for the consumer to capture the value from this technology shift, while simultaneously enabling utilities to begin the development of advanced solutions that meet the needs of future smart cities.

CHANGE IS NOW UNDERWAY

Since the beginning of recorded time, armies and societies that have distributed decision making and action closest to the problem, closest to the battle have prospered over their centrally bound rivals. It is only now that these same concepts can be applied across our networks and edge devices. This is a broad, complex set of challenges that requires a long-range vision and technology that can enable management of distributed assets across multiple domains.

The good news is that the proof points are already here and the technology already exists to start making this vision a reality. Forerunners include Florida Power and Light, which currently runs advanced metering, distribution automation and over half a million of smart streetlights that adjust light levels based on motion or presence levels, all on the same multi-application network. And the utility industry as a whole is making strides in aftermarket services – for example, by retrofitting non-communicating devices with IoT edge routers – and in consumer services, providing open platforms through the latest generation of smart meters.
The future of energy management is distributed and intelligent. To reach this point of technological maturity before it becomes a question of playing catch-up, providers and governments must re-evaluate their strategies today, devise new systems and spur innovation that leverages advanced analytics in the context of local environments, local communities and most importantly, consumers. **www.itron.com/emea**