Vendor Ecosystems to Optimize the Smart Grid

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1.1 The Energy Transition is Well Underway

By 2030, Navigant Research projects that the future utility value chain will have transformed significantly. Many utilities have already embarked on their transformation journey, and the cycle of disruption appears to be accelerating. Utilities are considering new energy-based services that are contrary to the traditional supply-based model, where customers are helped to reduce their power consumption. Distributed energy resources (DER) present utilities opportunities (such as new revenue streams and business models) and threats (in the form of competition and the risk of irrelevance).

Energy services will be built around customers' different needs and requirements. These vary from simple energy efficiency programs, to the provision of distributed generation and storage or EV recharging stations, through to the aggregation of DER for grid management services or transactive energy platforms.

For some, the future is already here: almost daily, there are announcements of this shift to service-based business models. An increasing number of European utilities—including British Gas, ENGIE, and Eneco—have publicly stated that there is more value in helping customers cut their energy consumption than there is in supplying it. Italian giant Enel has gone one step further by acquiring energy service company EnerNOC. UK-based OVO Energy has launched a service where it will charge Nissan LEAF EVs for free, in exchange for the use of the EVs' batteries in grid balancing services. In a similar vein, battery manufacturer sonnen launched its sonnenFlat product in Australia, a solar and storage package that guarantees any householder's excess power requirements will be provided for free, as it aggregates its DER to offer grid services.

One of the most interesting developments of recent times is the profusion of transactive energy trials, where solar owners can sell their excess power into local markets. The Brooklyn Microgrid project is a leading example of transactive energy. Trials are underway across the US, Europe, and Asia Pacific. While nothing has extended beyond small-scale trials at present, transactive energy could offer significant benefits to customers.

1.2 The Energy Transition Will Have a Significant Impact on the Existing Value Chain

The energy market's future will be cleaner, more distributed, and more intelligent. This will have a significant impact on the existing energy value chain. Some of the biggest changes include:

- **Customer centricity:** Whereas in the past centralized generation dominated the value chain, in the future, customers will be the focus. Energy services require a better understanding of individual customer needs than basic energy supply. By gaining insights into customers' behavior, requirements, consumption patterns, and preferences, more tailored services can be designed.
- **Volatility and dynamism in distribution networks:** Current distribution networks were not designed with these kinds of services in mind. Instability increases with every new DER

installation. As a result, distribution utilities will have to invest in technologies that first improve visibility into distribution networks, then bring management and control.

- **All sources and loads have a value:** A result of this increased visibility is the ability to value all sources and loads connected to a network. If value can be attributed to all sources and loads, pricing signals can be used to manage volatility before loads are shut down.
- **Reliance on technology:** All these services rely on connected devices and the data they create. Future network connectivity models—which will extend into customer premises—will not just represent how devices are connected physically to the grid, but also how they connect to communications networks and where this data is stored for future analysis.

1.3 New Business Models Will Require New Technologies

This future breaks the existing linear value chain and causes significant disruption to current energy suppliers and network managers. Navigant Research anticipates that by 2030, existing distribution network operators will have transformed into distribution service orchestrators responsible for far more than just network operation. Likewise, the current energy supply business—already transitioning to a service-based model—will be fully transformed into energy service providers (ESPs) model, where companies will offer end-to-end energy services that have little in common with today's volume-based approach to revenue generation.

These new business models will require new IT infrastructure, which relies heavily on the analysis of huge volumes of data. Distribution orchestration platforms will rely on the integration of existing advanced distribution management systems (ADMS) and DER management software, as well as the incorporation of a market pricing mechanism to reflect the changing value of millions of connected endpoints throughout the day.

For example, distribution utilities currently use ADMS to monitor and control their networks. However, the reach of these systems is limited to just the most valuable assets, and visibility tends to decrease in the lower voltage parts of the network. If all sources and loads have value, a utility must have visibility of them. DER management systems (DERMS) have been developed to manage DER, but at present DERMS run alongside ADMS. For future requirements, DERMS will likely be a core part of ADMS, as will automated demand response management systems and real-time market signalling.

The service-based business models of the future ESP will similarly rely heavily on new technologies. These services will optimize customers' investments in DER, providing a balance between comfort and profits. ESPs may act as aggregators, or work closely with third parties such as community energy programs. ESPs will also be an important sales channel for connected devices into customer premises beyond the meter. One of the biggest challenges facing an ESP is to develop a platform that records transactions for individual customers and has billing and settlement functionality.

1.4 To Maximize Value, New Technologies Need a Robust Architecture

It is no easy task to develop these new products, services, and business models. Any company that makes this transition will need to set out a detailed strategy roadmap. One cannot simply acquire a digital transformation or launch new services overnight. A utility's transformation to a digital, service-based business model will be delivered by a large ecosystem of vendors, and each transformation will be

tailored to each utility's specific needs. This transition will be delivered by technologies that are essentially a series of Internet of Things (IoT) solutions. Figure 1 depicts the technology stack that will underpin the utility transformation.

It is important to remember that there is widespread heterogeneity across this technology stack:

- Devices are manufactured by different vendors, each of which will operate in different parts of the value chain
- Multiple communications technologies are used, often using different data standards, which can affect interoperability
- The devices are procured and deployed by different stakeholders: a homeowner will buy their own smart thermostat; a utility will deploy and own a smart meter
- Data is stored in different locations, and access is often restricted
- Devices will be valued differently depending on their function, use case, and location
- Regulators will have different approaches to new technologies; what works in one market may be banned in another.

Figure 1 Heterogeneity of IoT Services Across the Utility Value Chain

	SMART GRID	SMART METERING	SMART HOME
PRODUCTS AND SERVICES	DER aggregation, demand response, grid management	Billing, consumption analytics, loss prevention, customer experience management, transactive energy	Energy efficiency, remote energy management
APPLICATIONS	ADMS, DERMS, ADR	Smart metering, transactive energy platform	Building energy management, customer engagement
DATA STORAGE	SCADA historian, on-premise	On-premise	Private cloud, third-party cloud
COMMS	SCADA networks	Smart meter comms: radio, PLC, cellular	Broadband, Wi-Fi, Zigbee, Zwave
DEVICES	PMUs, RTUs, smart reclosers, sensing	Smart meters, EV charge points	DER, thermostats, smart building sensors and controls, smart appliances

(Source: Navigant Research)

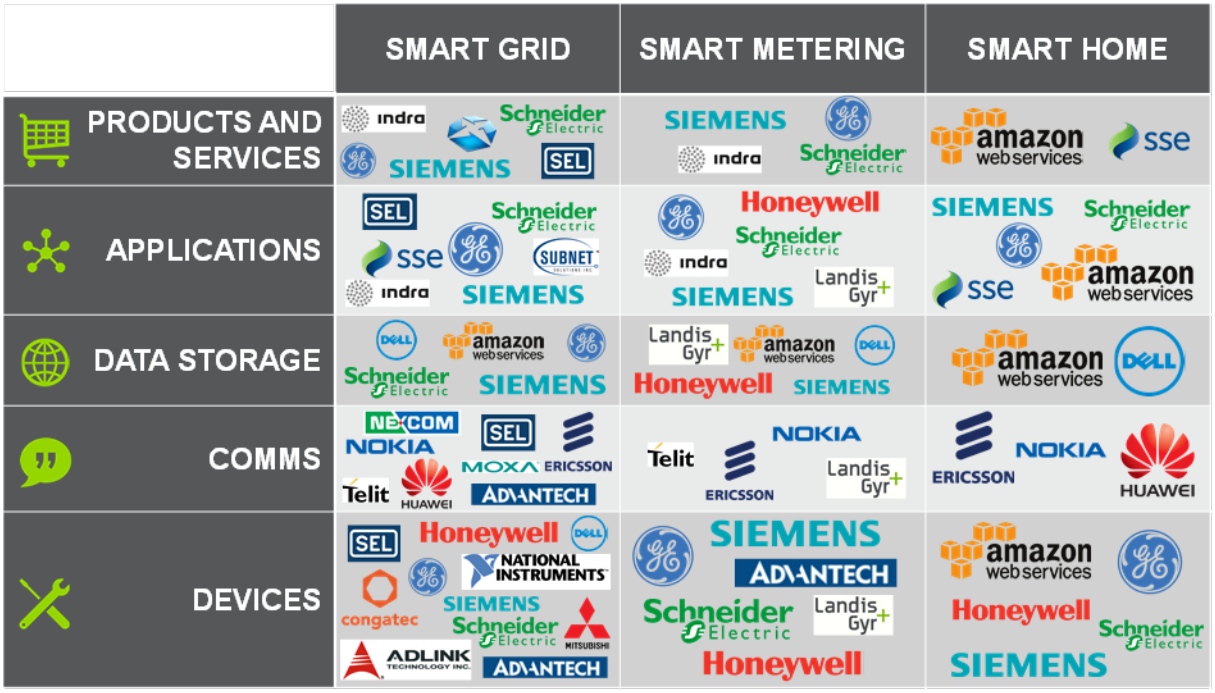
A project's success will rely on—among other things—the insights provided by the analysis of IoT data, often alongside other data sources. This analysis can drive operational excellence. For example, improved sensing and remote diagnosis can vastly improve incident response times—predictive maintenance programs, customer energy efficiency programs, and much more. However, with such heterogeneity across IoT solutions, it can be difficult to align this data without first planning a robust

architecture across the different technology areas or investing in a platform that supports a company's wider ambitions.

1.5 Utilities Must Partner with a Strong Vendor Ecosystem

In practice, all utilities will rely on an ecosystem of providers to help deliver the technology infrastructure that will drive the industry's digital transformation. Many vendors are collaborating to develop their own partner ecosystems, bringing complementary products and services to market. At the recent European Utility Week exhibition in Amsterdam, processor manufacturer Intel showcased some of the partners participating in its ecosystem. Intel is in a unique position to enable a broad ecosystem of partners. Microprocessors are used across the entire technology stack, from thousand-dollar smart grid devices to simple smart home equipment. It comes as no surprise that Intel has a partner ecosystem delivering products across the value chain.

Figure 2 Intel's Partner Ecosystem



(Source: Navigant Research)

The 2017 European Utility Week hosted more innovative new products and services than ever before. Software vendors, rather than hardware providers, were in the majority. Given that the pace of innovation is increasing, utilities will find it harder to manage the digital transformation. They will increasingly rely on partner ecosystems, such as Intel's, to deliver the products and services of tomorrow.

As part of overall strategies, Navigant Research recommends utilities not only map vendor capabilities to their own requirements, but also understand the interrelationships among different vendors. While some vendors may offer attractive standalone products, a lack of partnerships might expose hidden data sharing and interoperability weaknesses. Buying products from groups of vendors that cooperate in both

formal and informal partnerships can help address inherent problems of future incompatibility, technological obsolescence, and vendor lock-in.

For more information, readers are encouraged to listen to the recording of a recent webinar[1] in which Intel discussed how its partner ecosystem was helping deliver the energy transition. The webinar discussed the energy transition and how it transforms business models away from supply toward technology-based services. However, the profusion of devices and the data these devices create must be managed through a number of Energy Cloud platforms, which will be delivered by multiple vendors.

[1] Stuart Ravens, Dean Samara-Rubio, and Prithpal Khajuria, *Technology Trends at the Grid Edge,* Navigant Research and Intel, https://www.navigantresearch.com/webinar/technology-trends-at-the-grid-edge.

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