Accenture's Digitally Enabled Grid Research Program

The charge for change

Powering distribution businesses for the energy transition

Executive Summary

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The energy transition is accelerating, with major impacts for the entire utilities value chain. Distribution businesses are being propelled toward a future driven by several external factors: increased distributed generation (DG), growing demand, more active customers, the electrification of transport and heat, among others. There are tremendous opportunities for distribution, not only for their business, but also to help lead the charge in the journey toward a net-zero future for all.

However, with these opportunities come multiple risks. At some point—most distribution businesses believe within the next decade—the deployment of new low-carbon energy technologies will cause a tipping point to occur, potentially causing an extreme level of disruption to operations.

Amid the impending disruption, the industry finds itself ill-prepared to respond. For example, most of the 250 distribution utility executives we surveyed as part of our global Digitally Enabled Grid research believe their existing networks will be unable to cope with the expected volume of EVs hitting the roads over the next 10 years. Other factors will also bear down on the industry. More than half of our respondents find themselves unable to predict and respond to cybersecurity threats, extreme weather events or regulatory changes.

However, there are actions this utilities can take now as they work toward addressing this uncertain future. Data will be the critical foundation on which to build the necessary visibility to manage and control future stresses on the grid. And innovation and digital technologies will need to be strategically applied to build the network system architecture that will define future success. More automation is essential. And increased agility will help more effectively deliver all new solutions to the grid at scale.

Delivering the data-driven, intelligent distribution system of the future is necessary for the industry itself, but also puts distribution utilities in a leading role in the larger energy transition.

84%

of the 250 distribution utility executives surveyed as part of our global Digitally Enabled Grid research agree that electricity distribution businesses will have to manage growing business uncertainty over the next five years.

Distribution in disruption

The energy transition is an unstoppable force of disruption. It creates opportunities for distribution businesses but, for the unprepared, it presents significant threats. The move to a net-zero future is driving deep structural changes to how energy is generated and consumed, and significantly increases risks to distribution network management. More renewable energy sources will connect directly to distribution networks. We will see prosumers switch between dispatching and drawing power, depending on weather and market conditions.

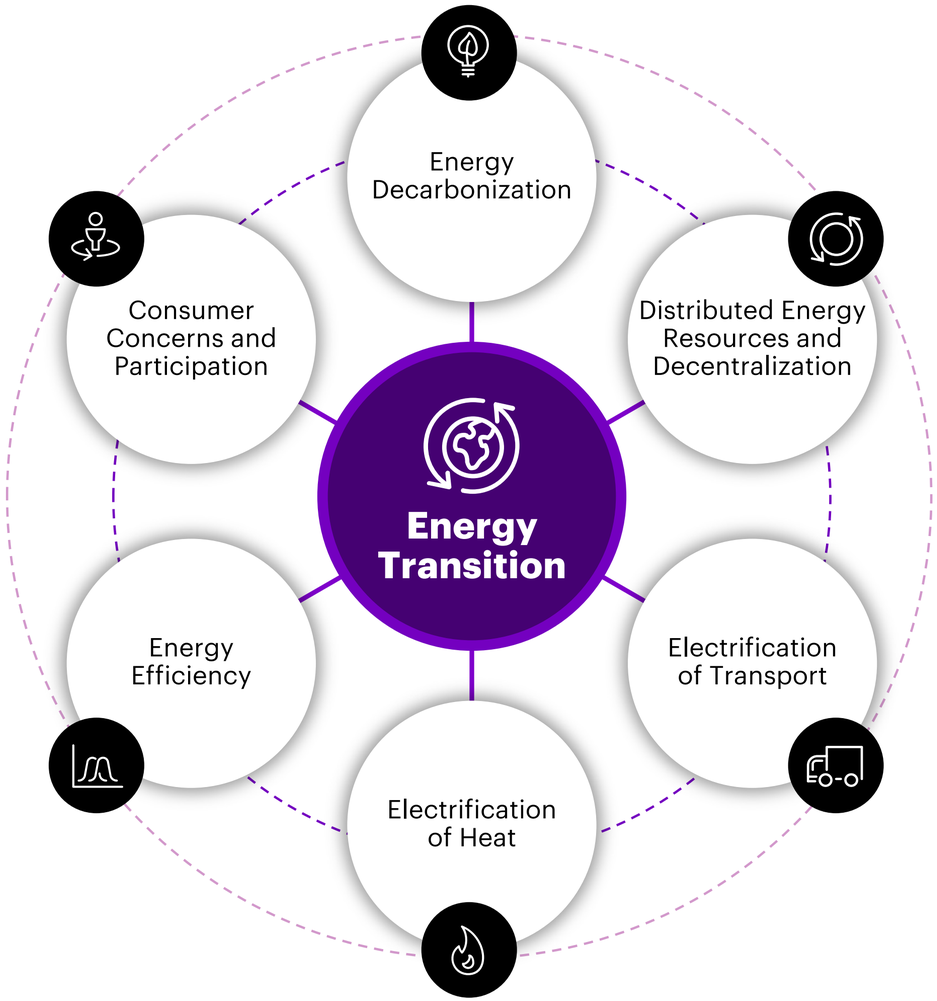
And while electric vehicles (EVs) and space heating create new load-growth opportunities, they could put huge strains on existing networks. For a business that has historically not experienced significant change in half a century, the energy transition means fundamental change for distribution.

There is great potential for distribution businesses to generate new value from the energy transition, although this will differ depending on region and regulatory model. They can expand their regulated asset base, in some cases creating new products and services—including driving efficiency from the purchase of newly defined flexibility services—and collaborate more with other parts of the value chain. They can redefine the nature of network management by using data to drive operational improvements and create new and innovative roles for employees—especially the next-generation workforce.

New regulatory and policy frameworks for low-carbon technologies are driving many of these changes, so closer collaboration with regulators will be critical to help craft the role of distribution during this transformation. Most of all, distribution operators will be called on to continue their remit of delivering safe, affordable and reliable power to customers as the energy transition unfolds.

The shift from centralized to distributed generation (DG) puts distribution networks at the center of the electricity system. Some utilities are already piloting the sale of balancing services to the transmission system operator (TSO) to support system stability. As DG penetration grows, active operation of the distribution system and visibility into connected distributed energy resources (DER) will become vital for stability.

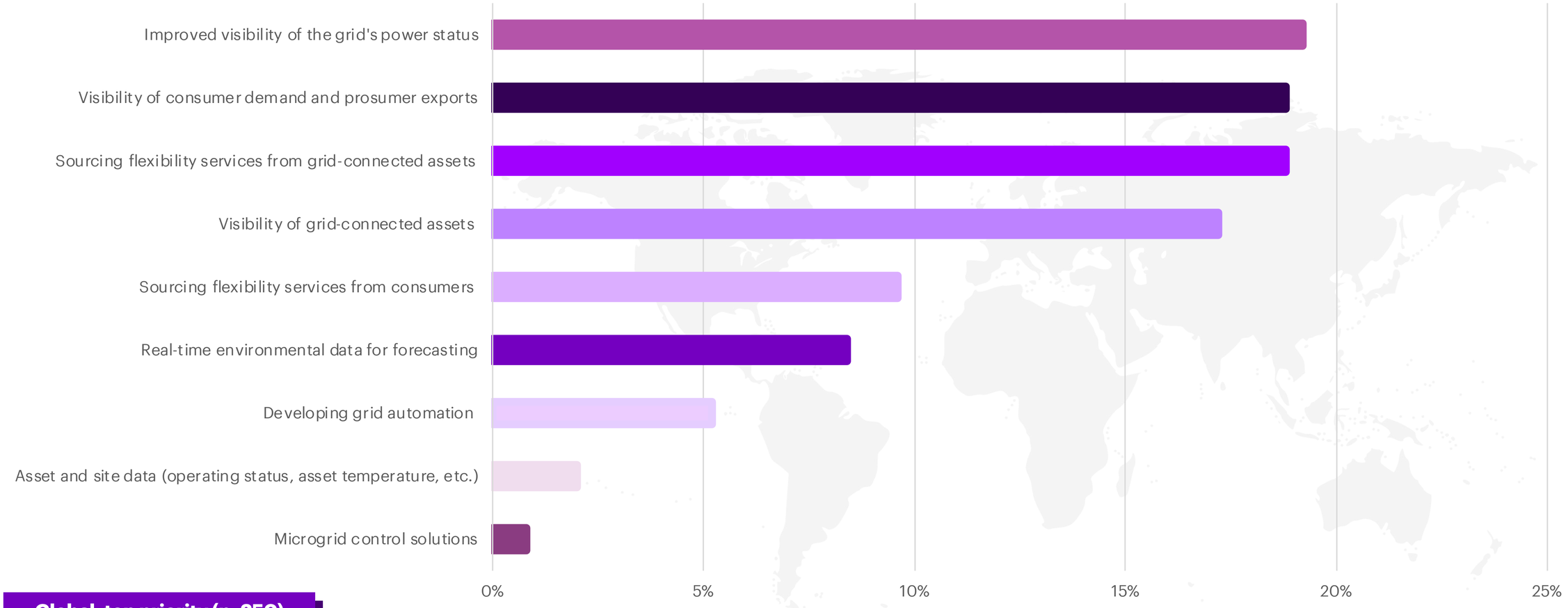
Key external trends driving the energy transition.



Distribution executives' priority areas for delivering flexibility are focused on improving visibility.

Revenue growth will increasingly be tied to opportunities from transition-related new assets and services. As part of the push to develop flexibility capabilities, 88% of survey respondents are looking to extend assets or services, at least moderately, to support a more flexible system over the next five years. Half are planning to significantly extend energy transition-related assets or services within that time frame.

What are the priority areas for delivering increased flexibility into distribution operations over the next five years? Global dataset:



Global, top priority (n=250)

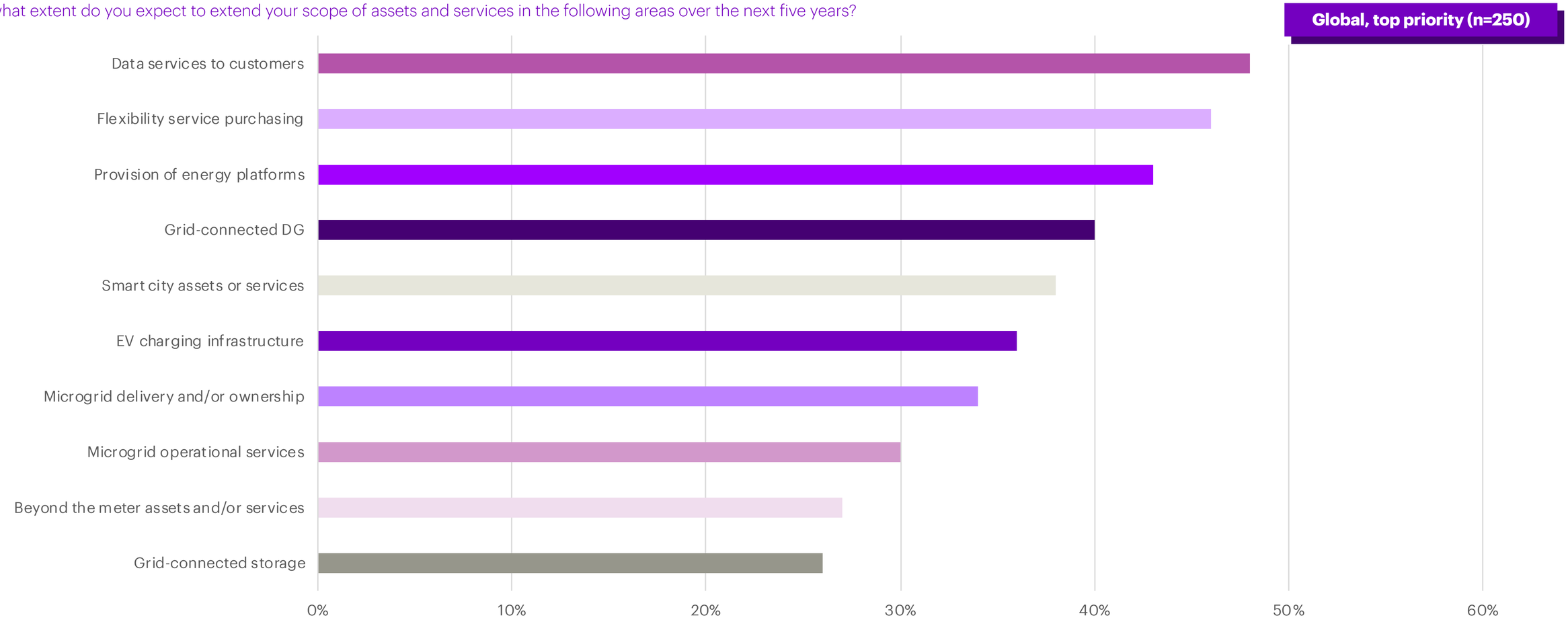
Source: Accenture's Digitally Enabled Grid research program, 2021 executive survey.

Executives are looking to extend assets or services, at least moderately, to support a more flexible system.

In some geographies—particularly in Europe—regulatory changes are progressively squeezing value from the traditional asset-ownership distribution business model, forcing distribution businesses to rethink their roles. One option is to become a distribution system operator (DSO), with an increased focus on enabling flexibility and optimization across the grid. New, platform-based business models will be developed, where the DSO controls energy flows and acts as the key data facilitator for the electricity system. The DSO model relies on innovation for the cost-effective delivery of the energy transition, system-wide efficiency and amplifying choice at speed to all users.

The DSO role represents one just one approach to the significant transformation of existing, asset-focused models. No matter what new model is chosen, evolution will be continuous. New capabilities such as flexibility sourcing will be developed in conjunction with the enhancement of existing capabilities like asset management and system operations.

To what extent do you expect to extend your scope of assets and services in the following areas over the next five years?



Source: Accenture's Digitally Enabled Grid research program, 2021 executive survey.

Tipping point threats

While the transformation to new business models will be progressive, the energy transition is anything but linear. Only so much DER can be deployed before a tipping point triggers significant disruption to operations. More than three-quarters of distribution executives (78%) expect the energy transition to trigger such a tipping point. And operations are already being impacted: All respondents note that they are already experiencing some form of energy transition-related disruption, with three-quarters saying the impact has been significant. Worldwide, the majority of respondents believe this tipping point will be caused by DG.

Preparation for the imminent arrival of these tipping points is critical. The many unique deployment characteristics for low-carbon technologies mean that, even within as little as a year, localized DG deployments could trigger a tipping point in parts of a distribution network. Other activities may take three to five years, or up to 10 years.

DG deployments will be uneven across a distribution network, making them difficult to manage. Significant clustering of low-carbon technologies—particularly prosumer PV and EVs—will occur, driven by the grouping of building types and demographics. And distribution utilities must be ready to respond or risk facing unforeseen, localized stress on the network.

For example, 72% of survey respondents believe that EV growth will be more rapid than the speed at which necessary grid capacity can be built to accommodate them. This figure rises to 85% in Europe, reflecting the greater deployment to date in many European countries and the particular challenges of densely packed cities. Distribution businesses will need smart approaches to manage EV loads to avoid grid overload. Constraints on charging behavior and pricing incentives are likely, but if these tools are overused and customers severely inconvenienced, the backlash could be severe.

The risks of doing nothing are significant, endangering a distribution business's operations, reputation and ability to comply with regulations. This level of uncertainty would be alleviated by the evolution of regulatory frameworks to support network resilience to the energy transition and other risks. However, most respondents (80%) believe regulators are waiting for distribution businesses to propose innovative models that incentivize flexibility.

86% of distribution utility executives think their business will reach the tipping point of disruption within the next decade.

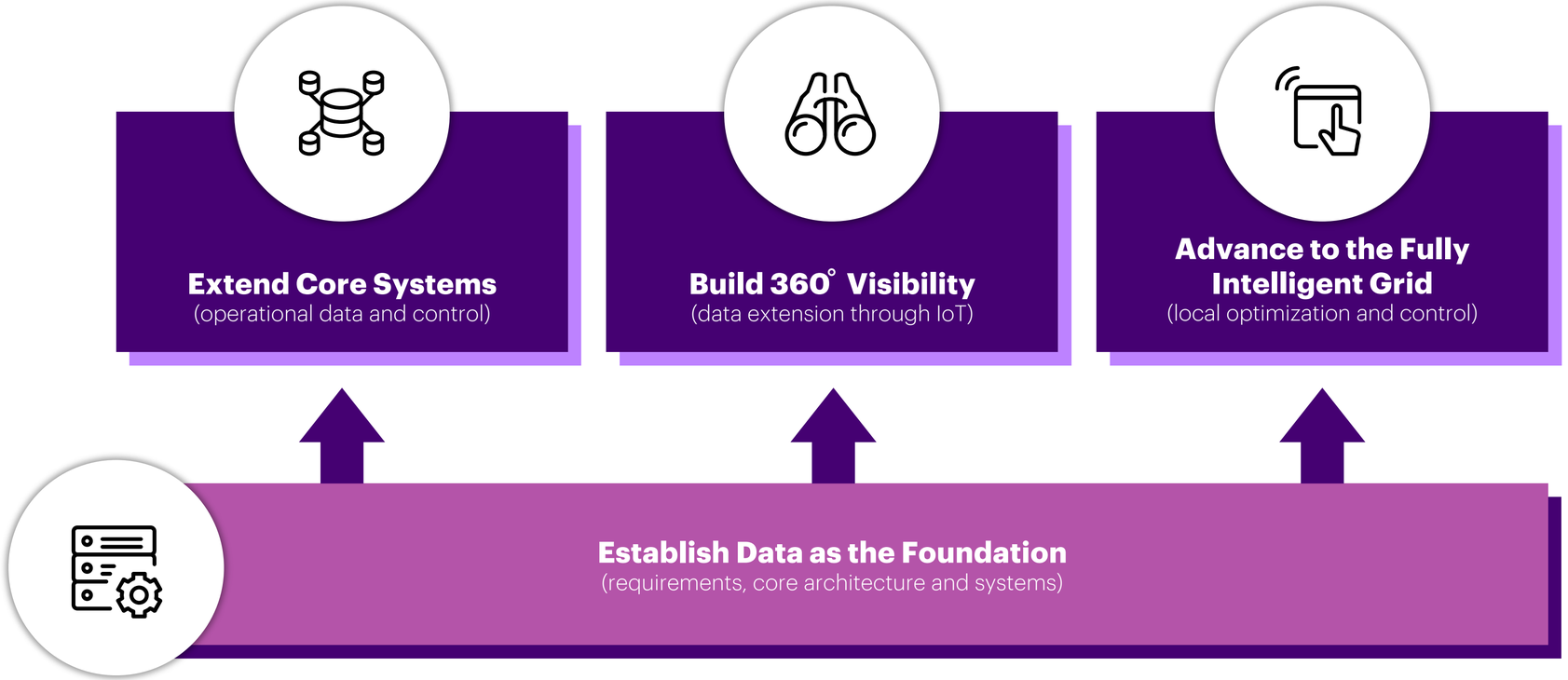
Delivering the data-driven, intelligent energy system

What is needed is a new digital infrastructure that supports active grid management as the energy transition moves forward. This means fundamentally increasing visibility and control of the electricity network, connected DER and consumer participation.

Through our Digitally Enabled Grid research, we have identified four distinct areas underpinning distribution's digital transformation. The first sets the foundation for the rest, taking greatest advantage of existing data and creating a data architecture that supports the evolving needs of the energy transition. The second extends core operational visibility and control, targeting grid-connected DER and the solutions needed to integrate it. In the third, IoT devices radically expand the scope of data for even greater visibility of the broader system. The fourth advances to a fully intelligent grid—enabled by edge computing, 5G, digital twins and platforms—which optimizes local assets in near real time and orchestrates DG and demand response.

Action is the imperative. What this looks like for each distribution business around the world will depend on many factors including region, industry structure, regulation and their current point in the energy transition journey. And there will be many lessons learned between businesses that will help accelerate the transformation for all.

Four distinct areas will underpin a distribution utility's digital transformation for the energy transition.



Approaching transformation with an innovative mindset and agility to execute

Data as the foundation

At the foundation is making the most of existing data and creating a data architecture that supports the evolving needs of the energy transition.
One of these needs is enhanced data exchange across a wide ecosystem in which distribution plays a central role. To successfully lay this foundational layer, distribution companies must integrate multiple data types; ensure the platform scales to incorporate exponential growth of IoT data; is sufficiently flexible to adapt to new rapidly changing requirements; embraces the requirements of both core operations and many third-party requirements; and robust network communications.

Extend the core

The second area extends core operational visibility and control, targeting grid-connected DG and the solutions required to effectively integrate it. Many distribution utilities have limited visibility and control in lower voltages. But the energy transition necessitates much better visibility and closer management of lower voltages. Core advanced distribution management systems (ADMS) must be extended to low voltage networks to actively manage the growth of DG, support new flexibility services and integrate distributed energy resource management systems (DERMS) with existing network management solutions.

360º visibility

The third area expands the scope of data through the deployment of IoT devices. Because, while utilities will extend core control systems to low voltages, they will also improve visibility of the broader system—both utility and non-utility assets—using non-core IoT networks. IoT devices and gateways linked directly to the cloud, will improve grid optimization, particularly through flexibility services, prosumer demand and output forecasts, and improved asset visibility.

Fully intelligent grid

The fourth area improves distributed intelligence and control, facilitated by edge computing, 5G, digital twins and platforms. It enables near real-time optimization of local assets, orchestrating DG and demand response on the load side.
These capabilities will likely be deployed as needed, rather than pervasively across the grid, for instance in virtual power plants, microgrids and autonomous operations.

Transformation starts today

The energy transition creates as many opportunities as it does threats. For distribution businesses to prosper, they must start their transformation now, adopting new digital capabilities and technologies, founded on radically improved visibility and control of the grid, DER and consumers.

We expect to see very different approaches around the world, however, at whatever stage a distribution business takes on this transformation, a strong data foundation is paramount. An innovative mindset and agility to execute must be baked into every action distribution businesses make as they move toward meeting the challenges of the energy transition.

78% of distribution utility executives agree that current regulatory models and incentives are no longer fit for purpose to deliver the energy transition.

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