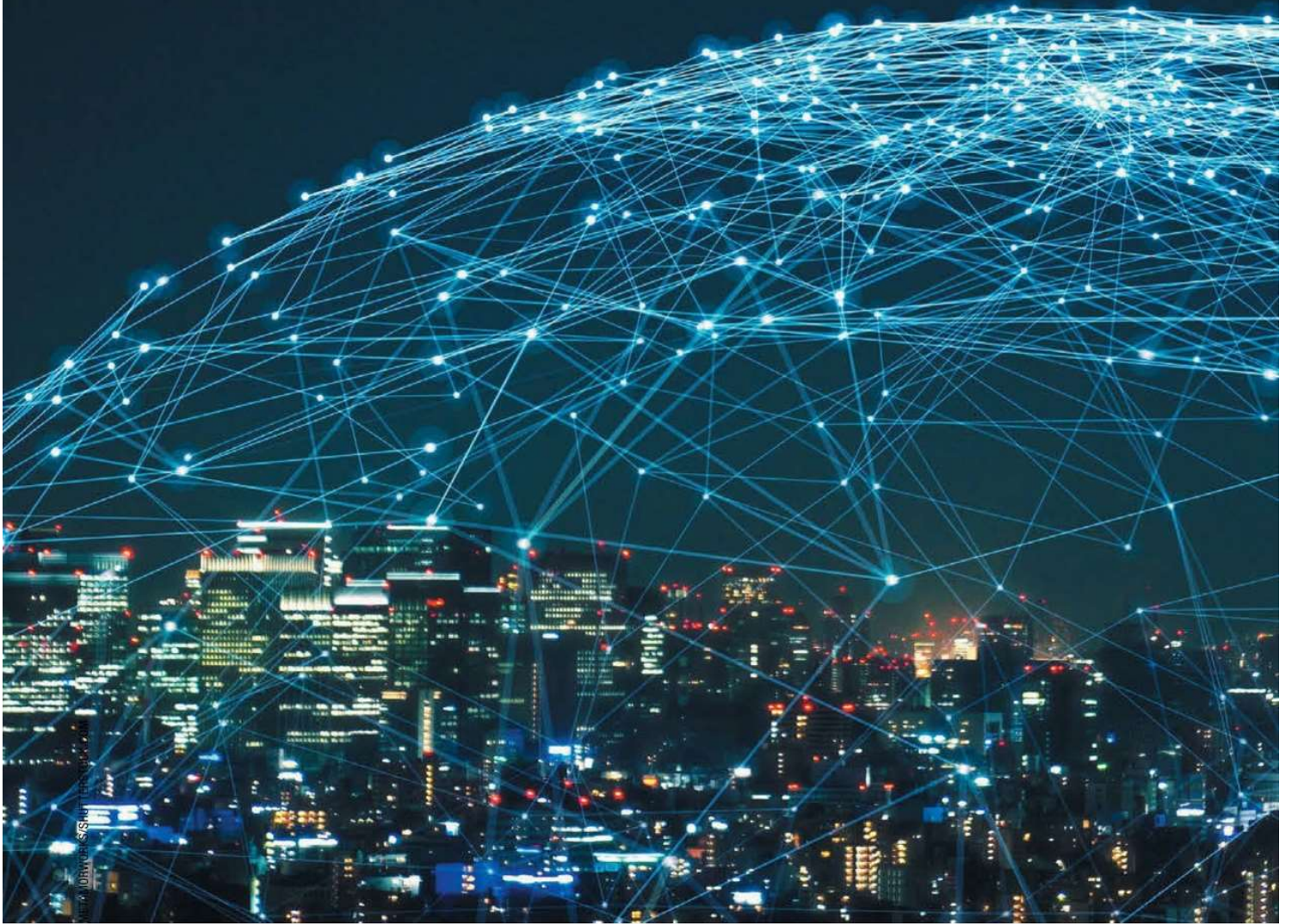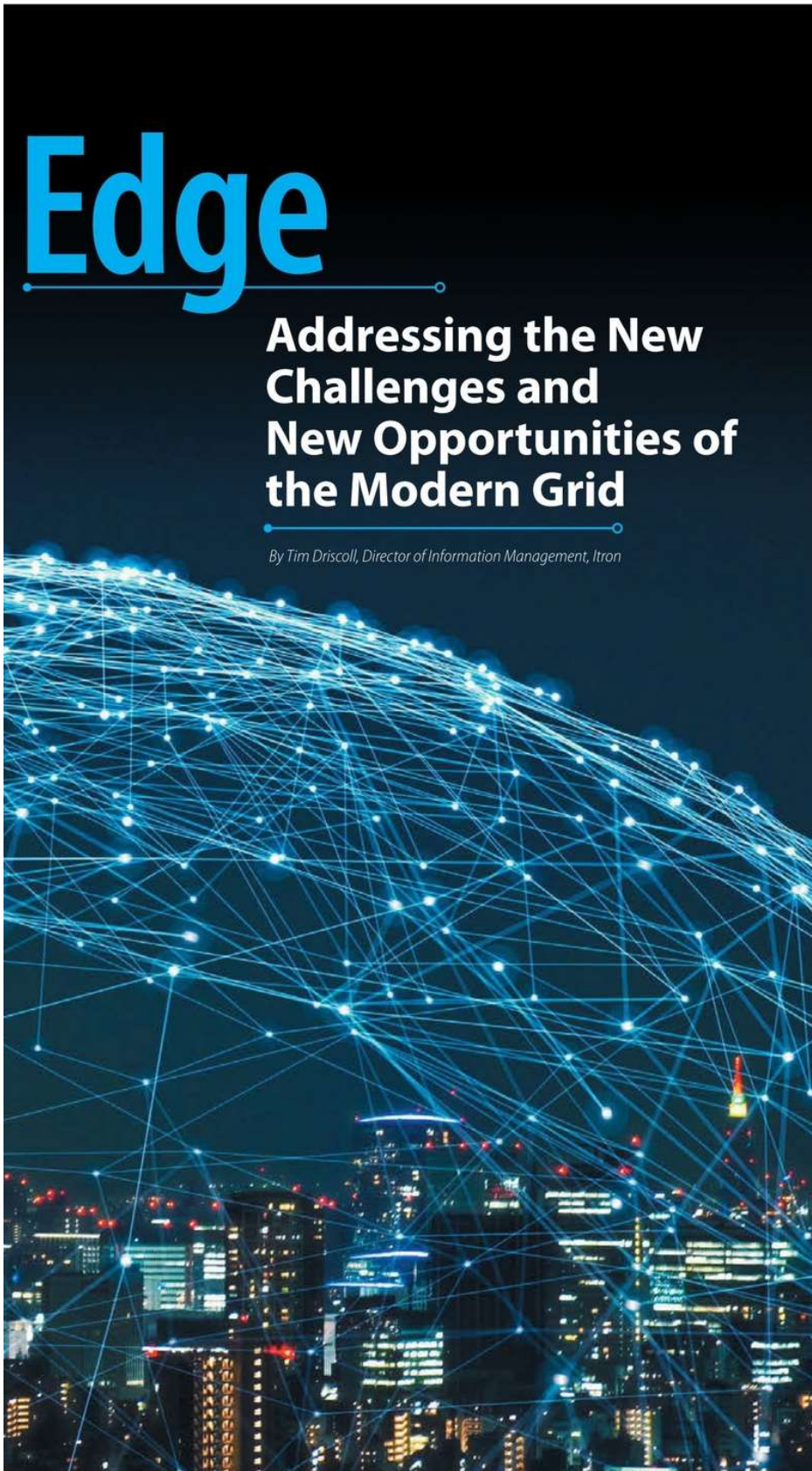# Intelligence at the

Edge

Addressing the New Challenges and New Opportunities of the Modern Grid

By Tim Driscoll, Director of Information Management, Itron

SMART METERING HAS EMPOWERED home and business users of energy to gain greater access to data insights that will give them better control over their energy usage. By the end of 2018, over half (57.9%) of all U.S. energy customers had a smart meter installed.

But while this has improved operations and management of electricity use, utilities and their customers are facing new challenges. The next-generation distribution grid has upended the traditional centralized generation and transmission network model. Today's grid has multi-directional power flows in the lower voltage network, created by renewable energy such as wind and solar generation, electric vehicles and storage systems.

On the traditional grid, there's also limited ability to add more infrastructure, and the grid requires usage optimization to ensure maximum capital asset life. Additionally, power generation is becoming more distributed throughout the grid.

Fortunately, all of this creates opportunities for new business models based on energy balancing, reactivity and customer focus. As a result, energy utilities need new tools to retain their place at the center of enabling consumers.

For today's utilities, rates have become a relic, and the delivery of value to customers has become the critical monetary driver for regulatory agencies. Several commissions are starting to move away from an emphasis on rates and toward value-based business models. This has become a significant challenge for utilities, and a challenge for commissions to define "value" and its worth.

Enter distributed intelligence.

While utilities are facing challenges and competition on many fronts, they have one monumental advantage: distributed intelligence, also known as edge intelligence, which provides power and control of the grid out to edge devices, rather than concentrating power and control in the grid core.

Today, edge intelligence is delivered through prime real estate—a smart device on the side of every customer's home. That device, the smart gas or electricity meter, has evolved to become a self-contained grid monitoring device and a real-time consumer engagement platform, installed for every customer. It means utilities can maintain control of their future in delivering not only energy but the real value in ways they never could before the advent of smart meters.

THE SHIFTING UTILITY PARADIGM

With the maturing of smart meters, the concentration of computing power and the explosion of IoT, advanced processing and memory have become much more cost-effective to deploy in meters, enabling real time data access along with the processing power to run local analytics in the meter itself.

The smart meter of yesterday in traditional advanced metering infrastructure (AMI) applications has evolved into a truly intelligent device empowering real-time network monitoring and control, along with a powerful and flexible user engagement "engine" to drive higher value to both the utility and its customers.

The emergence of distributed intelligence—that is shifting intelligence from solely in the back office to include the edge of the grid—is driving more intelligence in real-time to be able to better predict and manage energy needs across the entire network, while providing an unprecedented level of intelligence for consumers in the use, monitoring and management of energy.

The shifting dynamics of the market—through which solar technologies enable consumers to generate their power, and regulatory initiatives are beginning to allow distributed generators to sell power directly to consumers across the distribution grid—puts the traditional utility business model in jeopardy. In its place, utilities will have to build their offerings on their value. That will take a massive change in mindsets, but the upside is that utilities will find ways to offer consumers more value.

Utilities face other risks. They are saddled with regulatory edicts to maintain distribution infrastructure, but without the necessary funding to do so. What's more, the emerging transactive energy marketplace at the grid's edge will involve many financial transactions that will fall outside of the utilities' traditional business and financial processes.

If utilities are to survive and thrive amid these disruptive and competitive challenges, they will need to turn these challenges into business opportunities and leverage their "energy incumbency" and relationships with customers to become (or remain) the key player in an increasingly distributed and transactive grid.

But today's edge intelligence-enabled meters, sensors and other devices on the distribution network can communicate and manage these transactions and power flows in real-time, keeping utilities relevant and in control of their distribution systems and the financial transactions that ensue.

And so, the pressure is on. As the incumbents, utilities will be the logical choice to perform these functions, but only if they can provide the services when required. If they're not ready, other traditional technology vendors such as Google will happily step up and fulfill that role. The bright spot is that edge processing at the meter, combined with the business agility it provides to manage all these transactions, is the utilities' best defense against that outcome.

Distributed intelligence is beyond smart—it is active—pushing the analysis to the edge, on the meter itself, allowing for a truly intelligent platform to enable:

- Edge computing: Every device is a computing and application platform
- High-resolution data that delivers near real-time decision-making and post-processing analytics
- Improved safety and autonomous control at every meter
- Coordinated, autonomous action between meters

Each meter is an advanced computer and application platform providing local access to high-resolution data to:

- Drive peer-to-peer communications between meters and devices
- Empower an open and vibrant ecosystem of solution providers
- Drive real-time communications into the consumer premise for safety, and to deliver usage insights at an extremely granular level

MAKING THE BUSINESS CASE FOR DISTRIBUTED INTELLIGENCE

Making a strong business case for an innovative technology often requires providing a range of real-life use cases, and that is nowhere truer than on the distributed grid. Here are examples:

Location Awareness: A location awareness Distributed Intelligence (DI) app provides the electrical location of every meter on the distribution grid, including transformer, phase and feeder. This information can be used to update and validate GIS connectivity, improve outage response, feeder phase balancing and multiple other grid applications.

Transformer Load Management: A DI app for transformer load management provides protection and extended life of distribution transformers by continuously monitoring the total load on the distribution transformer in both directions and actively controlling consumer loads and distributed generation to maintain loads within safe operating limits.

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Outage Detection: An outage detection DI app provides more rapid and accurate identification and location of significant outages by optimizing the use of the communication network for outage messages during storm conditions. Communication network statistics and location awareness are used on each meter to select optimal bellwether meters for outage notification and detection. During storm mode, only bellwether meters will report outages, maximizing the likelihood that highest priority outage messages will be received.

Load Disaggregation: A DI app for load disaggregation provides disaggregation of the whole premise electric load into the individual electrical appliances and loads within the premise, in the form of time series load profiles for the individual loads. This information can inform numerous customer and utility operations applications and programs.

Excess Usage: With an app focused on excess usage identification, consumer benefits by identifying appliances with excess usage or usage that is increasing over time. This information can identify candidates for appliance replacement marketing programs or identify appliances requiring maintenance.

TOU/Peak Alerts: A TOU/Peak Alerts DI app provides consumer benefits by identifying when high-usage appliances are active during peak price periods and the approximate savings achieved by curtailing appliance use during the peak price period.

Active Demand Response: An active demand response DI app provides high predictability and reliability of demand response results by actively controlling loads and generation within premises to meet that demand response reduction targets. Groups of meters are assigned target demand reductions and work amongst themselves using peer-to-peer communications to ensure that the group target is achieved and maintained.

EV Detection: An EV detection DI app provides detection of electrical vehicle charging at a premise and calculation of time series usage profile. This can help multiple consumer marketing programs aimed at providing the best possible experience for electric vehicle owners.

Solar Disaggregation: A DI app for solar disaggregation provides detection of solar generation at a premise and calculation of time series profile of solar generation behind the revenue meter. This can be used for detecting illegally connected generation, the offering of marketing programs associated with generation, estimating generation standby requirements for cloud cover, etc.

The capabilities of DI apps are exciting, but what are the business value and ROI of edge intelligence? According to research by Itron, real ROI can be realized immediately. Here are four application examples of the estimated value:

- High impedance detection: $0.96 per customer per month
- Bypass theft detection: $1.99 per customer per month
- Location awareness: $2.30 per customer per month
- Outage detection: $3.03 per customer per month

CREATING AN OPEN MARKET IS KEY

Every new deployment of edge intelligence in the distribution system creates a more significant opportunity to build an ecosystem of innovation. Critical for exploiting the great ideas of app creators and other developers is to make the grid a landmark new business model that encourages innovation and ultimately delivers high value to utility customers.

This ecosystem enablement will be critical to ensuring rapid reactivity, continuous innovation and opportunity creation. It will require both a platform to support it and a business model that encourages innovation. Utilities must welcome innovation and will need to ensure that its ecosystem approach is enabling third-party applications and service options.

This new model is critical to delivering more useful information and higher-end value to customers. And it will take the burden of app development off the utility, allowing the utility to place a laser focus on delivering that customer value.

In turn, the utility will be able to charge for access and create new revenue streams because of its renewed focus on consumers.

CONCLUSION

Distributed intelligence provides utilities and consumers alike with the capabilities to improve their management of energy usage. The technology is being rolled out by early-adopter utilities, while other utilities are at the testing stage. Still, others are at an early stage focusing on understanding the ROI of such a transformation on energy grids.

For utility customers, arguably, the most significant advantage goes to the customer who will play an active role in using energy wisely and reaping the savings that come with it. **EE**

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