



How new service-based approaches **accelerate affordable municipal and co-op utility grid modernization**

SIEMENS

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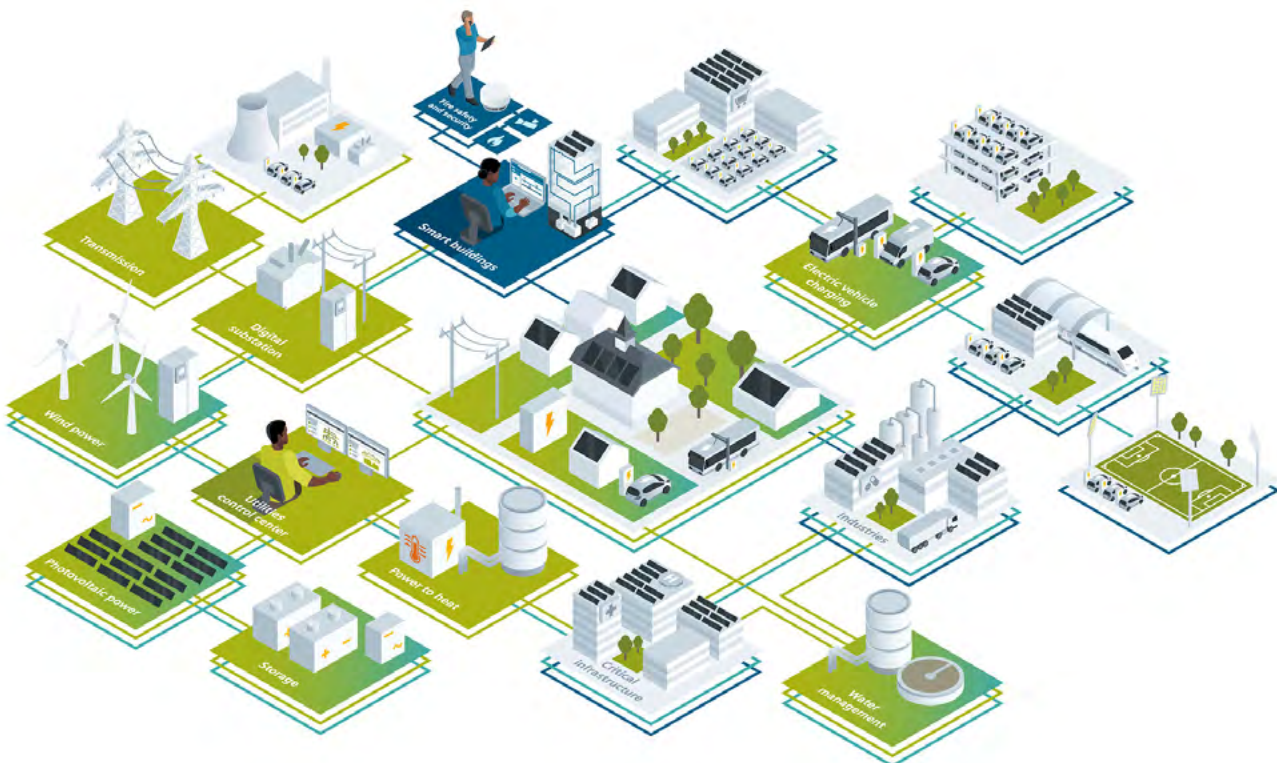
CHAPTER 1

The state of energy

Never has demand for new energy solutions been as high as it is today. The growing number of electric vehicles (EV) and the increase in renewable sources of energy such as solar are taxing distribution infrastructure and challenging utilities' reliability and resilience.

Meanwhile, the global migration toward decarbonization and renewable resources is making power supply choices for municipalities more complex than ever. Together, these forces are driving the digitalization of the utility industry and modernization of the smart grid and grid-edge technologies.

As worldwide momentum toward reduced carbon emissions accelerates, municipal utilities and cooperatives are feeling added pressure from customers to modernize their infrastructure to enable more sustainable operations. This global transition is forcing municipal utilities to balance grid sustainability and resilience with the network agility needed to meet evolving consumer demands.



The reality is utility business models are evolving, and supporting technology has to evolve in order to handle these new levels of complexity. For municipal utilities and cooperatives, embracing modernization and innovation is no longer a choice if they want to remain competitive, but a necessity.

In a perfect world, municipalities and cooperatives would aggressively pursue these needed business model adjustments. However, publicly-owned utilities find themselves in a very different position when compared to large, privately funded utility enterprises. Even though the need to modernize is acute, budgets are not increasing. There is little public appetite for increasing rates or borrowing money for infrastructure improvements. This limits funding for new technology projects or for expanding engineering teams.

Fortunately, this funding landscape has recently changed, creating new opportunities for municipal utilities and cooperatives to achieve their modernization goals. Publicly-owned utilities can now improve operational efficiency by leveraging cloud-based applications. Software and service-based data capture, monitoring and management solutions offer low-cost ways to manage energy systems. In effect, rather than paying for capital intensive investments up front, municipalities can fund modernization through the energy savings or services revenues they generate over time as a result of their technology digitalization deployment efforts.

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CHAPTER 2

Energy as a service opens access to capital



Energy as a Service (EaaS) is an example of an offering that provides publicly-owned utilities with new access to capital to fund modernization projects. EaaS utilizes new technologies, and cloud-based services that enable the more efficient adoption of renewables and management of energy resources through flexible subscription-based financing.

Prohibitive upfront capital investments are eliminated and, instead, utilities can pay for gradual, long-term, fixed-price subscriptions funded through cost savings and service revenues. Those cost savings and service revenues are derived through the deployment of distributed energy resources (DERs), digital grids, microgrids and energy distribution automation.

EaaS is growing in popularity; in fact, it is on track to exceed \$278 billion by 2028, according to Guidehouse Insights (formerly known as Navigant Research).¹ EaaS provides flexibility and resilience at an affordable price. An increasingly common approach is to tie EaaS financing to the implementation of a microgrid, which a technology provider can build and maintain as a service.

As self-sufficient power systems, microgrids accelerate deployment of DERs and strengthen distribution-level systems. They provide energy to remote areas, rural communities and critical facilities, and are able to disconnect from the main grid to avoid unplanned power outages. Microgrids can run on a combination of power generated on site and power supplied by distributors through arrangements such as power purchase agreements (PPA) and energy supply agreements (ESAs). Microgrids also have grid-supporting functions such as black start capabilities as well as voltage and frequency support.

Microgrids can include energy storage and provide backup power, allowing them to operate when the main grid is down. They can switch from one power source to another as needed – for instance, in cases when solar stops producing suddenly and voltage drops, a microgrid can switch to on-site batteries. Energy storage capability is the ultimate flexible resource that provides the resilience and reliability that municipal and co-op utilities need to satisfy user requirements. By minimizing CapEx investments, microgrids specifically – and EaaS as a whole – make costs more predictable and budgets more manageable.

CHAPTER 3

EV infrastructure as a service addresses changing demand

As utilities manage the energy transition to green supply, a main area of focus will be the growing numbers of electric vehicles. Replacing carbon-emitting vehicles with EV fleets helps meet sustainability goals, but also places a tremendous burden on power distribution systems.

By 2030, over 70 million fleet vehicles will be electric, up from 2 million today, according to Guidehouse Insights. The share of fleet vehicles that are electric will rise from less than 1% today to 12% in a decade, the group predicted.²

To address this increased demand, on-site power and storage can help mitigate peak demand issues within the grid. A plan that includes a Charging as a Service (CaaS) model can provide municipalities and cooperatives with the means to manage EV charging infrastructure investments in an efficient, affordable and “green” way. As with EaaS, CaaS can be delivered on a subscription basis by a provider that builds and maintains the infrastructure.

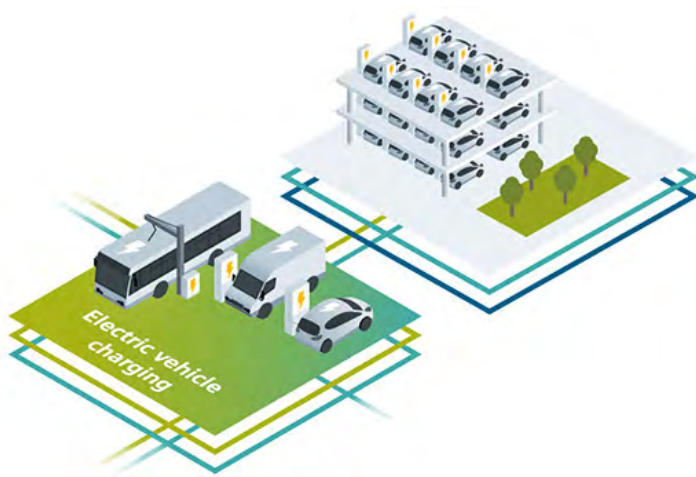


Under a CaaS model, providers deliver both technology and digital services built around charger usage. Chargers have data capture and transmission capabilities that provide detailed accounts of how much energy is being consumed and how each unit is performing. Data collection from EV chargers includes:

- Details on kWh usage by each vehicle and how often it is charged
- Monitoring data from the charger to ensure that the unit itself and its data transmissions are functioning properly
- An overall account of energy consumption by aggregating charger data system-wide
- Insights for supporting demand management, ensuring a consistent power flow and avoiding problems such as tripping circuit breakers or low-voltage brownout situations

Charger-generated data also helps with load projections and infrastructure planning. For instance, utilities can use data to mitigate charging in locations where demand for power may risk exceeding the supply. Data trend analysis can help determine when to expand the infrastructure. In addition, municipalities and cooperatives have the option of installing more charging capacity than the existing infrastructure could normally handle and use software to dynamically control the load to keep the load within the available limits. This means that adding EV charging stations doesn't necessarily require adding distribution network reinforcement.

CaaS also delivers monetization opportunities via charging services for consumers. The chargers' data-collection capabilities can be used to track usage and to bill individual drivers who set up EV-charging accounts. As such, municipal and co-op utilities have a way to generate revenue to help offset their costs.



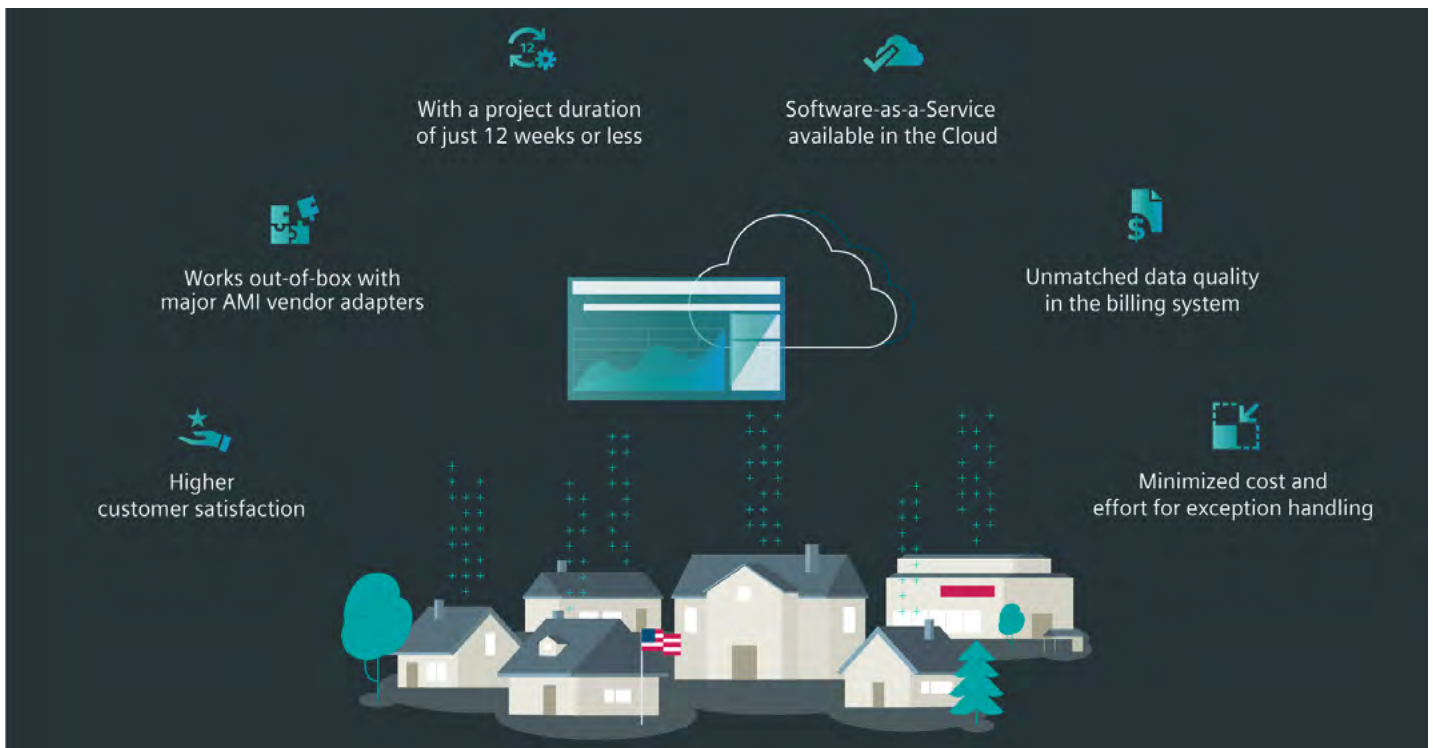
CHAPTER 4

Cloud-based automation services enhance efficiency

In addition to CaaS, municipalities and cooperatives should consider cloud-based power management and automation services to achieve modernization. From meter data management to outage management to planning and forecasting applications, an abundance of options exist that can help publicly-owned utilities improve operations and meet customer needs.

Meter Data Management

Meter data management (MDM) software, now available as a Software as a Service (SaaS) option, enables municipal utilities and cooperatives to maximize their investments in advanced metering infrastructure (AMI). AMI systems provide for smart meters and for enabling communications infrastructure to read meters remotely. Meter data management software enables utilities to avoid errors caused by missing data and communication issues, and benefit from improved data from AMI electric, water and gas meters.



Additionally, MDM provides utilities with the capability to sift through the AMI meter data and spot anomalies, and support utility restoration activities and distribution operations. Direct access to MDM data by customer service representatives enables them to identify usage spikes causing complaints about billing and resolve disputes without rolling a service truck to get a check reading. MDM eliminates thousands of staff-hours in data reviews and dispute resolution, saving time and money.

Outage Management

With so many facets of modern life – WiFi networks, EV charging, IoT environments –depending on power grids, utilities need effective ways to manage outages. This, too, is manageable with SaaS software. In the event of an outage, meters generate signals when they go out of service, and utilities can triangulate the source of an outage by reviewing data from disconnected meters. This allows the utility to respond more accurately and quickly by dispatching a crew to the source of the outage. Speed and accuracy of response helps minimize outage duration, saves staff time, and improves customer service.

Planning and Load Forecasting

Municipal and co-op utilities can also consider SaaS-based applications to improve planning and load forecasting. Data collection from both substations and individual customers in real time, along with grid simulation, can help to more accurately predict future load requirements and variables such as solar driven power supply intermittency. These exercises help utilities to study factors that contribute to reliability and resilience, such as power quality and frequency stability.

Energy Automation

Digitalization has enabled the implementation of digital substations, wide area monitoring, distribution automation and other technology-based enhancements that improve grid reliability and availability. Data capture and digitally connected systems make it possible to quickly identify and address faults, resulting in fewer outages and quicker remediation when they occur. Automation of energy systems is essential for modernizing grids and making them more resilient and, increasingly, self-healing. The ability of smart energy networks to automatically identify and correct issues has emerged as a key network resilience building block.



CHAPTER 5

Siemens value-added contributions

Siemens has a long-standing commitment to helping utilities meet their energy transition challenges. By offering advanced technology, deep expertise and flexible financing, Siemens helps municipal utilities and cooperatives to drive grid modernization initiatives.

EaaS Offerings

In partnership with Macquarie's Green Investment Group, Siemens has formed Calibrant Energy, a company dedicated to supporting the evolving needs of utilities as they strive to manage their own energy transitions. Calibrant delivers a fully integrated and managed (EaaS) solution that requires no upfront CapEx investments. In addition to flexible financing options, Calibrant takes over operational or performance responsibilities, allowing utilities to focus on refining go-to-market strategies and future planning.

Microgrids

Siemens delivers microgrid implementation and management services in order to support the reliability and resilience needs of municipalities. Through a combination of renewable energy sources, on-site energy storage, and other innovative approaches, microgrids such as the one in Blue Lake Rancheria in Northern California protect communities from power interruptions caused by wildfires and other events. For municipalities and cooperatives, a self-sufficient microgrid delivers the peace of mind that there will still be access to power when the main grid fails.



Blue Lake Rancheria

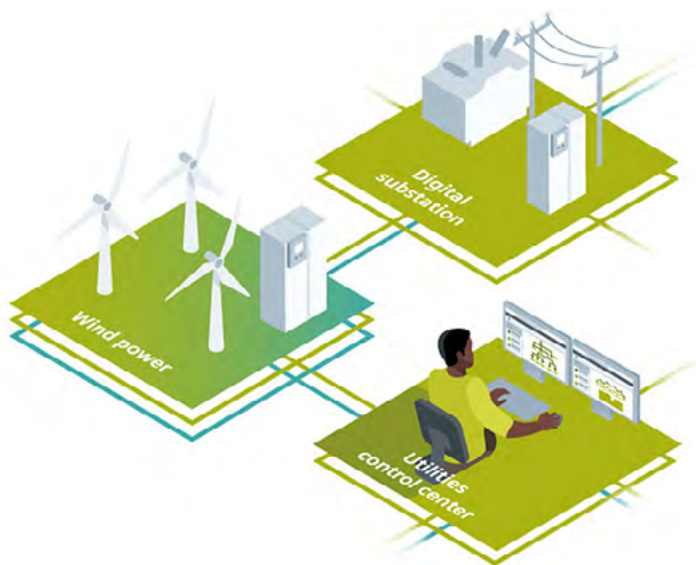
eMobility Charging

Responding to the needs created by fleet electrification, Siemens has introduced a suite of CaaS offerings that includes charging hardware, make-ready equipment, data capture, reporting and network management. Municipal utilities and cooperatives can leverage these services to manage EV fleets and offset costs by providing charging services for consumer-owned EVs. As carmakers and governments move to replace gas- and diesel-powered vehicles with EVs in coming decades, municipalities and cooperatives that start building EV charging infrastructure now will lead the race toward electrification.

Digitalization and Power Automation

To support the modernization of power systems and the move to renewables, Siemens offers a comprehensive suite of power automation and smart grid products and services, including a number of cloud-based data-collection and power automation hardware and software solutions:

- **SICAM Localizer** – Monitors the operational status of overhead power lines to quickly locate faults
- **PSS®SINCAL** – Simulates power networks for analysis, planning and load projection
- **Fusesaver** medium-voltage circuit breakers – Help boost network reliability by minimizing the impact of faults on lateral lines
- **EnergyIP MDM** – Works in conjunction with AMI to collect and analyze data from meters



CHAPTER 6

Conclusion

As global energy transformation expands, municipal utilities and cooperatives have the opportunity to take control of their destinies by leveraging cloud-based, XaaS (EaaS, SaaS, etc.) solutions to modernize their power networks smartly and cost-effectively. XaaS offerings allow utilities to accelerate their transformation and anticipate future growth as power distribution evolves and new technologies become available. Siemens stands ready to advise and support municipal utilities and cooperatives as they build a cost-effective, more sustainable future.

1 <https://www.businesswire.com/news/home/20190926005071/en/Navigant-Research-Report-Shows-Global-Annual-Revenue-for-Commercial-Industrial-Energy-as-a-Service-Is-Expected-to-Reach-278-Billion-in-2028>

2 <https://www.npr.org/2020/02/07/803145517/from-delivery-trucks-to-scooter-moving-vans-fleets-are-going-electric>



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