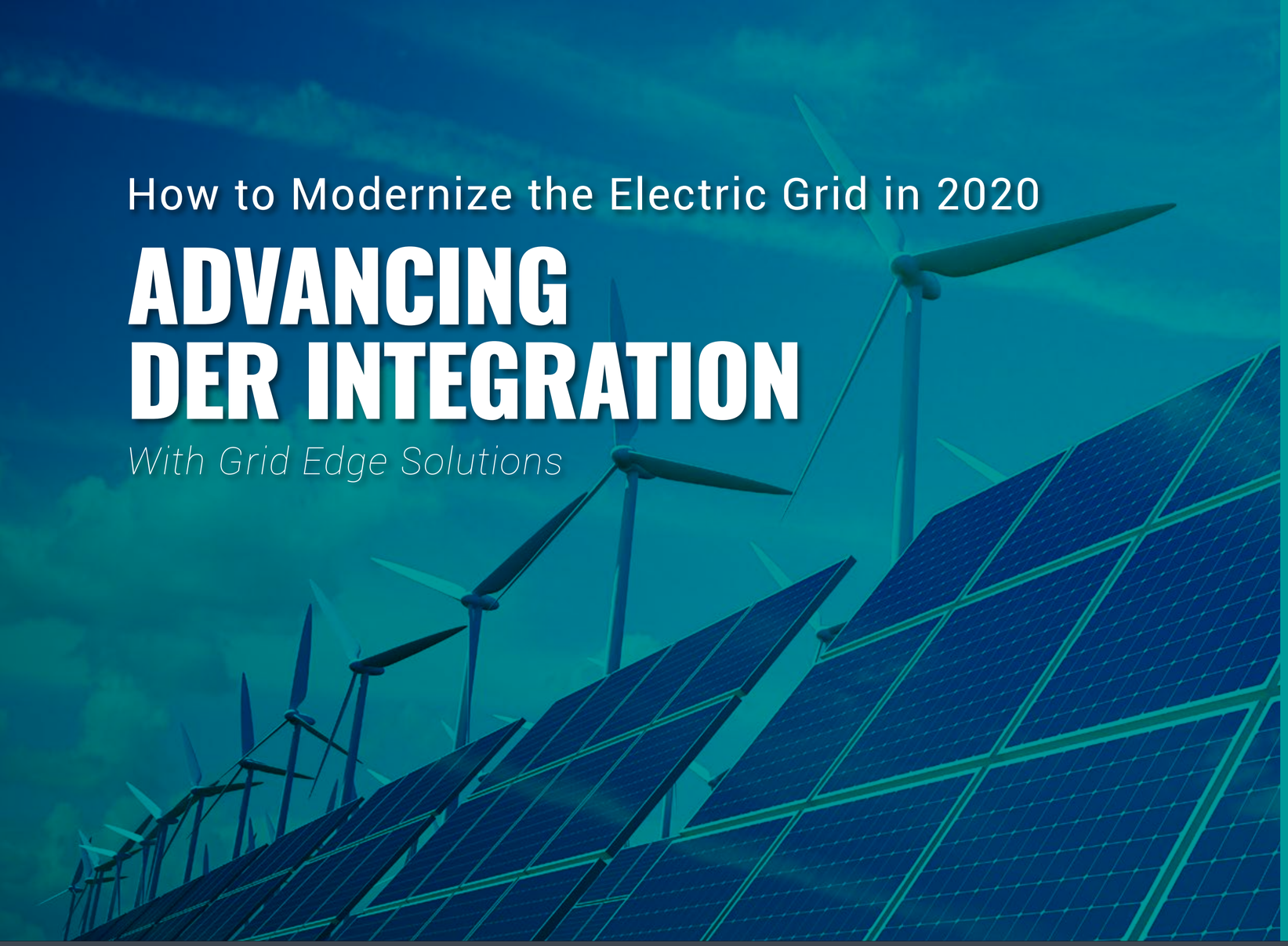

How to Modernize the Electric Grid in 2020

ADVANCING DER INTEGRATION

With Grid Edge Solutions

Bentley®

DISCOVER

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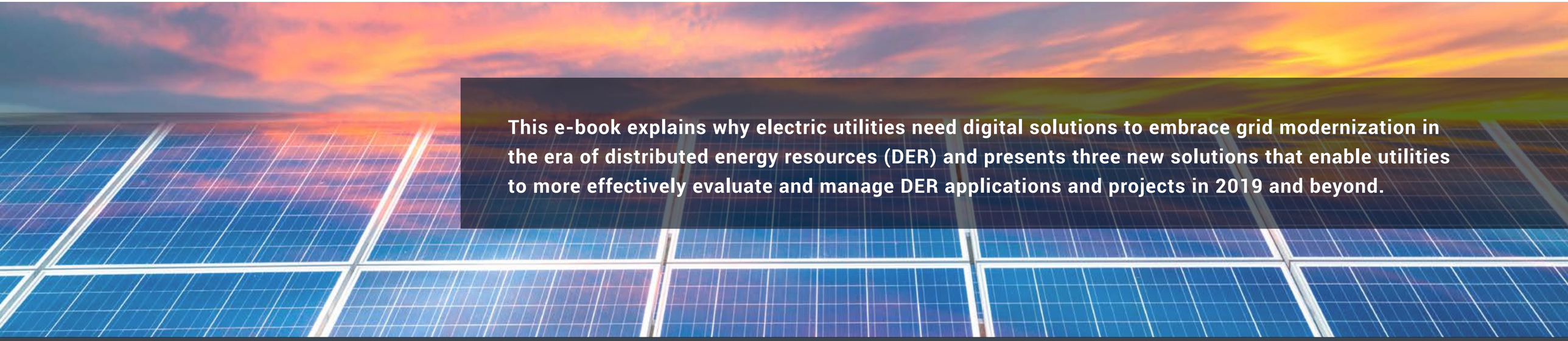
MODERNIZE THE GRID FOR DECENTRALIZED ENERGY

The International Energy Agency (IEA) predicts that PV solar generation will be the largest, by capacity, single-generation technology to be deployed out to 2030. According to the 2019 State of the Electric Utility Survey, the utility's power mix will change over the next 10 years and this includes considerable increases in solar (utility scale), distributed generation and storage, grid-scale energy storage, and wind*. Utilities need to understand how to integrate DERs into the increasingly digital power grid within the parameters of their regulatory environments. Successfully navigating the integration of DER will require a well-orchestrated approach to understand the impact of DERs on the system and what technology is needed to facilitate the planning, analysis, and designing process around grid modernization.

* *Source: Utility Dive "State of the Electric Utility 2019 Survey Report"*



This e-book explains why electric utilities need digital solutions to embrace grid modernization in the era of distributed energy resources (DER) and presents three new solutions that enable utilities to more effectively evaluate and manage DER applications and projects in 2019 and beyond.

WHY UTILITIES NEED TO EMBRACE DIGITALIZATION FOR DER INTEGRATION NOW!

DER presents new challenges and opportunities for utilities. Utilities are infrastructure systems by design and not traditionally equipped to accommodate massive amounts of information and data associated with grid modernization.

As DERs and the associated prosumers continue to expand in scope, utilities need to know what activity is occurring with prosumers, businesses, and government entities that could affect power availability and reliability.

Decentralized energy presents a new set of technology complexities around planning, decision support, and design optimization.

Utility network planning engineers and designers need better access to data to design smart communities with DER including PV, wind, and storage information.

In many situations, the process is still manual and paper-based, lacking many of the new data sets and analytical capabilities needed to properly assess the impact of DER penetration. As a result, utilities are engaged in a sequence of interconnection review studies and grid upgrades that are engineering-intensive, costly, and redundant.

According to the “State of the Electric Utility 2019 Survey Report” from Utility Dive, distributed resources are reshaping the economics of the grid. And digital transformation creates an opportunity to improve efficiency and gain a deeper understanding of grid management and customer service.

Digital transformation is occurring within every facet of the utility industry. This is an evolution of systems, processes, and people that optimize decision-making from planning to performance. Now is the right time to consider how automated planning and decision support mechanisms can enable business and operational processes to better handle the complex regulatory requirements, operational impacts, and business risk associated with DER integration.

MAJOR STAKEHOLDERS IN THE DECENTRALIZED ENERGY ERA

Residential Customers and Community Projects

Whether it's individual customers or community-driven plans, the demand for DER interconnections onto the grid will continue to expand as new technologies for DER and renewable power sources become more available. The shift from consumer to residential prosumer is driving the energy innovation ecosystem to provide greater flexibility, more choices, and faster response time for DER interconnections. Essentially, the prosumer revolution is empowering individuals and adjacent communities to directly control all aspects of their energy usage and adopt clean energy practices, driving utilities to shift focus onto DER.

Commercial and Industrial Businesses

Energy is one of the major operating expenses that fluctuates and is difficult to control for commercial and industrial enterprises. Distributed generation is one option that continues to gain traction as a potential means to reduce long-term energy expenses, hedge against price volatility, and reduce carbon footprint. Solar PV provides a great opportunity for businesses to significantly reduce energy costs and contribute to a clean energy future. With various incentives and funding options available, businesses can realize the benefits of solar PV systems and better manage energy costs.

Utility Owner-Operators

Utilities are under great pressure to address customer demand for DER interconnections while simultaneously addressing concerns around reliability and resilience. Utilities need to know how much distributed solar, storage, and other distributed energy resources the grid can hold in any given location while also complying with complex regulatory policies that are constantly changing. It is vital that utilities know how to better plan for DER and that they understand the potential impacts certain DER interconnections can have on grid performance.

Government Entities and Policy Makers

Federal, state, and local governments around the world are driving and mandating the clean energy movement and expanding their existing role in utility regulation when it comes to DER. In the U.S., state and local governments are helping to encourage technology and business innovation by proactively reforming policies to remove barriers so DER can be more widely adopted and incentivized. Policies are driving utilities to aggressively shift towards DER.

Technology Partners

The increased demand for DER is driving digital transformation in business and operational processes across electric utility organizations. Utilities can enable huge transformation with integrated software applications that automate the planning and decision support processes around DER to create efficiencies, control costs, and improve customer response time. Utilities need technology partners who understand energy infrastructure, grid modeling, and reliability engineering.

DER INTEGRATION CHALLENGE FOR UTILITIES

The major challenge DER presents to utilities is thoroughly understanding the impact bidirectional power flow will have on the grid. Modeling the grid for decentralized energy is increasingly complex and must not only consider operational variables but regulatory and economic factors as well. Utilities still need to depend on impact and hosting capacity analysis (HCA) to study many power flow scenarios. However, these detailed studies can be costly, require specialized engineers, and are not always necessary for low impact interconnections requests. The process for evaluating DER interconnections is still largely a manual and disjointed set of processes.

GRID EDGE SOLUTIONS FOR NETWORK RESILIENCY

In 2018, Bentley Systems and Siemens Smart Infrastructure jointly developed digital solutions to address the challenges and complexity associated with grid modernization initiatives — particularly DER integration. The digital utility-focused solutions equip utilities with state-of-the-art applications to address the major challenges around DER, enabling utilities to streamline the DER interconnection process to improve customer response time, facilitate cost-effective non-wires investments, and increase operational efficiency.

At the core of these solutions is an open, connected data environment (CDE), which provides a set of cloud-provisioned or on-premises services that supports digital workflows for DER interconnection evaluations and network analysis. The CDE offers a flexible information sharing environment to support stronger collaboration across organizational silos, an accurate and trusted information center, and an open environment for conducting models and simulations.

With streamlined workflows and capabilities, utilities can model both capacity and performance impacts, using automated methods to easily establish and compare multiple power flow scenarios involving combinations of grid influencers, such as demand response and energy efficiency programs, solar and wind generation, energy storage, electric vehicles, and microgrids.

The digital utility-focused solutions equip utilities with state-of-the-art applications to address the major challenges around renewable integration.

KEY CAPABILITIES

OpenUtilities™ Solutions Powered by Siemens' PSS®SINCAL

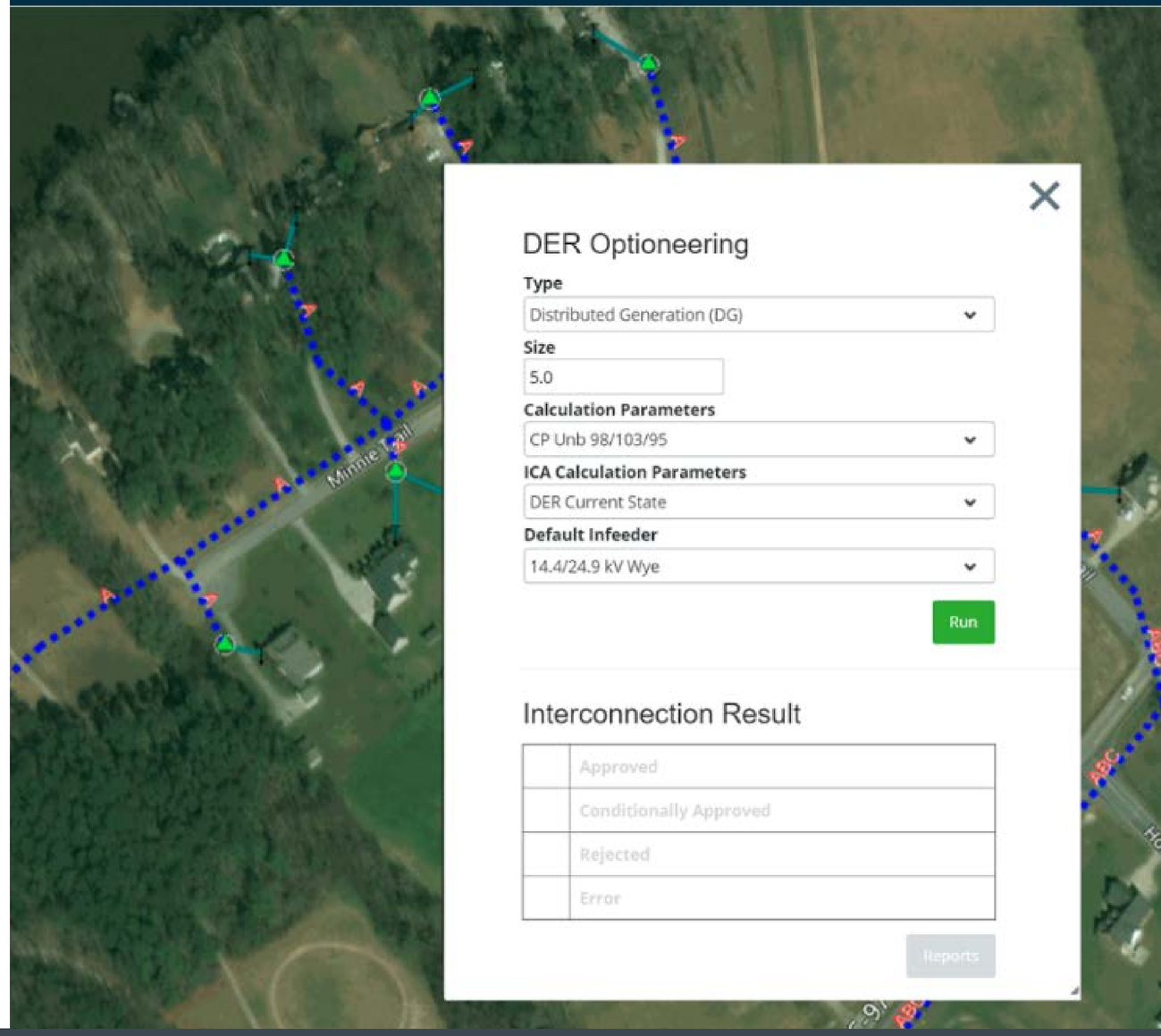
- ✔ Enable continuous model building by integrating data sources into one master data management system.
- ✔ Ensure data quality with integrated preprocessing that incorporates business rule validations, load flow validations, and short circuit validations of the network model information.
- ✔ Streamline data cleansing with quality control workflows initiated by the automated validation handlers.
- ✔ Streamline the DER interconnection approval process by requiring less direct involvement from valuable engineering resources and expedite the interconnection request process when applicable.
- ✔ Improve decision support; readily determine if further engineering analysis and studies are necessary for each application or project.
- ✔ ...and so much more!

OpenUtilities™ DER Optioneering

(Powered by Siemens' PSS®SINCAL)

CONNECT Edition

Utility service agents and business clerks need a way to evaluate DER applications without having to always involve highly specialized engineering resources. They must feel empowered to make decisions or defer the application to a specialized engineering resource at the appropriate time. OpenUtilities DER Optioneering (Powered by Siemens' PSS®SINCAL) is a fast-track review process to allow nonengineering staff or managers alike to effectively manage DER interconnection applications while adhering to complex regulatory requirements for DER permits. The automated application enables a rapid evaluation of DER interconnection applications using an automated screening method that quickly approves or defers DER interconnection applications for further detailed analysis and study. The fast-track review process combines an initial and supplemental screening mechanism into a single workflow, reducing the need to engage power system engineering resources during the early screening stage of a DER application.

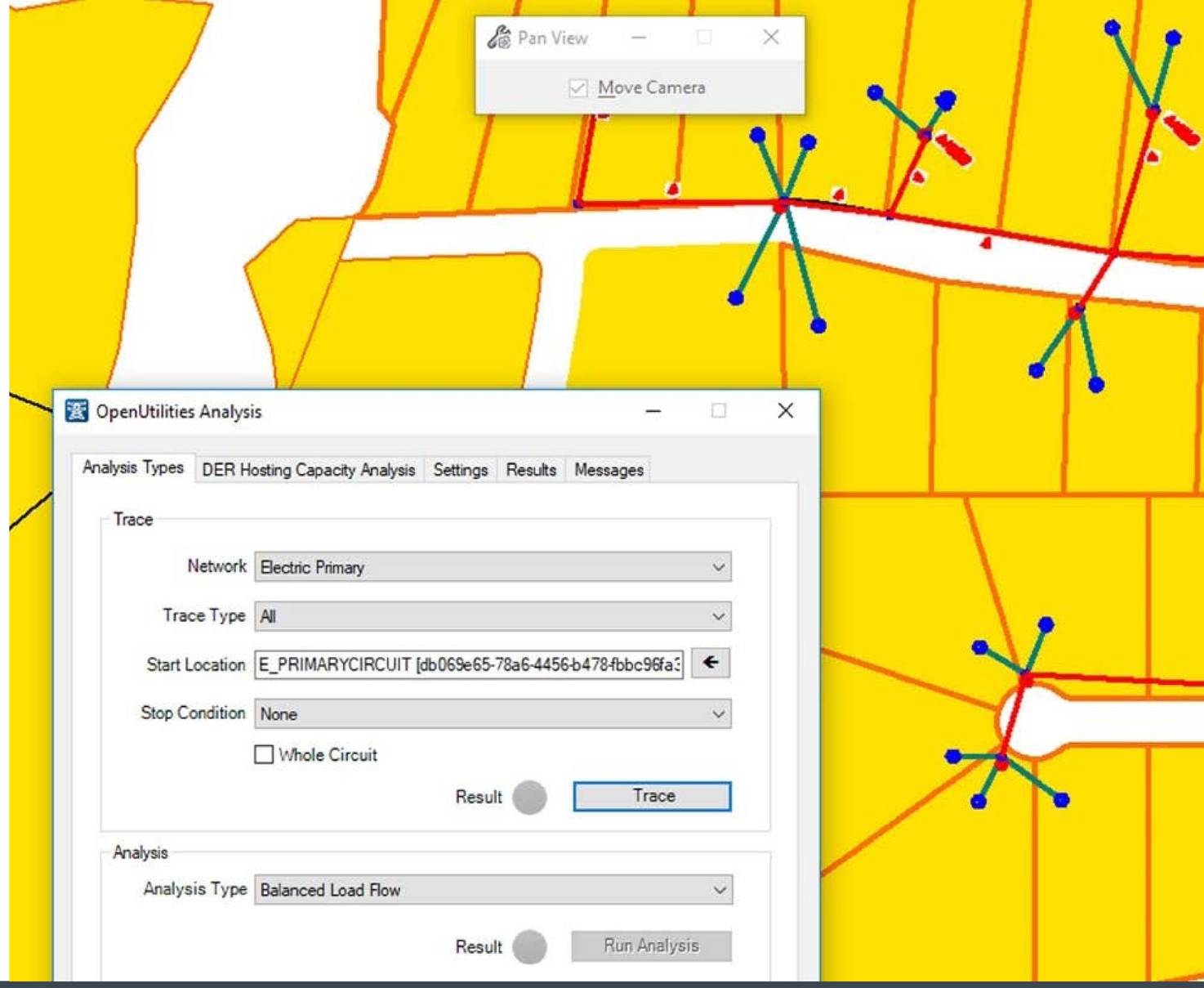


OpenUtilities™ Analysis

(Powered by Siemens' PSS®SINCAL)

CONNECT Edition

Power systems' planners need to perform engineering studies to assess and analyze the impact of distributed generations. Planners have extensive, global experience performing interconnection requirement studies (IRS) and impact studies for various DERs, including combined heat and power providers, solar PV plants, wind generation, and battery storage. The OpenUtilities analysis framework enables planning engineers to perform simulations to investigate DER integration and provide solutions in terms of capacity, connections, compliance, load, and even security. Using network models, DER loading can be added and calculations can be run to determine success in each workflow. This results in cost savings from automated assessments and creates complete and qualitative documentation.



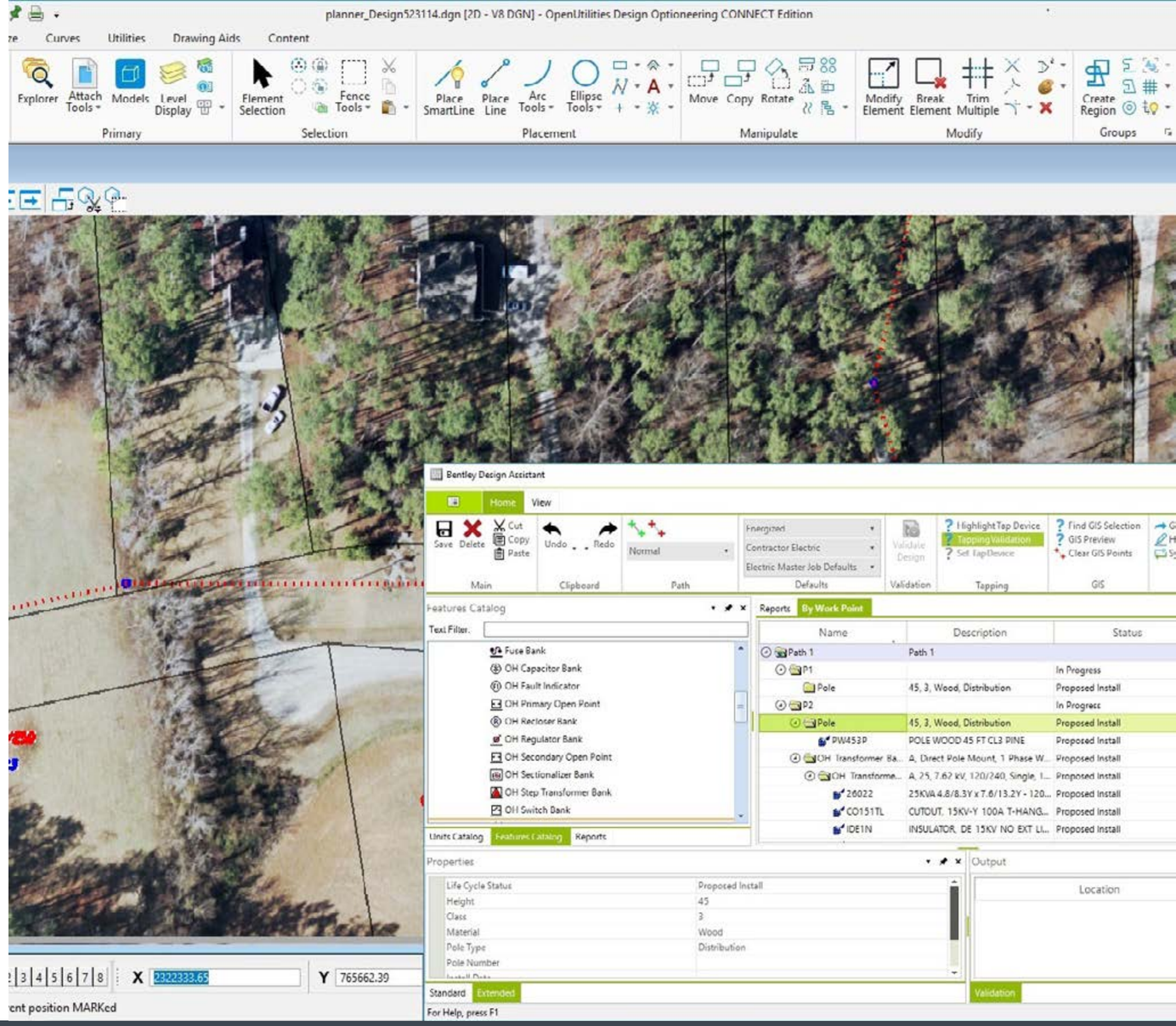
OpenUtilities™ Design Optioneering

(Powered by Siemens' PSS®SINCAL)

CONNECT Edition

Utility network designers and GIS experts need a way to design for renewables, but they do not always have the detailed information from engineering teams to include renewables into their network models. Optimizing equipment size and estimating costs is critical to help them design complex networks and analyze infrastructure. OpenUtilities Design Engineering permits designers to collaborate with engineers so that they can design and upgrade smart communities with DER, including PV, wind, and storage. This application enables designers and engineers to:

- Accelerate planning and design with engineering-precision capabilities
- Refine plans and designs quickly with on-the-fly cost estimation
- Speed workflows with integrated work management



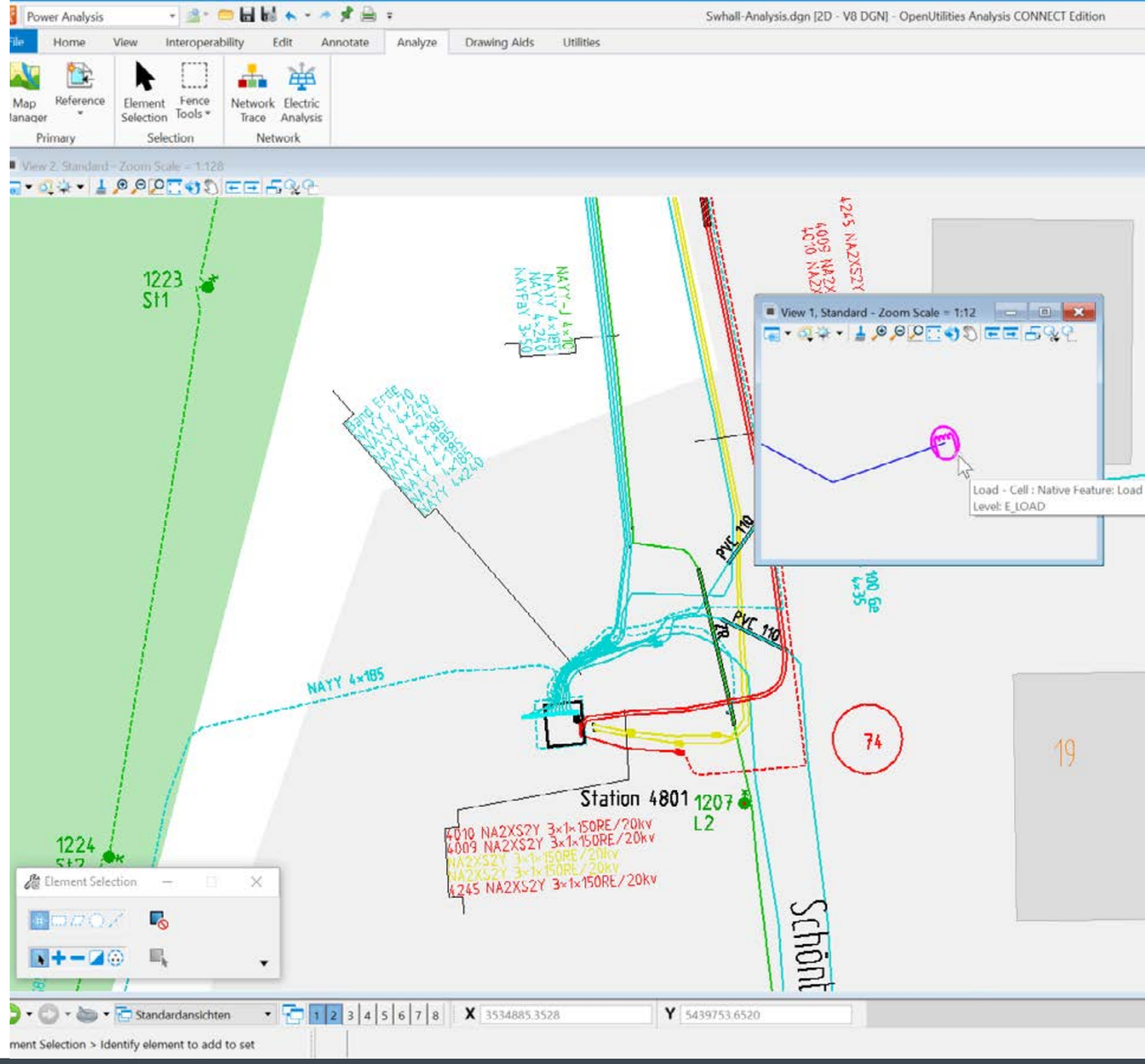
EARLY ADOPTER:
STADTWERKE SCHWÄBISCH HALL GMBH, GERMANY

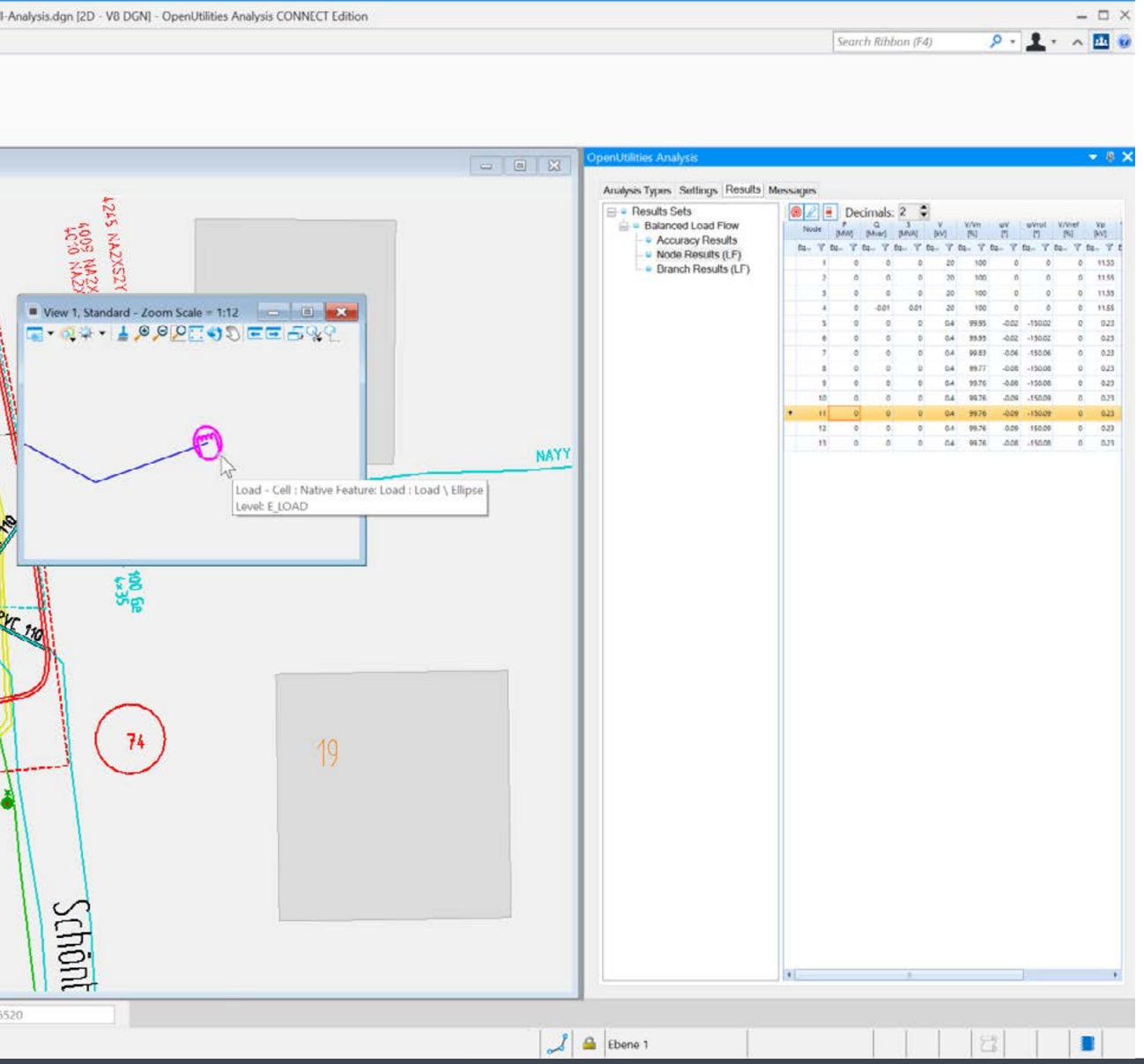
Stadtwerke Schwäbisch Hall GmbH is an innovative expanding public utility based in Schwäbisch Hall, Germany. Stadtwerke Schwäbisch Hall generates electricity and heat in combined heat and power plants (CHP) and power generation plants from renewable energy. The company supplies electricity, natural gas, heat, and water to approximately 500,000 customers and operates natural gas-filling stations, electric charging stations, baths, and parking facilities. The network area is not only limited to Schwäbisch Hall but also to other areas, such as Ottobrunn and Neubiberg near Munich.

As part of the CO_2 reduction and the EEG Renewable Energy Sources Act, Stadtwerke Schwäbisch Hall relied on an energy mix, and the increased use of renewable energies to generate electricity and heat in the cogeneration plants significantly reduced CO_2. Since the end of 2012, biogas and biomethane, which is biogas upgraded to natural gas quality, have been used instead of natural gas or heating oil, which are fossil fuels, for power and heat generation. The share of renewable energies in the heating plants increased from 11% in 2012 to more than 50% currently. By 2030, Stadtwerke Schwäbisch Hall wants to convert electricity generation in the region to 100% renewable energy.

Power is generated by combined heat and power, photovoltaic (53,000 MWh electricity for 15,000 households), biomass, hydropower, and wind power. The decentralized feed-in of photovoltaic and other plant types, as well as the expected requirements of electromobility with charging stations in many households, are making new demands on electricity grids. To guarantee the security of supply, quality, and performance of the networks, the medium-voltage network is calculated using Siemens PSS®SINCAL software.

The challenge is to map the entire network in the future to the low-voltage grid in PSS®SINCAL. Data from the existing GIS OpenUtilities™ sisNET® from Bentley Systems as well as estimated consumption data and feed-in data are used for this purpose. The data transfer takes place mainly manually, and this also applies to the data continuation. This considerable effort and the redundant management of the data should be simplified in the future. Stadtwerke Schwäbisch Hall and Bentley Systems have agreed on a pilot project using the new software OpenUtilities Analysis from Bentley Systems.





With OpenUtilities Analysis, the medium and low voltage networks can be taken over and calculated directly from the GIS. The import of consumption and feed data can also be supported by the software. Therefore, Schwäbisch Hall can perform network calculations on the current data of the supply networks, including consumption and feed-in data, without further continuation or acquisition costs. The integration of OpenUtilities with Siemens' PSS®SINCAL enables Schwäbisch Hall to utilize a connected data environment to bring together GIS and operational data into a digital twin that encompasses both existing and proposed infrastructure information. Schwäbisch Hall can enhance their network design and operations with this digital twin. This accessibility allows owner-operators to share data across silos, encourages stronger collaboration, and represents a single source for digital twins.

The requirements of the DER and the requirements of the regulator BNA (e.g. the certification of new wind turbines, which provide grid calculations to demonstrate feed-in capability on a current data basis) make it imperative to break new ground. OpenUtilities Analysis will make a significant contribution to increasing the efficiency, quality, and reliability of network operation.

A Brief Introduction to Stadtwerke Schwäbisch Hall GmbH

www.stadtwerke-hall.de/startseite/

ACCELERATE THE RENEWABLE ENERGY FUTURE NOW!

OpenUtilities Solutions Powered by Siemens' PSS®SINCAL empowers electric utilities with digital applications to efficiently streamline DER interconnection applications, perform detailed analysis, and understand potential performance impacts to grid reliability and resilience. As global utilities face huge challenges and work to adjust all aspects of their business with the integration of DERs, Bentley and Siemens' have jointly innovated solutions to accelerate digitalization of planning, design, and operations for power utilities around the world to rapidly respond to the changing energy mix and support the clean energy revolution.

POWER IN PARTNERSHIP

SIEMENS
Ingenuity for life

Bentley Systems and Siemens formalized a strategic alliance in 2016 to accelerate digitalization in utilities in support of the modernization of the electric grid. Bentley's Energy Infrastructure team and Siemens Smart Infrastructure have built on Siemens PSS® Portfolio and Bentley's OpenUtilities, AssetWise®, and ProjectWise® solutions to advance infrastructure project delivery and asset performance.

Distributed energy resources (DER), like microgrids and their off-grid on-grid mode, require more advanced planning approaches to ensure system reliability and stability. Bentley's OpenUtilities solution for utility power grid design and GIS is integrated with Siemens' PSS® Portfolio for power system planning to provide seamless workflows and data integration, while supporting optimal network design for both operational and economic performance.

Through a connected data environment, utility engineers can enable a digital twin to more efficiently model the grid for decentralized energy without compromising safety and reliability. And this environment provides decision-support, cost-based models, and simulations – all critical to reduce design time and construction costs, deliver optimal utility performance, and address comprehensive utility network updates.

Bentley®