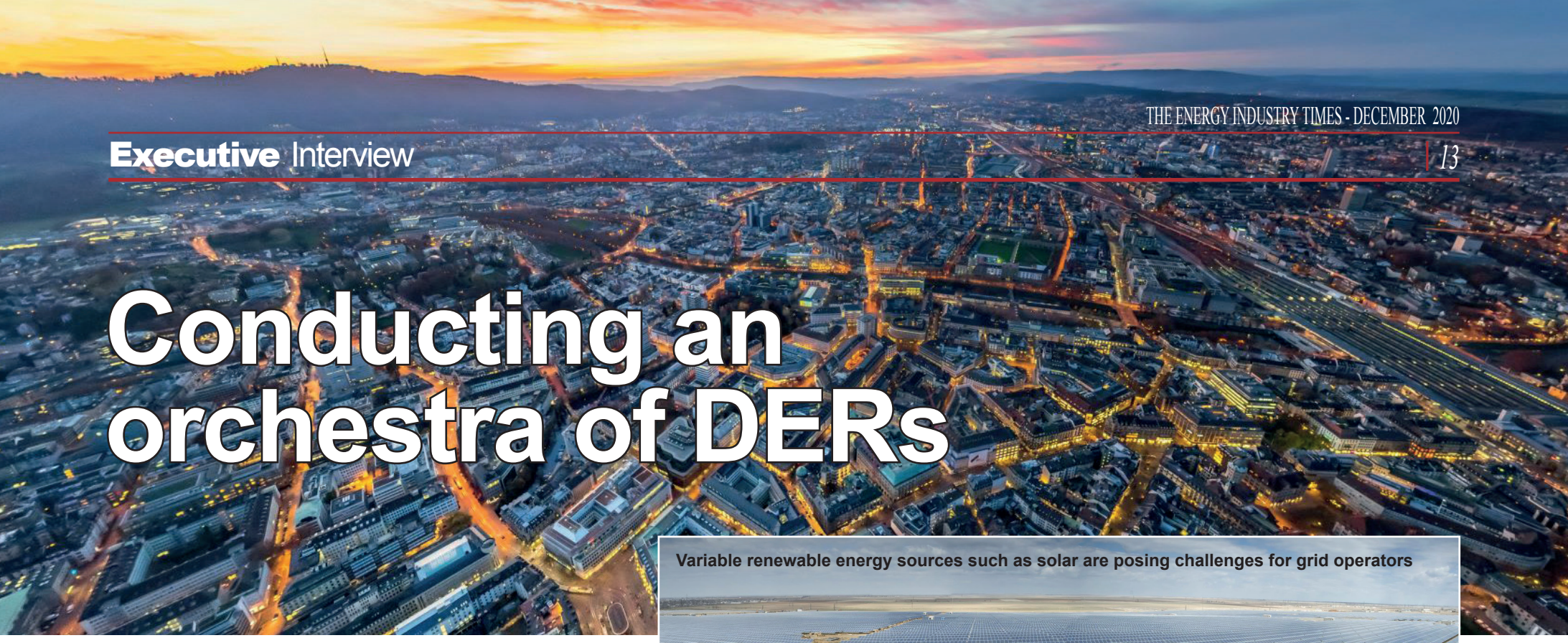
Conducting an orchestra of DERs



Variable renewable energy sources such as solar are posing challenges for grid operators

The growing amount of renewables and distributed energy resources (DERs) on the grid is presenting unprecedented challenges for today's grid operators. GE Digital's Jim Walsh explains why a single, coordinated, view of the distribution and transmission grids is needed if utilities are to maintain reliability efficiently.

Junior Isles

Managing a constantly changing electricity network is no easy task. And the job is not getting any easier. With the proliferation of variable renewables at the transmission level and distributed energy resources (DERs) at the distribution level, such as electric vehicles, heat pumps, batteries, and energy from prosumers, utilities more than have their hands full.

It is a new world that Jim Walsh, General Manager, Grid Software Solutions, GE Digital, says is becoming increasingly complex and calls for greater renewable and DER awareness for utilities and a much more "orchestrated" approach across their full information technology (IT)/operational technology (OT) network.

"The world of the grid operator is becoming more challenging by the day. They are seeing more change in the last five years than they have in the previous 125. Renewables penetration is fundamentally changing everything that they thought they knew about how to seamlessly operate an electric grid," he said. "When we talk about orchestration, we are describing the integration of all the different electron sources, and management of supply and demand in a much more seamless way."

Existing grids have been built to handle consistent power flows in one direction. Today, there are many intermittent generating sources – many of which are embedded in the distribution grid – and consumers can also produce and feed power back into the grid.

Transmission system operators (TSOs) perform a balancing act between grid supply and demand every day. Meanwhile, distribution system operators (DSOs) work to ensure quality and continuity of service to end-users. Utilities and regulators expect this to be done flawlessly. But renewables and DERs are creating unprecedented challenges for the electric grid. In some geographies, there is now more energy being fed directly at the distribution level than there is at the transmission level.

Walsh: Variable renewable energy sources such as solar are posing challenges for grid operators

But while utilities are coping with this high degree of complexity, all while maintaining reliability, Walsh says it is causing a fair degree of inefficiency. What utility leaders need, he says, is an end-to-end solution to coordinate how they model, monitor, forecast, and ultimately control and dispatch these new renewables and DERs across all internal and external systems and stakeholders.

"When reliability is a constant and the grid itself is becoming more dynamic, what you will see suffer in the short term is efficiency," said Walsh. "Operators tell us that out of 100 electrons that get created, only 50 are consumed. So we are trying to help them bring these disparate energy sources together. And that's where you hear us starting to talk about this notion of orchestration, which is having the ability to model, monitor forecast and ultimately control the dispatch of these new renewables and DERs. That's where we believe you will achieve this balance between reliability and efficiency."

These resources are disrupting utility business models and operations at the most fundamental level. At the transmission level, the challenges are linked to installed capacity, balancing, reserves, stability, lack of inertia, and lack of visibility to what is happening at the distribution level.

Here, the challenges include hidden loads, backfeeds, and voltage issues. Hidden load refers to the share of consumption covered by embedded generation, which is therefore not directly visible to the grid operator whose traditional operation systems only manage "net load", i.e. the net flow on the power lines.

However, accurate visibility of the two components of the net load (native consumption and embedded generation) is essential to many core distribution grid management processes. When a fault occurs, for example, ensuring that a faulty feeder is de-energised is paramount for the safety of workers in charge of the repair. As such, operators must be aware of every single PV rooftop and fully comprehend its connection/disconnection status.

GE Digital makes the point that DERs cannot be marginalised. As distribution level challenges aggregate up to the interface with the transmission level, DERs are pushing TSOs and DSOs to coordinate. Clearly it is more of an issue in regions where there is higher renewable penetration. Utilities in states like California and countries like Germany and the UK have therefore been forced to adapt faster. These have subsequently been the places where GE Digital says it has been doing most of its work.

Walsh argues that some utilities and TSOs may not yet be experiencing significant impacts on energy flows and voltages profiles but cannot wait for the day they start to experience those impacts. And there is a growing backlog of devices on the grid that utilities are unaware of.

Every single system in grid asset and operations management needs to be involved in the management of renewables and DERs. Certainly Geospatial Information Systems (GIS), Advanced Distribution Management Systems (ADMS), Advanced Energy Management Systems (AEMS) and Advanced Market Management Systems (AMMS) all have a role to play. But Walsh explains that the grid cannot be operated through a number of different silo-type bespoke solutions.

"There has to be one integrated platform, so there is one view of the network; one version of the truth," said Walsh.

While there has been innovation around renewables and DER management, including solutions that, for example, take weather into account, Walsh says today's siloed solutions "come up short". GE Digital has therefore been looking to bring the capabilities of these systems together in an integrated way on a common platform that leverages a common data model. "This is the next level of efficiency and capability that utilities are looking for," said Walsh.

The other thing he says is missing, is the ability to recognise when new DERs are added to the grid. With no formal registration process for adding DERs to the grid in many jurisdictions, he says self-recognition is an advance that will be "really important" in the next couple of years.

Walsh noted: "We are looking at ways to provide more automated capabilities to our utility customers, so they don't have to be as dependent on the registration process."

In an effort to help DSOs and TSOs "connect some of the dots", GE Digital has been building "DER-enabled" capability into its products and started working with network operators on specific projects. For example, in December 2018 it worked with Dutch DSO Stedin in creating a network capability called T-Forecast. This connected the DSO with the TSO so they had consistent updates in terms of demand coming from the DSO.

"This is just one example of where those silos can be connected with a common view that gets updated in more real-time so that the TSOs are better positioned to plan and the DSO or DNO is in a much better position to receive. We are seeing that [kind of] digital linkage across all the different silos," said Walsh.

According to Walsh, much of the ongoing innovation is taking place on the distribution grid – where microgrids, rooftop solar panels, etc., are becoming more commonplace. He stresses, however, that the DSOs "need to do a better job" of providing visibility and communicating to the TSOs upstream.

Walsh said: "As things change on the distribution grid, with more electrons being generated on the distribution side than there was before, it all needs to be communicated to the TSO in close to real-time."

He says that bringing this data together offers utilities the opportunity going forward to potentially build new business models by becoming aggregators of all the electrons from the various sources, and thus create new markets.

"Having visibility of all the assets and getting all of this data under control would give utilities whole new degrees of freedom so they can innovate on their business models in the future," noted Walsh. "But in the short-term, it's about how to keep the grid reliable without significant levels of redundancy that are inefficient. Storage technologies will be part of that equation."

As a player in both the transmission and distribution parts of the electricity chain, GE Digital says it well placed to help utilities meet their immediate needs as well as realise the future possibilities.

According to Walsh, the company operates in every level of the value stream. "From the time an electron is created to when it hits the consumer, we have software capabilities that can help orchestrate that," he said.

It also has geospatial capabilities that enable the physical world to be represented digitally, and the bringing together of all the changing assets in order to create the underlying data model that represents the complete grid.

Walsh summed up: "Our vision is to build a platform for the network operators that the rest of the participants on the network can consume. This enables the orchestration that we talk about. As a provider of the control platforms and operational systems for network operators, we are in a great position to provide natural extensions to the rest of the market participants, which then leads to better choreographing than we've ever seen before."