

Operational Technology Solutions

# A grid operator's guide to DER and EV integration readiness





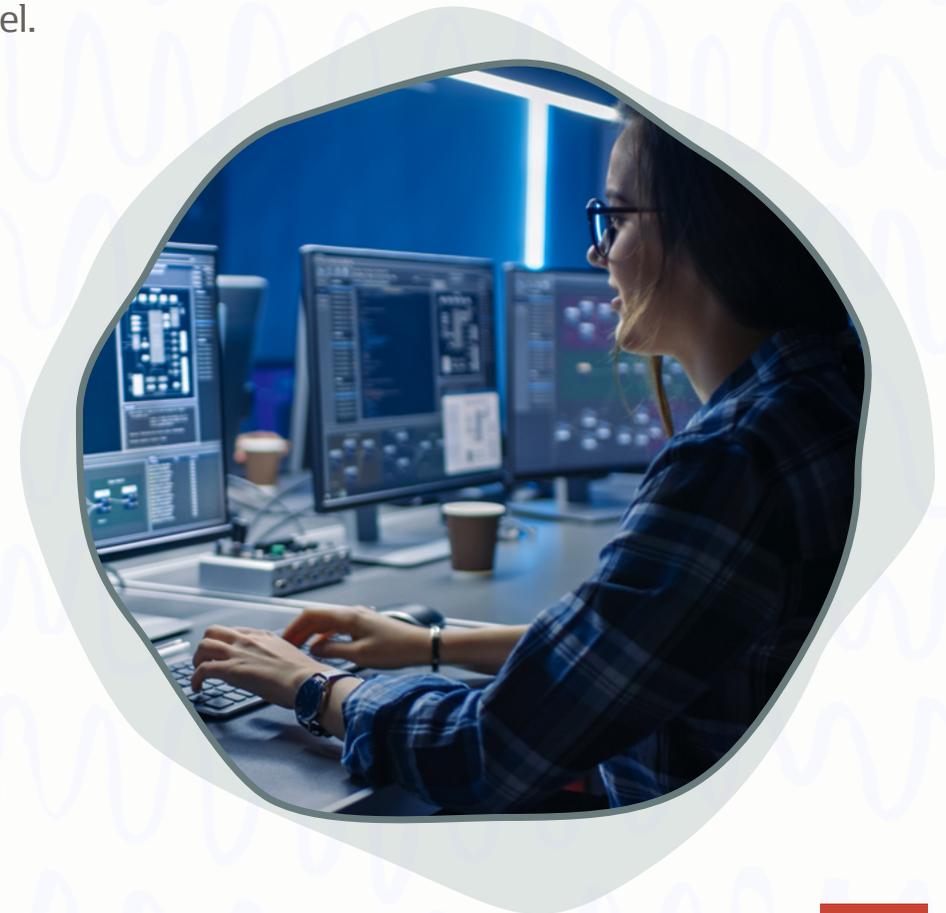
## A step-by-step process for utility distribution grid operators and their stakeholders to evaluate and plan for the opportunities and challenges posed by DER and EV integration.

The next decade of utility industry transformation will present both opportunities and challenges for distribution grid business owners and operators. Over the medium to long term, transportation electrification will become a huge driver for capital investment in the distribution grid, providing funds to pursue much needed grid modernization and automation investments that make distribution grids more reliable and resilient. Over the short term, however, faster-than-anticipated distributed energy resource (DER) or electric vehicle (EV) adoption could easily create operational challenges such as two-way power flows and accelerated degradation of grid asset condition or performance on overloaded feeders.

## Where to invest now and on what basis?

As a grid operator, you have several tools at your disposal. In jurisdictions where “behind the meter” installations of DER or EV chargers are not mandatorily disclosed to the distribution utility, you can invest in [artificial intelligence and analytics](#) to ascertain with high confidence (accuracy of 97% or more has been achieved) where DERs and EVs exist on their distribution networks. Once you have a strong read on DER and EV installations and penetration trends, you can invest with greater confidence in physical infrastructure and equipment upgrades such as substations, transformers, sensors and automation to better manage variability at the distribution substation or feeder level. You can also invest in upgrading your distribution management

system software and IT infrastructure to optimize power flows and minimize impacts to power quality and reliability. It is always a balancing act deciding when to invest in software versus equipment upgrades, so it is imperative that distribution grid strategy contemplate both in parallel.



## Technology can guide utility grid planning and investment for better safety and reliability

Like all utilities, your utility walks a fine line when it comes to distribution system and asset planning, particularly for grid assets that are many decades old or otherwise well beyond their useful lives. While you and your power system engineering and planning colleagues would love to modernize your entire distribution network to keep pace with changes on your grid, you may feel held back by regulatory or business pressures to keep rates as low as possible and to only replace assets for which there is clear justification for replacement. While your utility has outgrown the “run to failure” mentality that was once endemic in the industry, your access to asset health intelligence may be limited to only high value assets for which monitoring technology is

readily available or infrastructure that can be visually inspected with a high degree of confidence.

The imperative for better asset health diagnostics and monitoring can substantially increase with DER or EV penetration. For example, if EV charging loads on a specific feeder grow faster than anticipated, the distribution transformer that serves that load can quickly become overloaded. The worst-case scenario is a catastrophic failure that risks the health and safety of line workers or the general public.

A similar hazard to utility line and field service workers exists for DER penetration on a feeder when it comes time to perform maintenance, repairs or



upgrades on that feeder or upstream of it. If a material amount of DERs have been installed on that circuit, the safety of the utility field workers can be put at risk when the circuit is reenergized due to unanticipated backfeed.

## Make analytics, planning, control and customer program strategy your first priority, not your last

Analytics can help not just with EV detection but also [asset condition monitoring and performance management](#). Rather than relying on conventional asset replacement schedules and top-down planning studies, your utility can now use [analytics tools that ingest AMI and sensor data](#) to determine which transformers are overloaded long before they materially degrade or fail.

DER and EV grid readiness also requires having the right customer programs, advanced distribution management system (ADMS) and distributed energy resource management system (DERMS) strategy to take advantage of smart inverter (DERs) and smart charging (EV) technologies that allow the owner or a third party to modulate power

production or consumption via IP or cellular communications. Aggregated over thousands of behind-the-meter assets, these resources can serve as important resources for grid flexibility that can alleviate acute distribution grid stress caused by the assets themselves or by external factors such as storm or outage events.

Not all ADMS or DERMS are created equal in their ability to manage DER and EV charging asset portfolios at scale and across the wide variety of dispatch capabilities and communications channels and protocols. Look for [proven expertise in DER modeling, management and dispatch at scale](#) before investing in a DER integration module or full DERMS.

With the growing need for better DER and EV integration, it is important to periodically revisit your ADMS and DERMS strategy rather than waiting until an upgrade project is imminent because your system has outgrown your platform or because your license support has expired. DER and EV integration will require fundamental changes to the ways that distribution grids are managed and controlled in real-time. Deferring the technology exploration process will put affected distribution utilities at a huge disadvantage when it comes time to operationalize DER and EV integration into day-ahead, hour-ahead and real-time distribution system operations.

# A grid operator's guide to DER and EV integration readiness

Here is a step-by-step guide for distribution grid planners, engineers and operators to ready your distribution management and automation systems and infrastructure for DER and EV integration.

## STEP 01 Invest in distribution grid analytics to discover hidden needs

Before making any investment, you must first have reasonable assurance that your utility will meet the “used and useful standard.” This is predicated on first having established a need for an investment. When it comes to DER and EV integration needs, the first order of business is to understand the extent of DER and EV penetration on your network, and the best tool for that is analytics.

Oracle Utilities is one of the few ADMS vendors that offers robust AMI-based analytics that can accurately detect the presence and size of DERs and EVs. Using Oracle Utilities Analytics Insight (OUAI), analysts and engineers can perform descriptive and predictive analytics across all circuits to identify those with a discernable level of DER and [EV charging activity and capacity](#).

## STEP 02 Leverage your ADMS for fast turnaround scenario analyses

The heavy lifting of grid planning is done today using specialty grid planning software. However, basic planning and scenario testing can be done with some types of ADMS solutions. For example, [Oracle Utilities NMS](#) comes with built-in DER modeling capabilities and a “[study](#)” or [simulation mode](#) that allows operators to test different configurations before implementing a switching strategy, adjusting protection settings or making other adjustments to the real-time control system in the production environment. This scenario analysis capability can provide a convenient mechanism for grid planners and engineers to quickly assess discrete changes on a specific distribution feeder without having to rerun grid planning software every time there is a material change.

## STEP 03

### Distribution management technology strategy and capital planning in parallel

You might ask yourself, “why focus on ADMS or DERMS before investing in capital infrastructure or equipment?” The answer is that grid management systems can be instrumental for extending the useful life of existing infrastructure or mitigating the need for major capital upgrades. Integrated distribution management, automation and switching strategies allow you to accomplish more with less, especially in high EV and DER penetration scenarios.

Once you’ve used analytics and modeling to achieve better EV and DER situational awareness, you can more confidently proceed with scoping and executing asset modernization and replacement without having to worry that you are overbuilding in certain areas and underbuilding in others. The foundational analysis you performed becomes the basis for both your rate case and your validation of having met the “used and useful” standard.

## STEP 04

### Stay on top of distribution management and integration technology trends

Looking at the mechanics of DER and EV integration more specifically, it is imperative to engage your ADMS vendor and other potential vendor partners early on in the technology strategy formulation process. Although many of the major advanced distribution management system (ADMS) vendors have developed or are developing modules for DER management and EV charging management, the industry is entering uncharted waters for both utilities and their vendors. Some vendors have already developed domain expertise with DER modeling at scale. Others have developed DERMS expertise with direct DER control in specific feeders. Relatively few have deployed integrated ADMS/ DERMS systemwide that can directly control DERs at scale using an established protocol like IEEE 2030.5.

The “one-stop shop” approach for end-to-end distribution management and DER/ EV integration is still several years away, in part due to the nascent stage of market development and communications protocols. In the meantime, your utility faces a “system of system of systems” quandary that, without the right core technology frameworks and partners, can quickly lead to inordinate complexity for licensing, system integration and support.

## STEP 05

### Invest now in the OT integration frameworks and technologies for flexibility and scalability

The right OT integration platform and partner can simplify the enormous complexity of grid device, DER, and EV integration. This can dramatically decrease system integration schedule, cost, and maintenance. When evaluating OT integration technologies and middleware, look for native support of industry protocols, in-memory processing, embedded scripting for complex data manipulations, and API development capabilities.

## STEP 06

### Get ready to go (and change) much faster than expected

Right now, utilities like yours are focusing on physical infrastructure due to fact that current DER and EV adoption tends to be concentrated in certain areas versus system-wide. However, as DER and EV penetration builds, localized physical infrastructure solutions may not be able to sufficiently contain load and power flow variability. This threshold has already been surpassed by dozens of major utilities around the world. At Northern Ireland Electricity Networks (NIE Networks) for example, [upstream wind and DER production now exceeds the utility's winter peak](#). In the San Francisco Bay Area, EVs accounted for [more than 10% of new vehicle registrations in 2019](#). With early DER and EV subsidies giving way to manufacturer targets and [governmental mandates in important markets](#), both DER and EV markets are expected to [continue their rapid growth](#). As DER and EV penetration approaches critical levels in different utility service territories, [dramatic changes in energy consumption patterns and grid operations will follow](#).

# A journey, not a destination

All utilities have a well-developed grid planning process, and many have already undertaken the steps above, often in iterative fashion as market and regulatory conditions change. With the grid changing rapidly and in previously unforeseen ways, it is imperative that utility leadership and regulators provide full support to that planning process and consider allowing for more frequent “fast track” revisions in service territories where DER or EV penetration levels are changing quickly. Grid planners, engineers and operators will need more agile internal processes and technology platforms.

While many details have yet to be sorted out, there is little question that the growing consumer adoption of DER and EV technologies will result in fundamental changes for many in the electric utility industry. The biggest peril facing utilities today is not change, it is paralysis. The opportunity is now to engage your regulators and technology partners in a forward-looking discussion of the changes happening on your grid today, the types of changes that can manifest in the near future, and technology investments that can facilitate the transition while supporting utility health and viability.

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