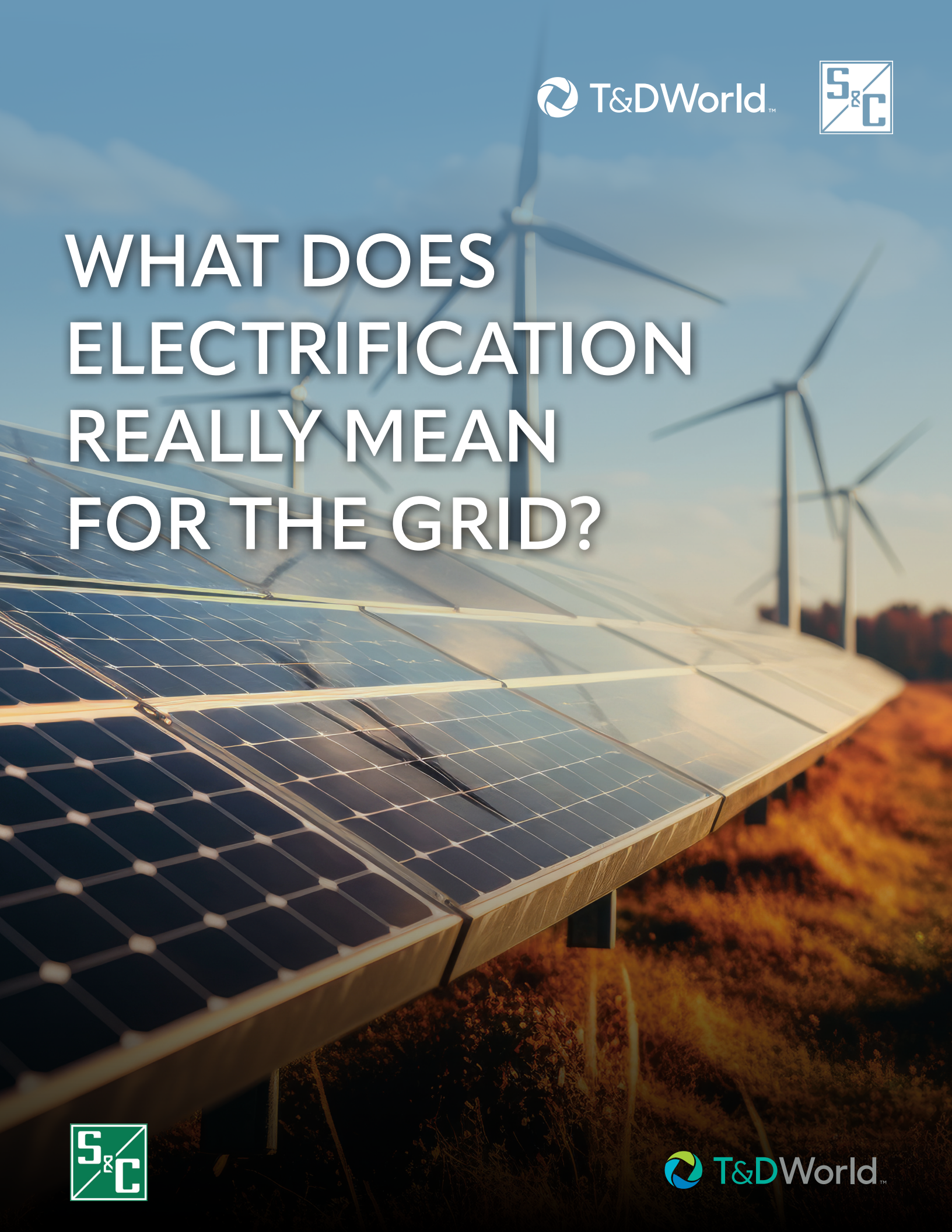
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WHAT DOES ELECTRIFICATION REALLY MEAN FOR THE GRID?
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Imagine a future where the hum of electric vehicles replaces the roar of combustion engines; clean energy flows through an intricate web of smart grids; and every appliance, gadget, and life-saving medical device is powered by sustainable sources. That future is coming at us fast.

Electrification is more than a buzzword in today's lexicon; it is the pulse powering the energy transition. Yet, the electrification conversation often skims the surface, missing the many unknowns beneath. We know the tide of electricity demand will surge and carbon footprints will shrink, heralding a wave of innovative infrastructure.

But the devil is in the details, and these nuances will redefine the role of utilities, technology providers, and consumers in a world where the grid's edge becomes the center of action.

This white paper from S&C Electric Company highlights the pivotal role of utilities at the forefront of this monumental shift in energy dynamics. It explores the technical advancements and strategic planning necessary to manage the transition, with a focus on grid modernization, infrastructure scalability, and the importance of collaborative partnerships.

Defining the Challenge of Electrification for Utilities

To illustrate the electrification challenge, picture a kite blowing in the wind. Sometimes the wind gusts, sometimes the direction changes, and sometimes it dies down. While it's possible to predict whether it will be a windy or calm day, it's impossible to predict the moment-to-moment changes. The person holding the end of the kite's string aspires to keep it in the air no matter what happens.

That kite blowing in the wind is very much like a day in the life of the distribution network of the electric grid, all the way from the substation down to customer meters at the grid's edge. The grid must remain stable, reliable, and resilient regardless of what supply-and-demand changes occur at any given moment. Grid operators, such as utilities, are like those flying the kite, doing their best to steer it successfully under any conditions.

Steering the kite is tricky enough with a gentle breeze, and it becomes even more challenging when intense winds start to stir. The same is true for utilities facing significant changes amid a rapidly transforming grid. The grid transformation is driven by a combination of four converging factors:

- Increased electricity demand at the grid edge from sources such as electric vehicles (EVs), air-source heat pumps, water heaters, and more that could strain localized segments of the distribution grid
- Integration of distributed energy resources (DERs), such as solar photovoltaic systems on customer rooftops, which are often intermittent generation sources and change the grid from a single-direction system to a complex, multidirectional network
- Policy and procedure changes, including policies and regulations intended to accommodate electrification and DERs; new standard operating procedures for managing the grid in the rapidly evolving grid environment; and updated metrics to understand the health of a more complex, multidirectional grid
- Time-sensitive decisions on how to test and integrate new grid technologies

Electrification is complex. The convergence of these four factors makes it difficult to predict and plan precisely how the grid must change. While policymakers and consultants might make high-level assumptions about electrification, utilities understand the specific shifting winds in their service territory and what is required to manage the moment-to-moment changes.

A Framework to Navigate the Unknown

Utilities across the United States are in various planning stages for their specific electrification outlook. However, because electrification is like the wind in that it is constantly changing, it's helpful to have a framework in place to navigate the complexity.

Moving past high-level assumptions to service territory-based specifics, utilities are asking and answering questions to clarify how the four converging factors will impact their specific operations. Key questions include:

- **What forms of electrification will impact our service territory, and when?**
  Customer surveys about home renovation plans, online tools for commercial customers that let the utility know about EV fleet plans, and programs that incentivize customers to work with the utility on electrification efforts are just a few ways utilities can gather information about future electrification plans and new load coming on the system.

- **At what rate do we expect DERs and intermittent renewables to grow in our service territory?**
  Utilities generally have good visibility into new generation resources in the pipeline via their interconnection request processes. As with efforts to learn about customer electrification plans, surveys, studies, and new programs are all means to get better insight into the future of DER and renewable adoption.

- **How should standard operating procedures and reliability metrics change to maintain a stable, reliable, and resilient grid?**
  Standard operating procedures and metrics must evolve to ensure a holistic perspective of the new grid reality. New standard operating procedures will largely depend on the answers to the first two questions. Ideally, they will change from processes designed for the management of a centralized, single-direction grid to ones optimized to control a complex, multidirectional grid. New reliability metrics are needed to measure true grid resilience in the face of all events related to extreme weather, renewable intermittency, and electrification-driven demand changes.

Keeping the Kite in the air with a system-wide approach to grid modernization

Many utilities are already feeling the winds of electrification, but they may only be considering the wind buffeting them at that moment. For example, a utility might learn about a company's plans to bring a large EV fleet online, so the focus becomes the grid impacts of that specific challenge. Or a utility may be focused on decentralized grid management amid rising electrification-driven demand. In some cases, utilities may recognize all the converging factors and have a sense of urgency around each. However, they still need support as they prioritize which areas require attention and action first.

When building a proactive plan for system management, a trusted technology partner can help support utilities with a strategic approach that keeps the kite flying. Collaborative partnerships are essential to successfully managing the journey when utilities must pursue widescale system deployments of solutions that help manage complexity and stability on the grid. This allows utilities to expand their vision for strategic investments with a systemwide approach that helps them think holistically about the grid to achieve sustainable reliability and resilience.

Utilities are ready to modernize their grids for the future. Preserving flexibility so their grid-modernization pathway can evolve as the winds of change blow is vital. Most importantly, strategic partners must offer solutions that enhance existing technology on the grid. This is done through a systemwide approach that provides complete coverage with advanced protection for the end customer at the edge of the grid.

While new technologies will be required to meet the new reality confronting the distribution grid, utilities have a mandate to ensure safe, reliable electricity 24/7, every day of the year, under blue or stormy skies. Collaboration with technology providers and effective communication with regulators help utilities navigate the tremendous changes and investments needed to support a successful energy transition.

Conclusion

Much like keeping a kite in the air amid changing weather conditions, operating a grid reliably while electrification blows away old processes and brings in new challenges feels like a game of constant reaction. However, a strategic partner with a systemwide approach is critical for successfully operating the clean, decentralized grid needed to serve a highly electrified world.

Strategic planning is a challenging task for a trend as complex as electrification, but the actions suggested in this white paper offer a roadmap to start the journey. In the simplest terms, utilities can learn what electrification means for their distribution grid and start proactive planning and forward-thinking investment:

- Seek out information about customer electrification plans.
- From there, determine a sense of urgency and prioritization.
- Choose a technology provider and partners to provide a systemwide approach to grid modernization.

As we move toward a decarbonized and electrically powered world, the utility sector's role becomes even more critical, serving as the backbone of a new energy paradigm. With strategic planning, we can lay the groundwork for a more resilient and reliable tomorrow, where clean energy powers our devices and vehicles and drives sustainability, progress, and innovation.

With over 100 years of grid expertise, **S&C Electric Company** is focused on empowering the transformation of the grid for the next 100 years. We offer unparalleled expertise, industry-leading quality, and customer-centered innovation. Our technology solutions work with a utility's existing distribution grid infrastructure to automate and upgrade the grid, extending the useful life of equipment and improving resilience and reliability.

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