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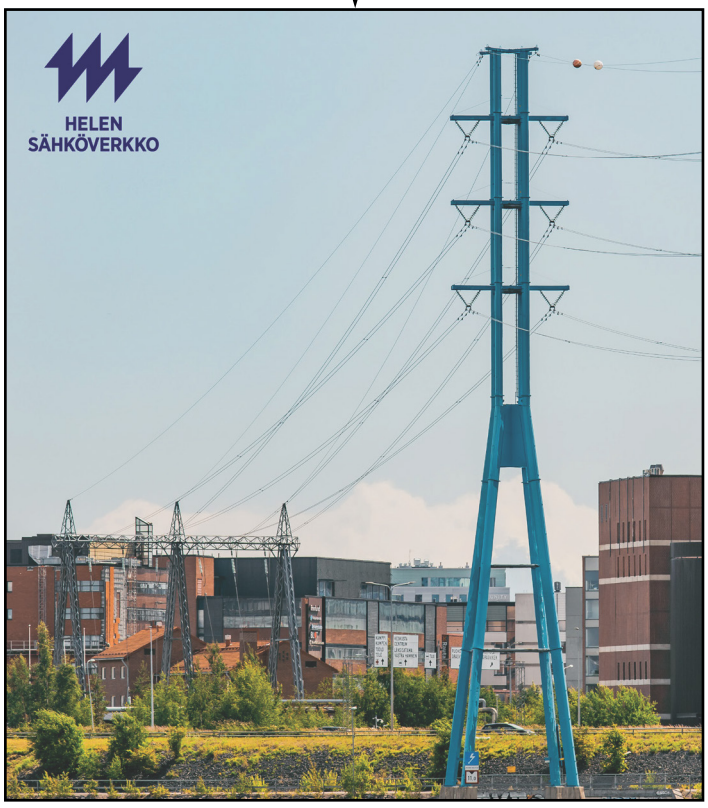
Scaling the Distribution Interconnection Process

White Paper

Overview

After decades of flat demand, many utilities anticipate a significant increase in usage over the next 5-10 years.

Similarly, interconnections have surged, driven by the rapid growth of distributed energy resources (DER), which are energy sources that can be used to generate and store electricity. This can include solar and wind.



Helen Electricity Network; helen.fi

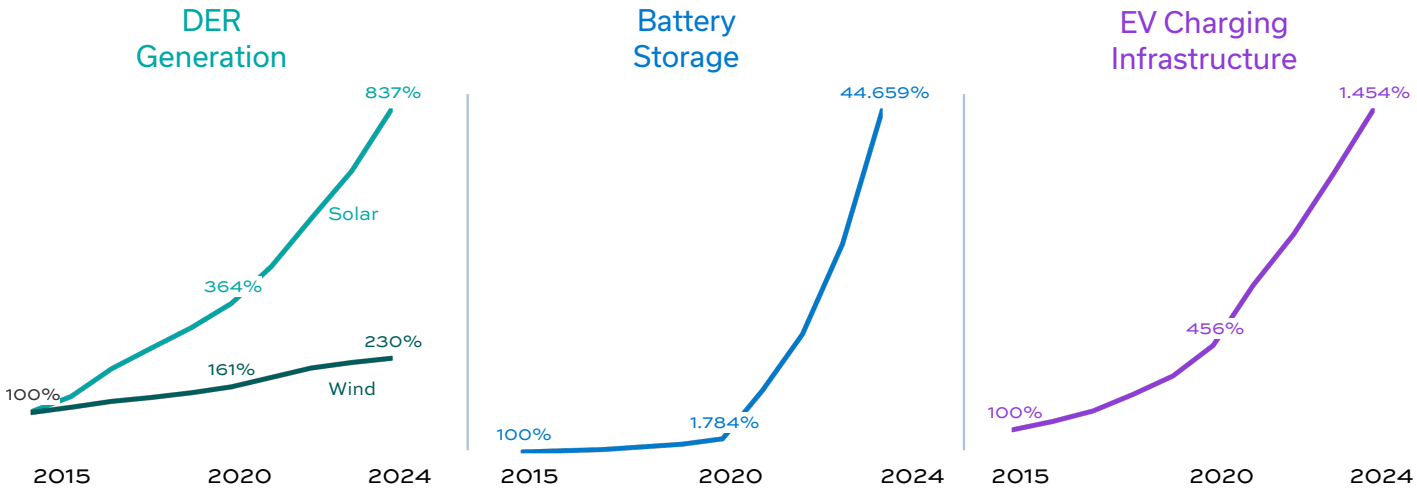
The Increase in Demand

After decades of flat demand, many utilities anticipate a significant increase in usage over the next 5-10 years. Similarly, interconnections have surged, driven by the rapid growth of distributed energy resources (DER), which are energy sources that can be used to generate and store electricity. This can include solar and wind.

Despite potentially reduced incentives, DER growth is expected to continue, driven by favorable unit economics and the ability to quickly add grid capacity. According to Wood Mackenzie's *2023 US Distributed Energy Resource Outlook*, the DER market is projected to nearly double in capacity from 2023 to 2027.

The graph below highlights the growth from 2015 to 2024:

- Storage Capacity: 446.6X increase
- EV Charging: 14.5X increase
- Solar Generation: 8.37X increase
- Wind Generation: 2.30X increase



The Legacy DER Interconnection Process

All interconnection requests and grid connected projects generally follow the following steps.

The steps are clear, but as request volumes grow, process inefficiencies become more apparent. Are applications complete, or do customers need to provide more information? Can engineering resources focus on the most complex cases instead of spending time on simpler requests?

Many utilities use digital application tools like PowerClerk by Clean Power Research to handle the general workflow. However, technical analyses remain largely manual, making it difficult to scale as request volumes and complexity increase.

- Preparing for each study is cumbersome, requiring extensive data pulls, model updates, data corrections, and integration of planned projects and queued applications
- Coordination across utility teams can lead to lost visibility into competing projects and missed synergies in analysis
- Managing the ever-changing queue and project lifecycle is challenging with manual updates.
- Integrating data and results into downstream processes and systems is not feasible
- Simplified analysis for smaller projects, often relying on conservative estimates instead of load-flow modeling, can result in wasted capacity and significant issues for feeders near full utilization

With interconnection requests expected to rise, scaling these processes will only amplify existing inefficiencies.

- Limited resources lead to overworked staff, the need for additional hiring, or neglect of critical grid planning activities
- Increased processing times due to request complexity and overall grid utilization can impact customer service, regulatory compliance, and create risk of lost revenue and other financial penalties
- Reduced planning quality results in inefficiencies, missed opportunities, and cost challenges in grid management

Improvements to the DER Interconnection Process

As the adoption of Distributed Energy Resources (DERs) continues to grow, the process of analyzing and planning DER interconnections remains largely manual and fragmented.

Data and workflows are often spread across multiple systems and managed by different stakeholders, creating inefficiencies that hinder both customer satisfaction and utility performance. By modernizing the existing processes, utilities can unlock greater efficiencies, improve customer interactions, and better prepare for the future.

Enhancing Customer Value

Modernizing DER workflows can significantly enhance the customer experience by providing more streamlined and transparent processes. Key benefits include:

Real-Time Feedback for Decision-Making

- Customers can receive immediate insights to guide their early decision-making processes.
- Utilities can reduce the need for extensive engineering studies for speculative customer requests.

Siting Assistance for Targeted Requests

- Advanced siting tools can direct customers to more optimal locations for DER integration.
- Encouraging strategic siting fosters more valuable interactions between utility engineers and customers, leading to more efficient project approvals.

Improving Operations and Management

Automation and enhanced data integration can drive significant improvements in utility operations, leading to more efficient DER interconnection processes:

Automated Model Validation and Preparation

- Ensures that queued projects are automatically considered in system studies, reducing errors and inefficiencies.

Improvements to the DER Interconnection Process

Automated Technical Review

- Full load flow analysis can be conducted automatically, accelerating the review process.
- Small-scale requests can be fully automated, expediting approvals.
- Large-scale requests can benefit from partial automation, allowing engineers to focus on higher-value tasks that require expert analysis.ciencies, improve customer interactions, and better prepare for the future.

Preparing for the Future

To ensure sustainable and scalable DER integration, utilities must embrace a more connected and adaptable ecosystem. Key modernization strategies include:

Seamless Integration Between Applications and Models

- Enhanced interoperability between different software tools ensures a more efficient analysis process.
- Model updates can be performed in real time, improving responsiveness to customer inquiries and regulatory requirements.

Advanced Scenario Planning

- Leveraging real-time, integrated data allows utilities to explore a wide range of future scenarios.
- Dynamic modeling capabilities enable utilities to optimize system planning, ensuring resilience and reliability in an evolving energy landscape.between utility engineers and customers, leading to more efficient project approvals.

Conclusion

By modernizing DER workflows through automation, enhanced integration, and real-time data utilization, utilities can unlock greater operational efficiency while improving customer value. A forward-looking approach to DER planning and management will not only streamline current processes but also lay the groundwork for a more flexible, resilient, and customer-centric energy future.

As the distribution system becomes more complex, interdependent connections require deeper analysis. Digitization and automation streamline processes, making it easier to manage workloads and leverage existing data efficiently.

While the steps of the interconnection process may stay the same, how we handle them has evolved - enabling us to build the power system of the future, today.nalysis.ciencies, improve customer interactions, and better prepare for the future.

About envelio

envelio provides a collaborative software platform to utilities and grid operators that enables data orchestration, holistic planning, and advanced simulations. Through data-driven decision making and automation, utilities can drive shorter interconnection queues, reliable operations and intelligent grid investments.

The envelio Intelligent Grid Platform is already used by 70+ utilities globally.

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