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Integrated Grid Planning: An Essential Capability to Decarbonize the Economy

White Paper

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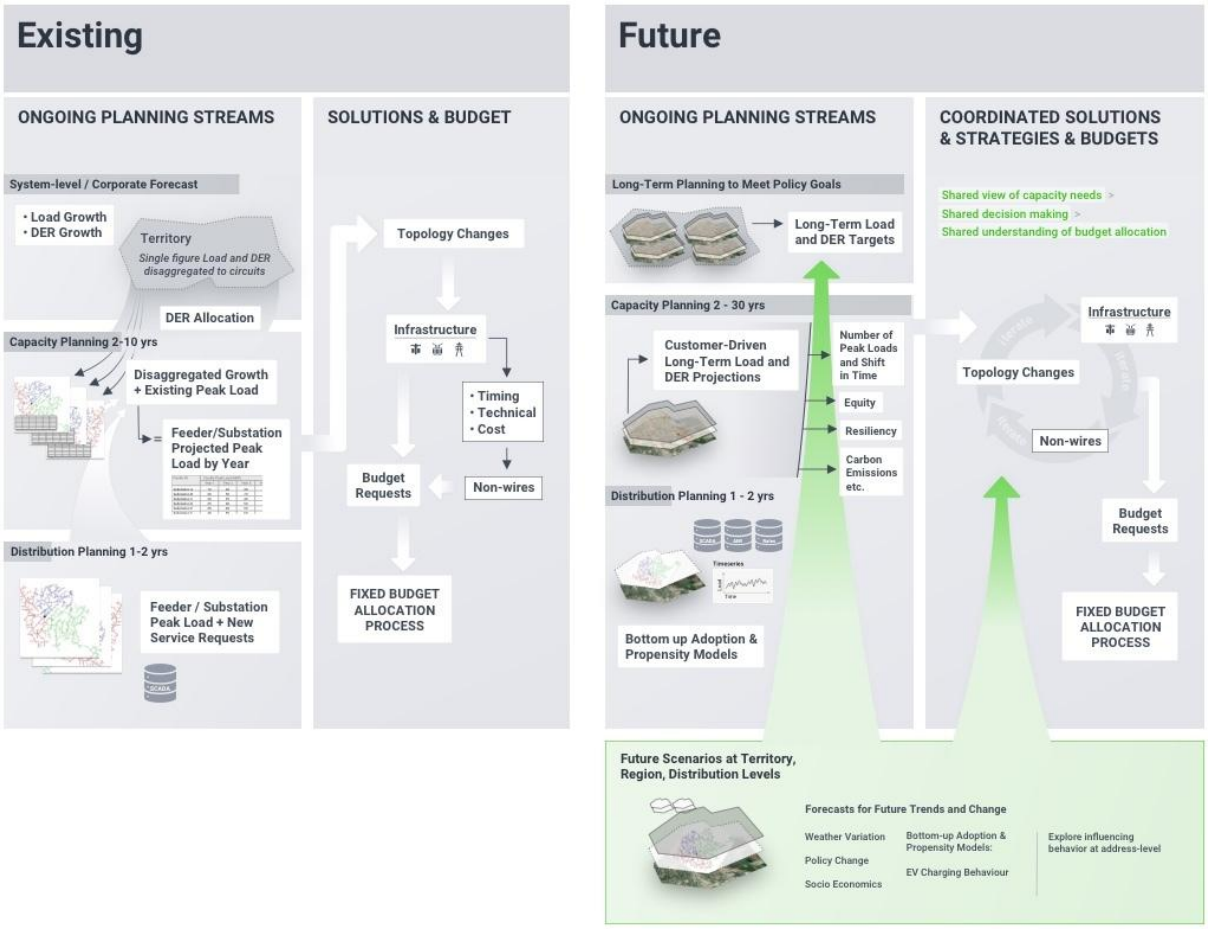
Decarbonization and the Electricity Grid

Many governments, states, and businesses have goals to achieve carbon-free or net-zero emissions by 2050 or sooner. Hundreds of utilities are working to support these requirements. Successfully achieving these decarbonization goals depends on an electricity grid that can support increasingly diverse and wide-sweeping electrification efforts and maintain the affordability of electricity for families and businesses. However, the scope, scale, and costs of potential electric grid impacts necessary to support ambitious electrification and decarbonization goals are not well understood. Further, current market offerings for carbon offsets and carbon accounting methods are inadequate for quantifying the carbon emissions avoided by any particular action. Kevala's ability to quantify emissions from the use of electricity in an integrated grid planning tool uniquely supports the identification and optimization of the associated decarbonization costs.

Exhibit 1: Comparison of existing distribution planning and Kevala IGP processes[1]



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Kevala's Approach

The ability of utilities and market operators to use **integrated grid planning (IGP)** to deliver actionable results through integrated carbon accounting creates a more efficient and effective planning process. Kevala's approach to IGP incorporates innovation and engagement across all stakeholders (government agencies, businesses, economic development groups, utilities, regulators, and many others) to unlock the benefits of clean energy at every scale and at every step in the planning process.

The highly fragmented and siloed nature of the datasets relevant to IGP means that today's efforts utilize partial and incomplete information, and distributed energy resources (DERs) are deployed where the carbon benefit is not clear or maximized. Only a holistic approach that can address the deployment of DERs, building and transportation electrification, and constraints on the distribution and transmission grids with all stakeholders can address **when** and **where** distribution grid enhancements are necessary as the adoption of DERs occurs. Missing the *when* and *where* can result in **stranded** and **inefficient** investments that may limit the effectiveness of DERs to lower carbon and costs and ultimately risk falling short of decarbonization objectives. Kevala's approach reduces the risks associated with the *when* and *where* because Kevala can track the change in carbon emissions on the grid from DERs to determine if the decarbonization goals are achieved.

Using IGP to Decarbonize the Grid

Historically utilities planned the grid by modeling the energy flow from large centralized generating stations through the high-voltage transmission system into the distribution grid and finally to the end consumer. That planning was focused on reliability objectives ensuring enough electricity was produced to be delivered to all customers at the peak demand. The process took into account population growth, economic growth, and energy usage trends but was static and hardly reflective of the complex grid that has evolved and the diverse resources that characterize it.

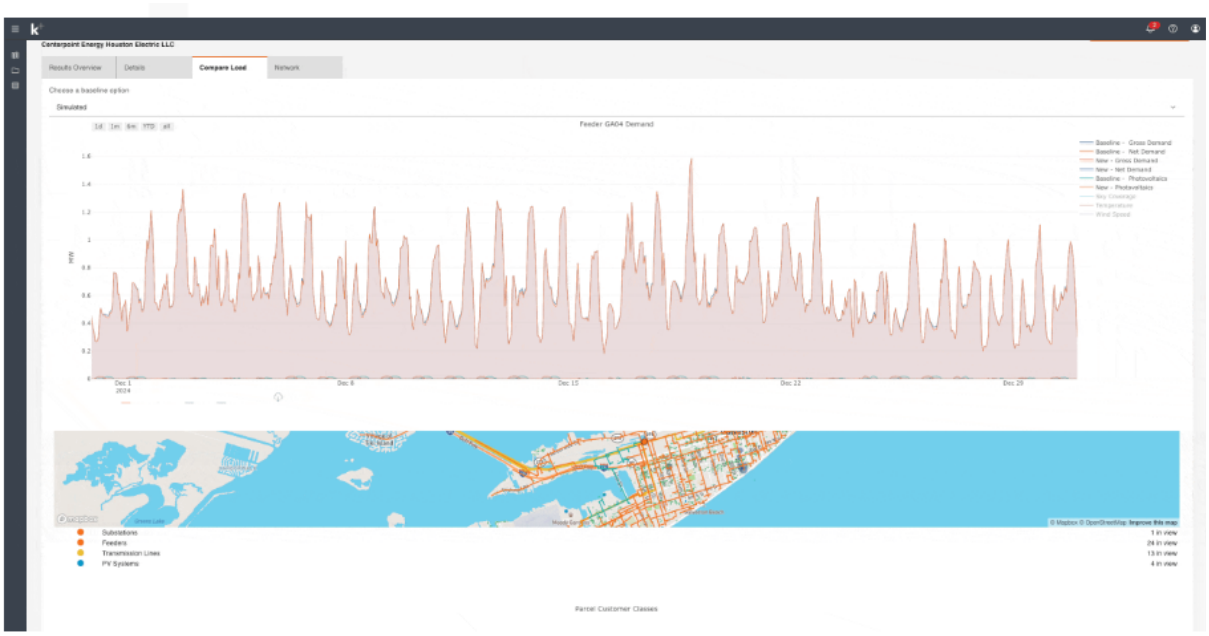
Successful electrification and decarbonization efforts benefit from a planning process that takes into account information from all stakeholders across the grid. These efforts also benefit from a single, integrated process that plans from generation sources to end uses and includes grid-connected distributed resources at the distribution and transmission levels while accounting for end-use load and net-load. An illustration of such an iterative and transparent process can be found in Exhibit 1.

Kevala recommends a four-step process for managing integrated planning processes:

- Forecast load and DER adoption
- Assess associated grid needs
- Identify potential solutions
- Select a solution framework

The first step of the IGP process is to **forecast** *when* and *where* DER technologies will be adopted on the distribution grid. Kevala's data-driven analytics can precisely estimate the likelihood of DER adoption at the customer level with detailed spatial and locational granularity. The DER adoption estimates are integrated with load forecasts to develop time series-based load forecasts using a combination of top-down spatial allocation and bottom-up customer-level modeling over many years.

Exhibit 2: Load and DER forecast and DER adoption propensity in the Kevala platform

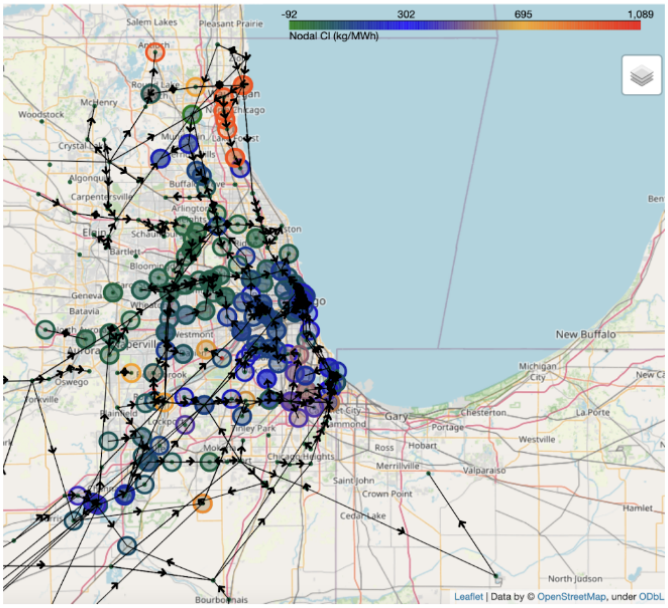


The second step of the process is to **assess** the distribution grid over the planning horizon and determine *when* and *where* any enhancements are needed to ensure network reliability and resilience. This step also involves assessing the impacts of those enhancements from a socioeconomic and equity perspective. Kevala's platform incorporates power flow analysis to understand the dynamics of the grid over time and the potential impact of achieving decarbonization. Kevala is employing this assessment technique working with the California Public Utilities Commission (CPUC) to predict and plan for the integration of DER technology, electric vehicle (EV) charging infrastructure, and battery storage over a 20-year

period using a distribution model that is highly informed by customer premise data, socioeconomic data, and adoption forecast trends.

After assessing the distribution grid over the planning horizon, the next step is to **identify** potential solutions to ensure the reliability and decarbonization of the grid. This part of the planning process is much more complex than in the past because the possible solutions are almost endless, but this assessment is crucial to decarbonization. Yet, every decision made today is limited due to the absence of a consolidated and objective holistic dataset and associated analytics. Kevala has worked with National Grid and Exelon to develop a methodology for assessing the carbon intensity of the grid[2] with a high degree of geographic and temporal granularity, ensuring the energy sector is best equipped to evaluate, prioritize, and measure decarbonization activities in the future.

Exhibit 3: Territory-wide carbon intensity utilizing granular carbon methodology



Finally, **solutions** are selected that satisfy the regulatory requirements, such as a least-cost standard or grid needs for reliability and resilience. The selection may very well be a mix of traditional utility solutions, non-wires alternatives, and DER technologies. The solutions are then used to start the next planning cycle of the IGP process to continually forecast, assess, and identify issues with the grid.

Kevala's platform provides all the data and tools needed to effectively collaborate across the organization, more accurately forecast the decarbonization of the grid using a bottom-up forecasting approach, and generate cost-effective solutions that provide a reliable, resilient grid that achieves decarbonization goals.

[2] See Kevala's November 2021 white paper with National Grid, Exelon, and ComEd: *Total Carbon Accounting: A Framework to Deliver Localized Carbon Intensity Data*.

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Summary

Radical decarbonization begins with a new view of the role of distribution grid planning, from siting renewables and storage to electrifying buildings and transportation. To do this without driving up costs for customers and stranding assets is a challenge that can only be solved with access to comprehensive grid data and truly integrated analytics. It is critical in this environment for distribution planners to view and understand time series data and develop baseline load and DER forecasts that account for external factors such as weather, block load changes, and corporate forecasts. Planners must also be able to integrate scenario-based analyses with load flow capabilities. Kevala's platform provides planners with an IGP tool that can solve these challenges by using previously siloed data, econometric analysis, and physics-aware modeling to plan for a more robust, affordable, environmentally sustainable, and safe electrical grid.

While planning in the face of increasing complexity of the grid and its operation is difficult, it is made more difficult as utilities try to support the carbon reduction goals of governments and customers. Just as the complexity of the grid continues to increase, carbon emissions do as well. Notwithstanding the myriad emissions reduction goals that utilities and states and other governments have articulated, carbon emissions continue to rebound from the pandemic decline.[3] Failure to recognize and use locational carbon intensity data risks inhibiting rapid decarbonization at scale, results in inefficient grid investment and furthers inequality for communities that suffer from higher levels of pollution and a higher share of wallet for energy. Kevala supports an evolving IGP process that considers carbon emissions, DERs, rates, programs, and grid infrastructure.

About Kevala

Founded in 2014, Kevala is a data and analytics company that specializes in delivering actionable grid intelligence. We help decision makers at the forefront of decarbonization predict and plan for a more robust, environmentally sustainable, effective, and safe grid with our cloud-based data analytics and visualization platform. Kevala leverages deep subject matter expertise across the entire energy value chain to expand insights from the platform, accelerate workflow integration, and position results to lead to successful strategic outcomes. Kevala is trusted by governments, utilities, and industry with the most sensitive critical infrastructure, market, and address-specific electric consumption and production data. For more information, visit www.kevala.com.

[3] Jeff Tollefson, "Carbon emission rapidly rebounded following COVID pandemic dip," *Nature*, November 4, 2021, https://www.nature.com/articles/d41586-021-03036-x.