ELECTRIFIED GRID™

A Wonder by Deloitte Business

Atlantic Canadian Conference On Energy System Modelling

Navigating Electrification Uncertainty: Turning Advanced Modelling into Actionable Insights for Grid Operators

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CARREFOUR DE MODÉLISATION ÉNERGÉTIQUE | ENERGY MODELLING HUB

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Today, we'll explore how **advanced modelling** is being used to better **plan future grids.**

Our Journey Today

01 Deloitte's Advanced Modelling:
ElectrifiedGrid™ Overview

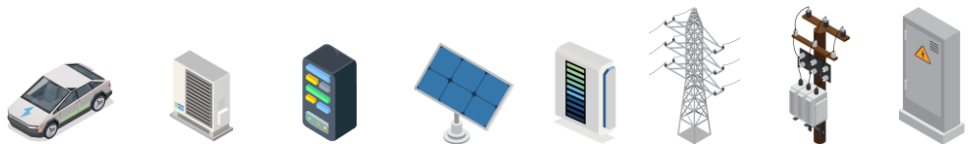
02 Advanced Modelling Approach:
ElectrifiedGrid™ Modelling Overview

03 Advanced Modelling Case Studies:
Europe and Canada

ElectrifiedGrid™ Overview

Why Deloitte is developing new tools, like ElectrifiedGrid™, to meet the evolving needs of utilities

Utilities are facing infrastructure challenges that threaten ability to meet decarbonization targets



Utilities are becoming increasingly concerned about the uncertainty of new, unfamiliar and disruptive loads

- Demand is surging
- DER pose new bidirectional planning challenges
- Localized load growth can bottleneck specific areas of the grid
- Policy & assumptions shifts can dramatically reshape planning scenarios

Physical Infrastructure Data

GIS
CIS
Weather
Meter
SCADA

Technology & Economic Data

Technology Costs
Census
Economic Growth
Consumer Behavior
Policy Parameters

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- Digital Twin of the Grid
- Advanced Forecast Models
- Solution Evaluation
- Plan Infrastructure

Use Cases Explored in this Presentation

Modelling Approach | Multi-Step Approach

ElectrifiedGrid™ is an advanced model enabled by a digital twin and geospatial disaggregation of technology adoption

Step 1

Build a digital twin of the grid including transformers, substations, cables, and meters

Step 2

Model technology adoption and simulate load profile impacts using Monte Carlo analysis

Step 3

Understand where future congestion might occur and evaluate the impact of solutions

Bonus

Model a range of supply mix options to achieve net zero target

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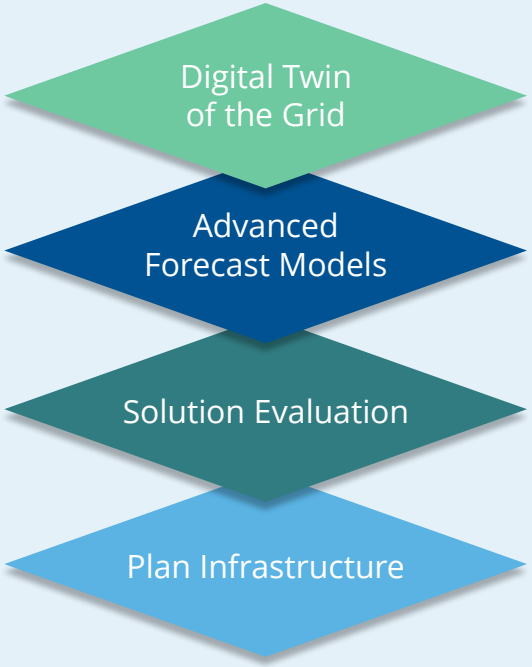


Use Cases Explored in this Presentation

Modelling Approach| Creating a digital twin of the distribution network

Multiple data sources are ingested to create a down-to-the-meter digital representation of the grid

Step 1: Digital Twin of the Grid

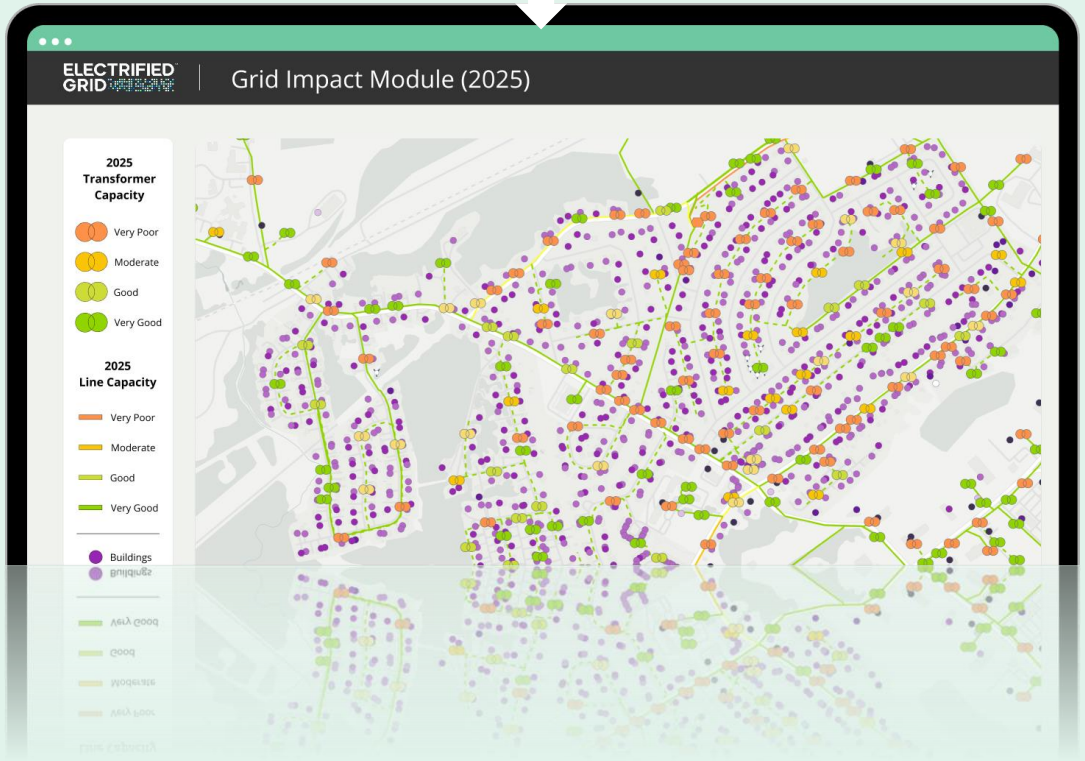
Build a digital twin of the grid including transformers, substations, cables, and meters

Use Cases

- Identify data quality issues
- Scale partial AMI data to 100% hourly historical data
- Integrate various data sources into a unified model

Various Utility Data

GIS | Meter | CIS | SCADA | Weather



Modelling Approach| Simulating future demand on the grid

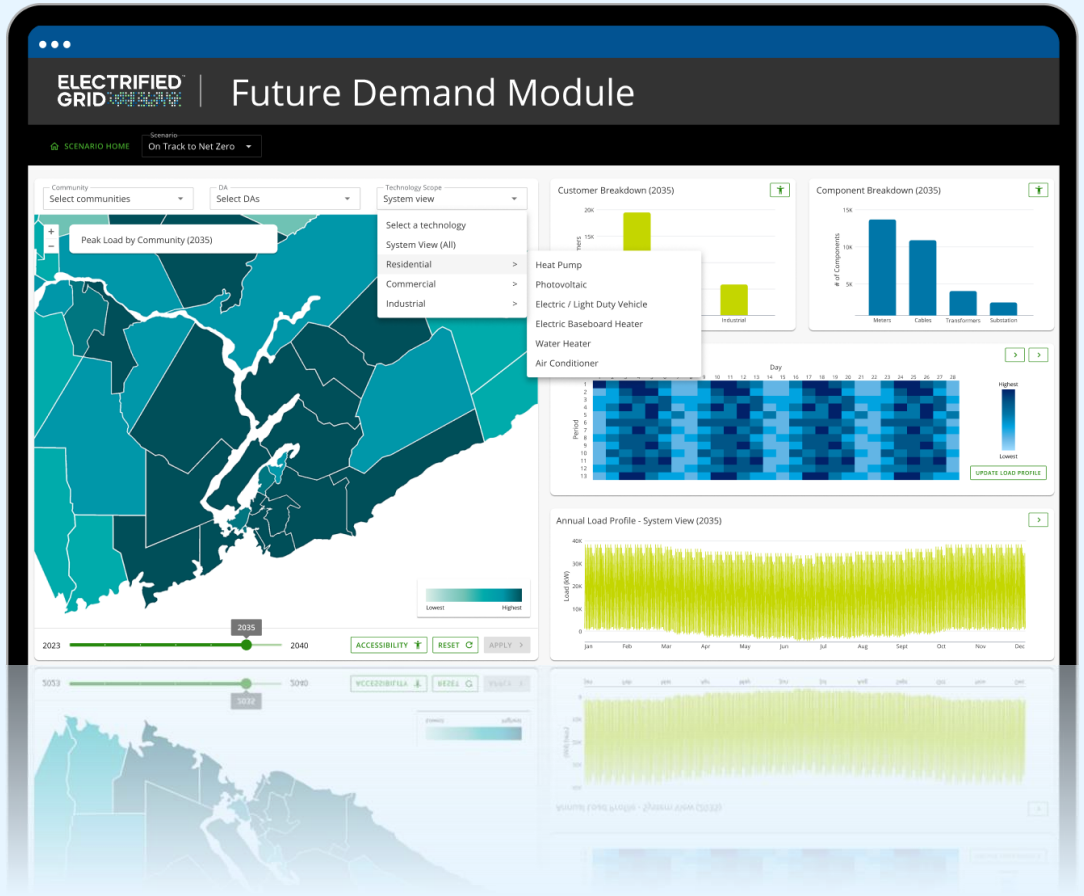
Geospatially disaggregate macroeconomic modelling to forecast bottom-up demand down from the meter level

Step 2: Future Demand Forecasts

Model technology adoption and simulate load profile impacts using Monte Carlo analysis

Use Cases

- Link modelling to government or other macro modelling
- Control for uncertainty with Monte Carlo analysis
- Geospatially model adoption of electro-technology
- Develop bottom-up 8,760-hr load forecasts



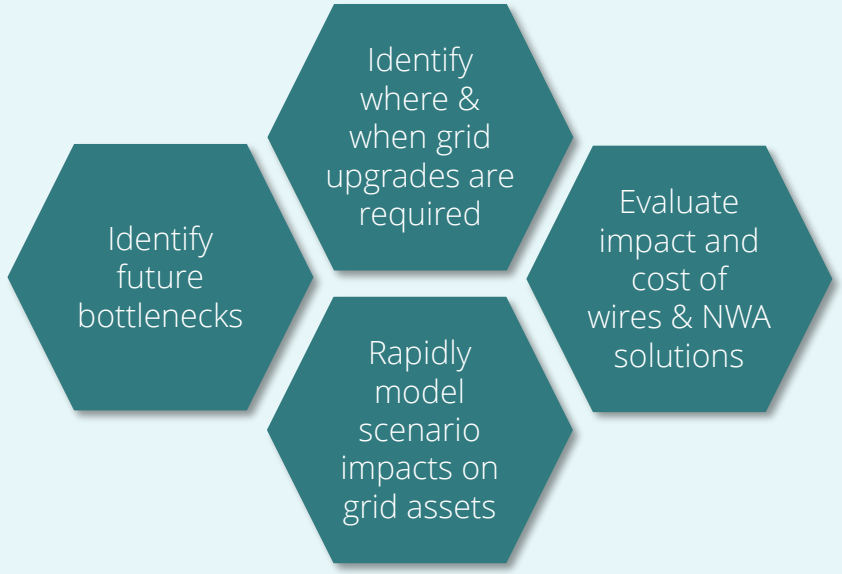
Modelling Approach| Identifying future grid congestion

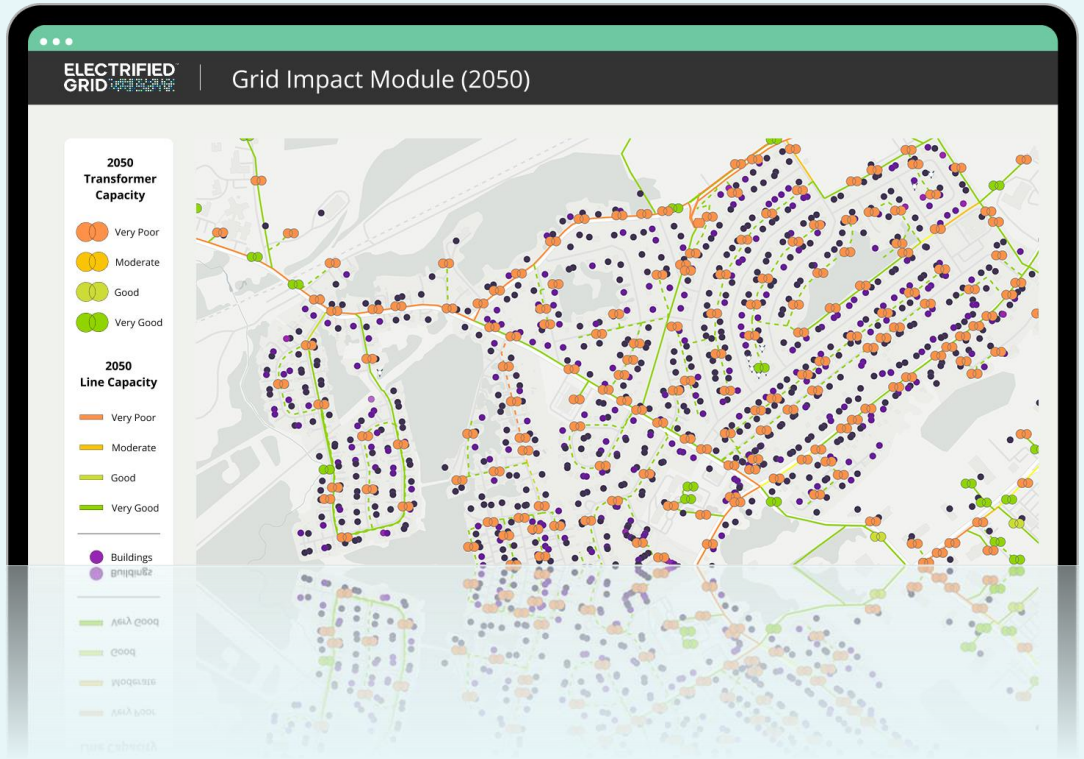
Using power flow simulations, model how new loads will impact current and future infrastructure capacity

Step 3: Load Flow Simulation on Digital Twin

Understand where future congestion might occur and evaluate the impact of solutions

Use Cases





Modelling Approach| Optimizing Generation Mixes

Using geospatially disaggregated macroeconomic modelling methods to forecast demand down to the meter level

Bonus: Integrating with Bulk System Modelling

Model a range of supply mix options to achieve net zero target

Use Cases

- Integrate with bulk system supply mix modelling
- Link local renewable resource to forecasted substation demand
- Identify optimal capacity for BESS and flexibility

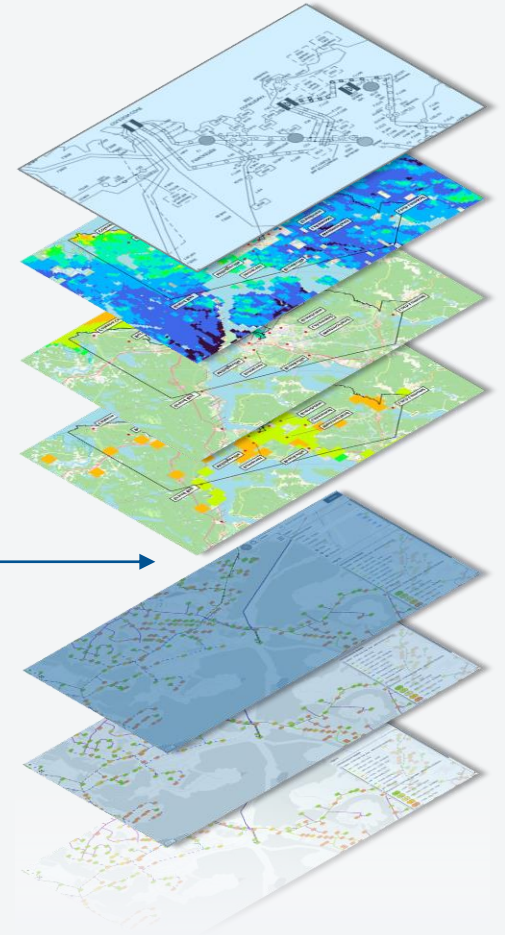
For each substation, we optimally balanced supply and demand

Supply

- Imports
- Offshore wind
- Onshore wind
- Solar PV
- Battery storage analysis

Demand

- Light-duty vehicles
- Space heating
- Other end-uses



Geo-Capacity Dispatch

ElectrifiedGrid™

Modelling Approach| Optimizing Generation Mixes

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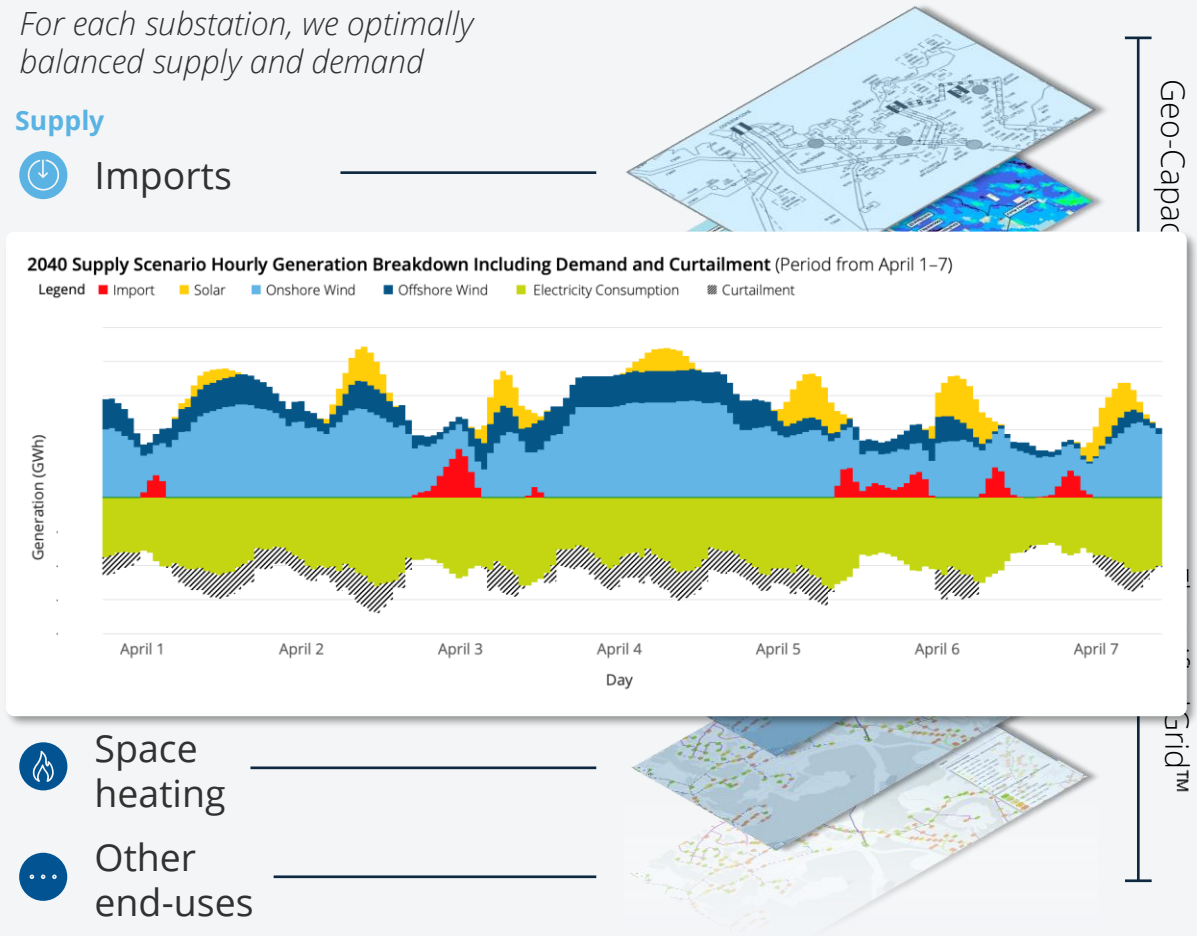
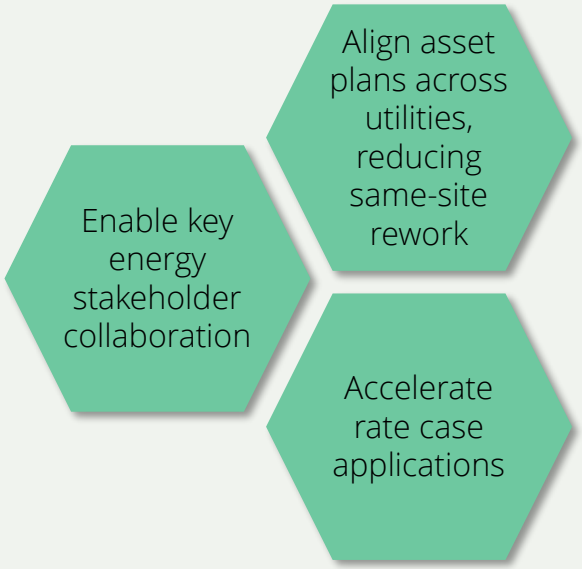


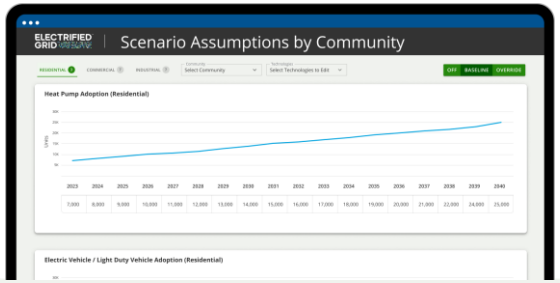
Fluvius| Investment Planning Process

How Belgium's largest DSO secured €4B of additional capital expenditures via advanced scenario planning

Building a more collaborative and transparent planning process to drive regulator and cross-stakeholder alignment

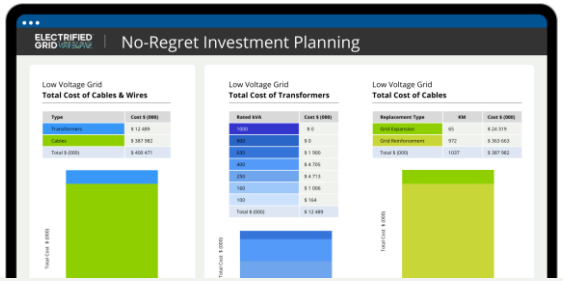
Use Cases





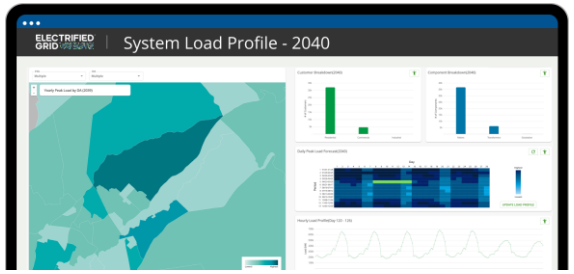
Early Stakeholder Input & Alignment

Collected and simulated diverse future scenario assumptions from a range of stakeholders



Rate Case Application Support

Congestion & financial modelling outputs served as rate-case evidence to regulators, helping securing €4B of no-regret investments



Cross-Utility Collaboration

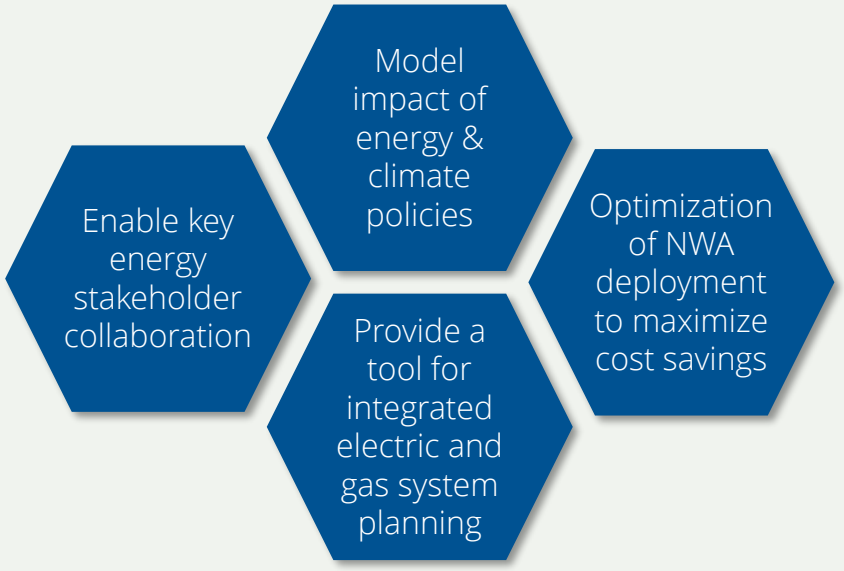
Collaboratively coordinate infrastructure projects with other utilities (e.g. telecom) to avoid re-work at the same site

Government & Utility Modelling | Innovative Approach to Policy Development

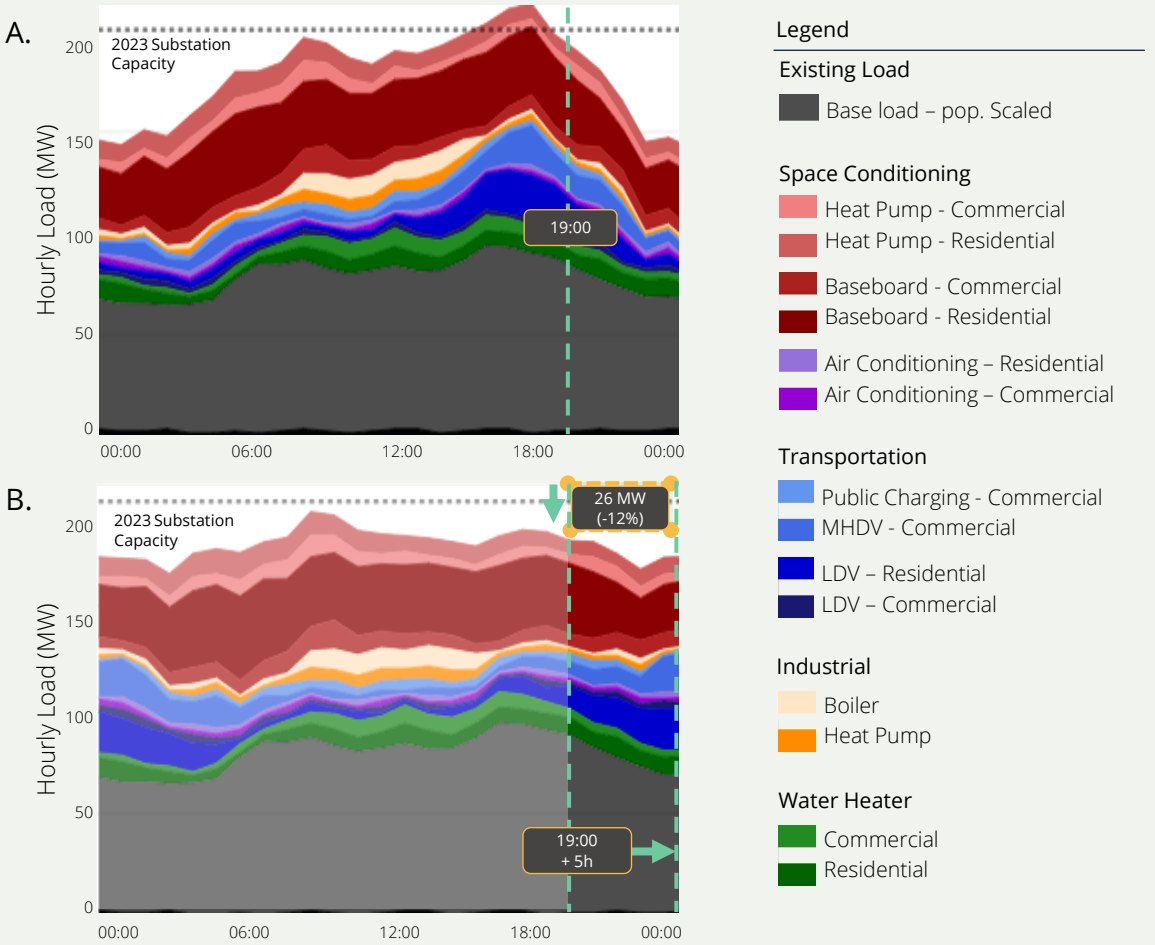
Modelling the impacts of policy on energy system infrastructure

Analyzing municipal-level impacts and solutions on both the electricity and gas system

Use Cases

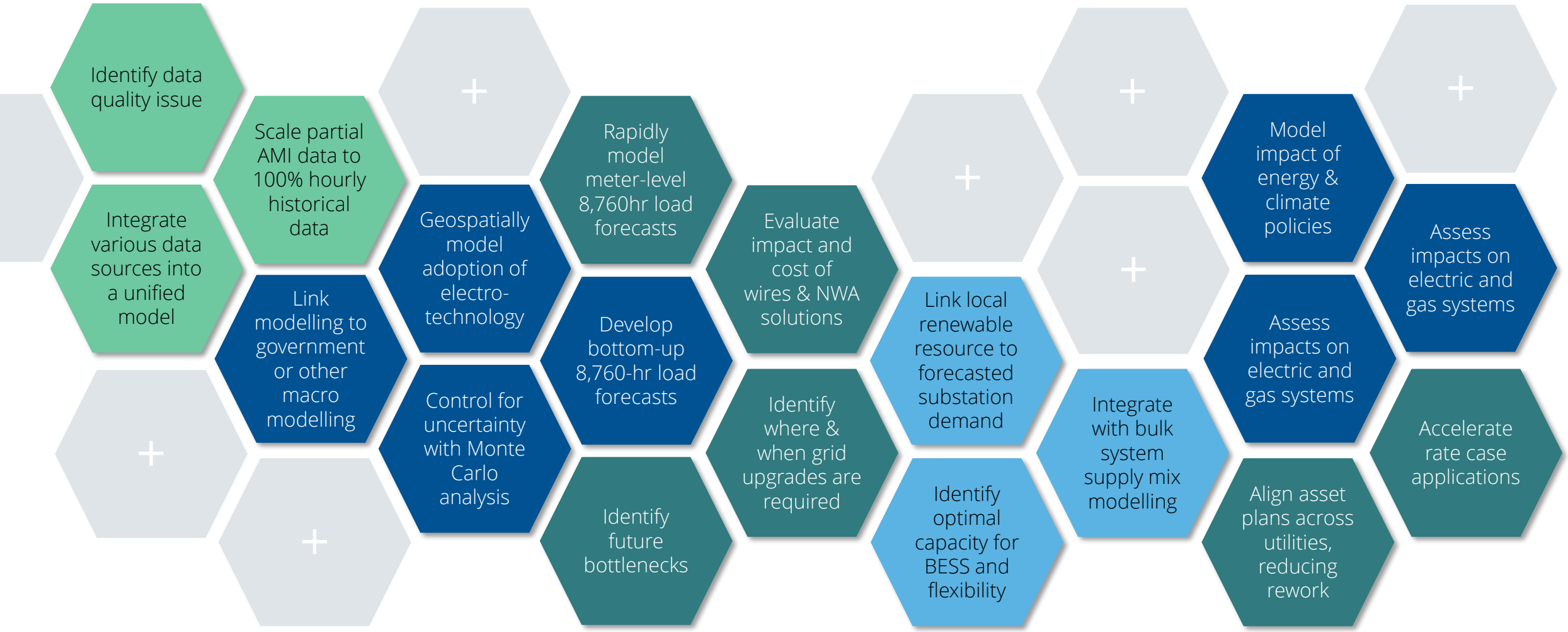


2050 Winter Peak: A. Before Managed charging vs. B. After Managed charging



Note: Charts have been generated utilizing generalized data and are intended for illustrative purposes only.

Advanced modelling is revealing new use cases every day.



Together, let's discover more as we plan tomorrow's grid.

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